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M A R I N C O U N T Y W I D E P L A N U P D A T E

Draft Environmental Impact Report

APPENDIX 1
BACKGROUND REPORTS

COUNTY OF MARIN
COMMUNITY DEVELOPMENT AGENCY

State Clearinghouse No. 2004022076

JANUARY 2007

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2005 MARIN COUNTY CONGESTION MANAGEMENT PROGRAM, SEPTEMBER 2005

Transportation Authority of Marin

2005 MARIN COUNTY

CONGESTION MANAGEMENT PROGRAM

Prepared by Wilbur Smith Associates for the Transportation Authority of Marin • September 2005

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EXECUTIVE SUMMARY

Purpose

The Congestion Management Program (CMP) was established with voter approval of propositions 111 and 116 in June 1990. The intent of the CMP is to more directly link land use, transportation and air quality, with the goal of prompting reasonable growth management programs that will effectively utilize new transportation funds, alleviate traffic congestion and related impacts, and improve air quality.

It is important to note that a CMP is not a long-range policy document. The main thrust of CMP recommendations is near-term (within a seven year timeframe). The CMP is not an exhaustive list of all desired improvements in the county. Therefore, exclusion from the CMP does not mean that a project is not being considered for action, nor does inclusion signify a notice to proceed with a project.

The CMP legislation is aimed at bringing local governments into the decision making process for capital investment in transportation. This serves to make local governments more aware of the real cost of transportation services. In addition, local governments are involved in the development of funding mechanisms for transportation (i.e., impact fees and user fees). Local agencies need to be prudent in their decisions regarding transportation infrastructure in order to make the most of existing facilities, services, and available improvement and program funds.

At the regional level, the CMP is guided by the Metropolitan Transportation Commission's (MTC) *Regional Transportation Plan* and the Bay Area Air Quality Management District's (BAAQMD) *Bay Area Clean Air Plan*.

Introduction

Congestion Management Programs (CMPs) are designed to address existing and future transportation problems in urban areas of the State of California. Each urban county in California is required to develop and bi-annually update a CMP. The main components of Congestion Management Programs are the following:

- A Congestion Management Agency (CMA) has been designated in each urban county. The CMA has the responsibility of developing, updating, and monitoring the CMP. Marin County and its cities and towns have designated the Transportation Authority of Marin (TAM) as their CMA. TAM is a 16 member board comprised of the Marin County Board of Supervisors and a representative from each City or Town Council in Marin County.
- Identification of a network of transportation facilities and designation of level of service standards for highways and roadways. Facilities are monitored for congestion levels periodically. (Chapter 1 and Chapter 2)
- Performance measures to evaluate current and future multimodal system performance for the movement of people and goods. (Chapter 3)

- Development of Travel Demand Management (TDM) techniques. Alternatives to the single occupant private automobile are identified and encouraged. (Chapter 4)
- Development of a process to determine the impacts of local development decisions on the regional transportation network. This facilitates integration of decisions about land development, transportation investment, and air quality. (Chapter 5)
- A computer travel model and database to be used for estimating future transportation needs and impacts has been developed. (Chapter 6)
- A 7-year investment strategy (Capital Improvement Program [CIP]) is developed and updated every two years, in order to promote the goals of the CMP. The investment strategy links project eligibility for regional/state funding to the CIP. (Chapter 7)

In early 2003, the CMA (predecessor to TAM) adopted *Moving Forward: A 25-Year Transportation Vision for Marin County*. The CMA developed a Transportation Sales Tax Expenditure Plan for a half cent sales tax increase which was approved by the voters in Marin County in November 2004. In addition, the County of Marin released an updated *Marin Countywide Plan* on August 19, 2005. This CMP update incorporates relevant goals, policies, projects, and programs of these related work efforts.

The CMP document is organized in chapters detailing the individual elements of the CMP. The chapters include the following:

Designated Roadway System (Chapter 1)

The CMP network of transportation facilities is designated so that it can be monitored biannually to determine service levels. Standards for traffic Levels of Service (LOS) on the network have been established, and CMP actions and investments proposed in the CIP must support the attainment of those standards. The CMP legislation requires that all state highways and principal arterials be included in the network.

Level of Service Standards (Chapter 2)

The CMP legislation requires the establishment of a uniform method for monitoring levels of service on roadways. For principal arterials and conventional highways in Marin County, LOS D has been chosen by the Congestion Management Agency as the standard for Urban and Suburban Arterials including highways that serve as arterials (e.g., SR 1, SR 131), and LOS E was selected as the standard for Highway 101, Interstate 580, and State Route 37. The Highway Capacity Manual methodology or accepted alternative is used to calculate levels of service on freeway segments as well as the volume-to-capacity ratios for segments of Urban and Suburban Arterials.

The CMP legislation allows trips not originating in a county, trips passing through a county, or trips generated by low and very low income housing to be excluded from the determination of conformance with LOS standards following consultation with MTC, Caltrans, and the BAAQMD. Even though they must be excluded for deficiency plan determinations, TAM has

elected to include these trips for planning purposes. Exclusion of these trips would present a misleading picture of the traffic conditions in the county.

For all roadways included in the portion of the CMP network within their jurisdictions, local governments are required to do the following:

- Adopt LOS standards for all CMP network roadways. LOS E is the minimum countywide standard for Highway 101, Interstate 580, and State Route 37. LOS D is the minimum Countywide standard for all other CMP network roadways. A local jurisdiction may adopt higher standards. In such a case, TAM will assess conformance with the higher standard, not the countywide minimum.
- Biannually monitor the LOS on the designated network according to the guidelines set forth in Chapter 8.

Performance Measures (Chapter 3)

Eight performance measures are included in the CMP. In addition to the Level of Service performance measures discussed in Chapter 2, three multi-modal performance measures are established, including:

- Peak-hour travel time
- Person throughput
- Vehicle miles of congested highway

One performance measure evaluates the jobs and housing (employed residents) balance within the County. A balance between jobs and housing can help the regional system by reducing trip length and congestion.

Two performance measures focus on transit service, specifically frequency and routing and coordination of service. These measures work in partnership with standards for roadway level of service and the transportation demand management element of the CMP. This will help bring about the desired goals with respect to mobility and air quality.

The performance measures for transit service in Marin County are based on the Golden Gate Bridge, Highway and Transportation District and Marin County Transit District's Short Range Transit Plan. The burden is on TAM to work with local governments and transit agencies to ensure that any transit improvements identified are reasonable and can be funded and implemented in the time frame they are proposed. Also, it may become necessary to require that some performance measure targets be met when transit improvements are identified in a deficiency plan.

The final performance measure looks at pedestrian and bicycle investments to ensure that pedestrian and bicycle travel is being accommodated in the transportation system.

Travel Demand Management (Chapter 4)

California Government Code section 65089(b)(3) requires a travel demand management (TDM) element of a CMP to promote alternative transportation methods, such as carpools, vanpools, transit, bicycles, and park-and-ride lots; improvements in the balance between jobs and housing; and other strategies, including flexible work hours and parking management programs, that help reduce congestion and air pollution.

TDM is an approach to solving transportation problems by improving the efficiency of the existing transportation system by better managing the demand for transportation facilities. TDM focuses on reducing the number of vehicles on highways during peak periods through ridesharing (carpooling), increased use of transit, and staggered work hours. Such measures can be integrated into the land use planning process with better development review, and incentives to provide designs and facilities that are supportive of a multi-modal transportation system.

The travel demand management element of the CMP has several goals, including a coordinated countywide TDM program and the establishment of an on-going process that promotes local and regional planning to reduce traffic congestion.

Land-Use Analysis Program (Chapter 5)

California Government Code section 65089(b)(4) requires that a CMP contain a program to analyze the impacts of land use decisions made by local jurisdictions on the regional transportation system (both highways and transit). The intent of the Land-Use Analysis Program is to improve the linkage between local land use decisions and regional transportation facility decisions; to better assess the impacts of development in one community on another; and to promote information sharing between local governments when the decisions made by one jurisdiction will have an impact on another.

The Land-Use Analysis Program in Marin County is a process designed to improve upon decisions about land use and the spending of funds on highway and transit improvements in the county. The process is intended to work in a positive, cooperative fashion that supports the needs of local, county, regional and state governments.

Marin County has in place an inventory of proposed development projects, known as "PROPDEV." PROPDEV includes all projects with at least five residential units or at least 5,000 square feet of non-residential use. The PROPDEV database file covers 40 items of information including location, project sponsor, acreage, zoning, square feet of building area and status of development application.

A two-tiered information and analysis process of local land use impacts is in place. Under "Tier I," local governments forward information on proposed General Plan Amendments to TAM during the period when the local jurisdiction is reviewing the application. "Tier II" includes an annual update of projected land uses in the future to be used for modeling both traffic and transit impacts.

In order to comply with the requirements of Tiers I and II of the Land-Use Analysis Program, all jurisdictions in the County need to:

- Keep the land use information contained in the countywide land use table up to date.
- Submit a complete accounting of residential and commercial projects to the PROPDEV inventory, a data table of proposed development projects.
- Submit information on all General Plan Amendments involving a net change (increase or decrease) of 100 or more P.M. peak hour trips and pay for a CMP modeling of their affects prior to their environmental review.
- Submit information on all highway network and transit system changes in their jurisdiction that result from: (1) project mitigations, (2) ordinance approvals, or (3) changes to the Transportation Element of their General Plan.
- Adopt traffic LOS standards that are consistent with or more restrictive than the LOS standards in the CMP.
- Develop a 7-year Capital Improvement Program designed to meet the adopted LOS Standards and support alternate modes of transportation.
- Submit the local agencies' Capital Improvement Program to TAM by July 1 of odd numbered years.
- Participate in TAM's Travel Demand Management Program.
- Comply with other requirements as outlined in the Monitoring and Conformance Chapter (Chapter 8).

Travel Demand Model (Chapter 6)

California Government Code section 65089(c) requires that every CMA, in consultation with the regional transportation planning agency (the Metropolitan Transportation Commission [MTC] in the Bay Area), cities, and the county, develop a uniform database on traffic impacts for use in a countywide transportation computer model. It also requires that the countywide model be the basis for computer models used for county sub-areas and cities, and that all models be consistent with the modeling methodology and databases used by the regional transportation planning agency. TAM should also approve sub-county area traffic models, and models used by local jurisdictions for land use impact analysis, if local jurisdictions decide to perform this work on their own. Appendix G of this report contains the full text of Code section 65089(c).

The purpose of this requirement is to guide TAM's decision making process in identifying the most effective balance of transportation programs and projects that maintain LOS standards. This includes the consideration of the benefits of transit service and transportation demand management programs, as well as the need for projects that improve congestion on the CMP highway and arterial system. The modeling requirement is also intended to assist local agencies in assessing the impact of new development on the transportation system. TAM will need to consider the nature of the analysis, functions of California specific analytic tools, and its available resources when deciding how to fulfill this requirement of the statutes.

The Marin County travel model is routinely updated as part of the consistency determination process with MTC.

Capital Improvement Program (Chapter 7)

Government Code section 65089(b)(5) requires that a CMP contain a 7-year Capital Improvement Program (CIP) to maintain or improve the adopted traffic LOS and to mitigate regional transportation impacts identified through the Land-Use Analysis Program. Capital improvement projects must conform to transportation-related vehicle emissions and air quality mitigation measures. These transportation control measures (or TCMs) are contained in the *Bay Area 2000 Clean Air Plan*.

Since the CMP will ultimately be incorporated into the Regional Transportation Plan (RTP) Action Elements, projects selected for Marin County's CIP will need to be consistent with the assumptions, goals, policies, actions and projects identified in the RTP. The RTP is the basic statement of transportation policy by MTC. Because of the interdependence of transportation planning and land use planning, a major effort was made by MTC to adopt policies that complement and support programs of federal, state, and regional agencies. The list of CIP projects is shown in Table 7, Chapter 7 of this report.

A review of the tables in Chapter 7 illustrates that there are serious deficiencies in funding the highway improvements necessary to upgrade current system deficiencies, as well as to maintain the adopted LOS Standards. Part of this deficiency was addressed during the 2004 ballot passing of "Measure A", a measure approving a half-cent sales tax increase to raise money for transportation improvements. Measure A is expected to generate $332 million dollars over the 20-year life of the measure, with over half of this money dedicated to transit, including local bus service, community shuttles, rural buses, clean fuel vehicles, and discount passes to low-income residents.

Monitoring, Improvement/Deficiency Plans and Conformance (Chapter 8)

California Government Code sections 65089.3, 65089.4, and 65089.5 govern the conformance process. These sections require that, based on the information obtained through monitoring, TAM must at least biennially determine whether or not the County and its cities and towns conform to the requirements of the CMP. If TAM believes that a local government is not conforming to CMP requirements, it must then hold a noticed public hearing to determine areas of nonconformance. If after the public hearing TAM still believes that the local government is not conforming to CMP requirements; it must provide written notice to the local government citing the specific instances of nonconformance. The local government then has 90 days to remedy the instances of nonconformance. If after 90 days the local government has not remedied the nonconformance instances, TAM makes a finding of nonconformance and notifies the State Controller to withhold certain gas tax subvention funds.

The CMP legislation makes the following requirements of a conformance determination:

- Maintaining the highway LOS standards outlined in the CMP.

- Participating in a program to analyze the impact of land use decisions, including the estimate of the costs associated with mitigating these impacts. Specific requirements and recommendations are outlined in the Land-Use Analysis Program Element of the CMP.
- Participating in adoption and implementation of a deficiency plan when highway and roadway LOS standards are not maintained on portions of the designated system.

No Marin County jurisdiction is considered out of conformance at this time.

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CHAPTER 1 – DESIGNATED ROADWAY SYSTEM

1.1 Purpose and Intent of Legislation

The designated roadway system includes all state highways and principal arterials in Marin County. Once a highway or roadway has been designated as part of the system, it cannot be removed from the system.[1] Furthermore, the regional transportation system is to be part of the required land-use program.[2]

The Congestion Management Program (CMP) roadway system is a network that allows monitoring of performance with respect to established level-of-service (LOS) standards. The network must be created at a level whereby impacts can be identified, and a connection can be made between proposed projects and their specific impacts on the network. The network cannot be too small, as impacts would not be identifiable, and at the same time, the network cannot be too large, as logistical problems would arise in monitoring performance.

1.2 Relationship to Regional Plans

The Congestion Management Program is a short-range document. The CMP elements contain a number of actions that further the goals of the Regional Transportation Plan (RTP) maintained by the Metropolitan Transportation Commission (MTC). MTC has determined that the Marin County CMP is consistent with the "Transportation 2030" RTP, adopted on Feb. 23, 2005. This "Transportation 2030" plan includes goals of safety, reliability, access, livable communities, clean air and efficient freight travel.

The designated roadway system is included within the RTP's Metropolitan Transportation System. This facilitates regional consistency between Marin County's CMP and those of adjoining Contra Costa, San Francisco, and Sonoma counties.

1.3 Designated CMP System

State highways and other principal arterials in this CMP were defined in prior CMPs. MTC has provided a framework that allows for flexibility in defining the principal arterial system. The following criteria were used to establish the designated CMP roadway network:

State Highways. All State highways must be included in the CMP roadway network according to the CMP legislation.

Principal Arterials. In 1991, the Marin County Public Works Association met and determined the non-State facilities that should be included in the CMP roadway network. The criteria they used to determine which facilities should be subject to CMP requirements included:

[1] California Government Code Section 65089(b)(1)(A)
[2] California Government Code Section 60589(b)(4)

- Purpose and function of the roadway
- Land use adjacent to the roadway and proximity to activity centers
- Average Daily Traffic (ADT) volume, generally over 25,000 vehicles a day
- Connectivity to other facilities

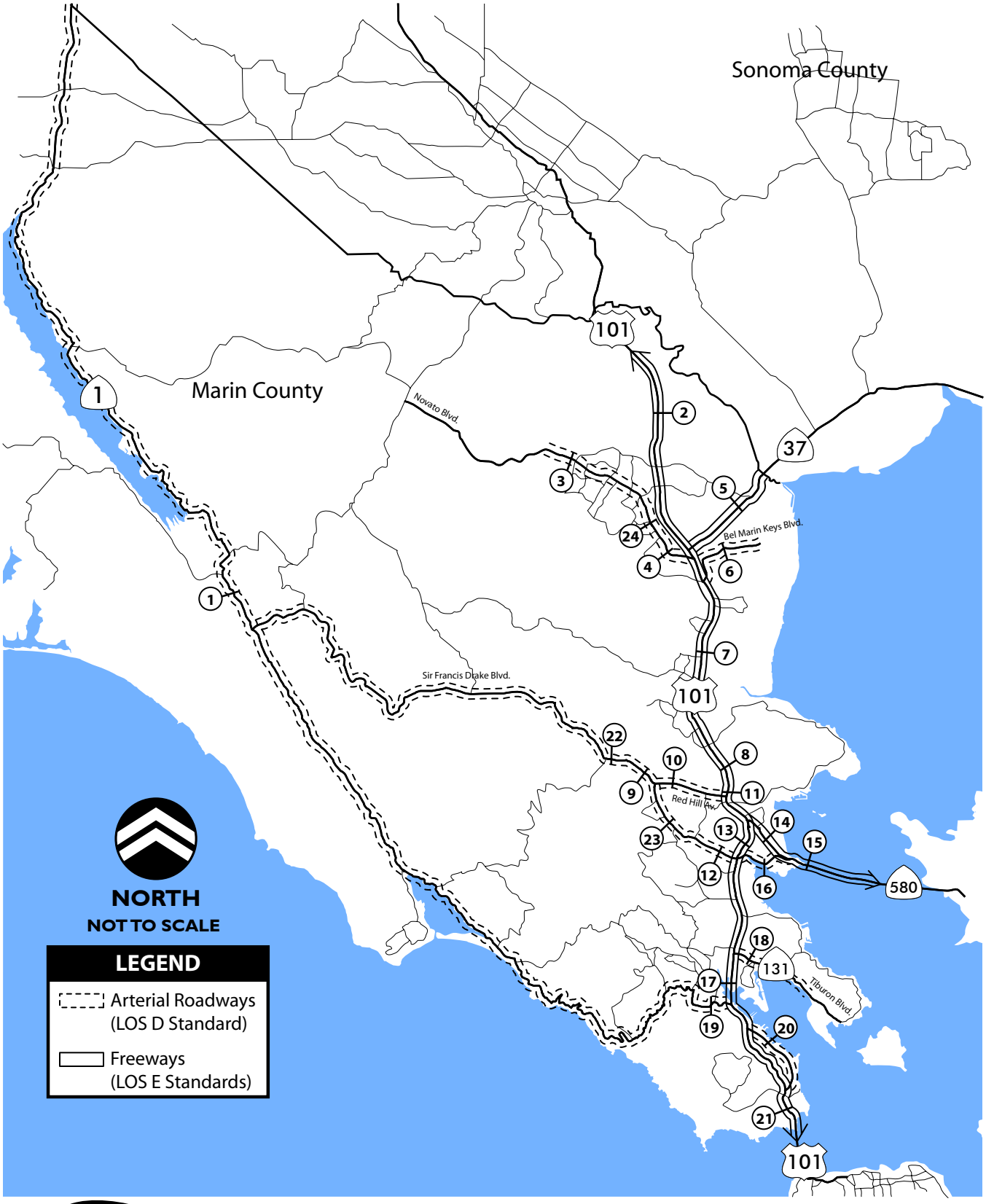
1.4 The CMP Network

The following routes, shown on Figure 1, are designated as the State Highway portion of the Marin County CMP network:

- Interstate 580 – from U.S. 101 to Contra Costa County line
- U.S. 101 – from San Francisco County Line to Sonoma County Line
- State Route 1 – from U.S. 101 to Sonoma County line
- State Route 37 – from U.S. 101 to Sonoma County line
- State Route 131 – from U.S. 101 to Main Street in Tiburon

The following routes (also shown on Figure 1) are designated as the principal arterial portion of the Marin County CMP network:

- Bel Marin Keys Boulevard – from U.S.101 southbound ramps to Arroyo San Jose
- Bridgeway/Richardson Street/Second Street/Alexander Avenue in Sausalito – from U.S. 101 to U.S. 101
- Fourth Street in San Rafael – from Ross Valley Drive to Marquard Avenue
- Novato Boulevard in Novato –from Sutro Avenue/San Marin Drive to Diablo Avenue
- Red Hill Avenue in San Anselmo – from Sir Francis Drake Boulevard to Ross Valley Drive
- Rowland Boulevard in Novato – from South Novato Boulevard to U.S. 101
- Second Street in San Rafael – from Marquard Avenue to U.S. 101
- Sir Francis Drake Boulevard in Larkspur and unincorporated Marin County – from U.S. 101 to Interstate 580
- Sir Francis Drake Boulevard in Larkspur, Kentfield, Ross, San Anselmo, and Fairfax – from State Route 1 to U.S. 101
- South Novato Boulevard in Novato – from Novato Boulevard to U.S. 101
- Third Street in San Rafael – from Marquard Avenue to U.S. 101
- In total, the 123-mile CMP designated roadway network contains 91 miles of state highways and 32 miles of principal arterials.



ENGINEERS
PLANNERS
ECONOMISTS
Wilbur Smith Associates

Figure 1
MARIN COUNTY 2005 CMP FACILITIES
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CHAPTER 2 – LEVEL-OF-SERVICE STANDARDS

2.1 Purpose and Intent of Legislation

Levels-of-service (LOS) standards are to be established as part of the CMP[3], and are defined consistent with the Transportation Research Board, Highway Capacity Manual, 2000, or accepted alternative.

2.1.1 Objective

Traffic LOS definitions describe conditions in terms of speed and travel time, volume, capacity, ease of maneuverability, traffic interruptions, comfort, convenience, and safety. There are five gradations of LOS, from A to F. LOS A reflects free flow conditions, with vehicles traveling at the maximum posted speed. LOS F reflects congested conditions, with vehicles traveling bumper-to-bumper.

The LOS designation provides a quantitative tool that can be used to analyze the impacts of land-use changes on the CMP network. Traffic LOS also is used as a measure of system performance (e.g., congestion). Biannually, at the first meeting after receiving the monitoring data and local agency follow-up, TAM is to determine whether local governments have been conforming to the CMP, including attainment of LOS standards. This will be achieved through a self-certification process whereby monitoring and reporting of the LOS conditions are conducted by TAM or by local jurisdictions. The TAM will then, upon receiving the local monitoring reports, determine whether the local government is in conformance with the CMP. Additional detail on monitoring requirements is included in Chapter 8.

Local governments must consider the impacts that land-use decisions will have on the LOS on the designated CMP network. Therefore, a systems approach may have to be examined when considering the LOS on the entire system. Cities and counties may be responsible for improvements and funding of programs that will affect the system as a whole.

2.2 Highway Level-of-Service Standards

2.2.1 Goals and Objectives

The LOS technique should allow for the measurement of traffic growth trends through volumes, capacity, and measures of delay. The objectives are to develop an approach that is consistent, easy to use, non-duplicative, and compatible with local government data and travel demand models. The following represents the approach used for each issue.

Issue	**Approach**
Inter-County Trips	In accordance with MTC guidelines, trips with no trip end in Marin County (through trips) will not be subtracted.

[3] California Government Code 65089(b)(1)(A)

LOS Standards	D for Urban and Suburban Arterials, E for Freeways and Rural Expressways (U.S. 101, Interstate 580, and State Route 37)
Methods of Analysis	**Freeway and Rural Expressway Segments** – The analysis technique for freeway segments, based on segment weekday P.M. peak-hour volume to capacity ratios is from Chapter 23 and 24 of the *Highway Capacity Manual.* (The P.M. peak hour is the highest consecutive 60 minutes of traffic in the afternoon, typically between 5 P.M. and 6 P.M.) **Urban and Suburban Arterial Segments** – Volume-to-capacity ratios will be the analysis technique for arterial sequences, utilizing capacities provided in Chapter 15 and 16 of the *Highway Capacity Manual,* and based on weekday P.M. peak-hour traffic volumes. (The P.M. peak hour is the highest consecutive 60 minutes of traffic in the afternoon, typically between 5 P.M. and 6 P.M.) **Rural Roadways** – Chapter 20 of the *Highway Capacity Manual* will be the analysis technique for rural roadways, based on weekday P.M. peak-hour traffic volumes. (The P.M. peak hour is the highest consecutive 60 minutes of traffic in the afternoon, typically between 5 P.M. and 6 P.M.)
Monitoring	The local agency (e.g., city and county) or TAM will do the LOS monitoring. Count frequency will be bi-annual (with certain exceptions outlined in Chapter 8), recognizing that more frequent counting could be done as part of development impact study requirements.
Deficiency Analyses	More refined analyses may be required when determining if a roadway segment is deficient. If appropriate, the operational analysis methodology described in the *Highway Capacity Manual* may be used to determine LOS.

The CMP legislation allows trips not originating in a county, trips passing through a county, or trips generated by low- and very low-income housing to be excluded from the determination of conformance with LOS standards following consultation with MTC, Caltrans, and the Bay Area Air Quality Management District. TAM decided to include these trips, however, when determining conformance with LOS standards for local planning purposes, as exclusion of these trips would present a misleading picture of the traffic conditions in the county and could artificially skew the inclusion and/or ranking of projects in the 7-year Capital Improvement Program.

In September 2002, the California Legislature passed SB 1636, which is intended to "remove regulatory barriers around the development of infill housing, transit-oriented development, and

mixed use commercial development" by enabling local jurisdictions to designate "infill opportunity zones (IOZ's)". These zones are defined as areas designated for compact, transit-oriented housing and mixed use within 1/3 mile of major transit stops. The CMP network segments within the IOZ will be exempt from CMP traffic LOS standards. In their place, a city must include these streets under an alternative area-wide LOS standard or multimodal composite or personal LOS standard, or approve a list of flexible mitigation options that includes investments in alternative modes of transportation. Marin County has not designated any zones at this time.

2.2.2 Facility Classifications

The *Highway Capacity Manual* provides methods for determining LOS on several types of facilities. These facilities are grouped into interrupted- and uninterrupted-flow facilities. Interrupted-flow facilities include city streets and surface highways (like Highway 1) that are part of the State Highway System. For purposes of LOS analysis, the CMP network can be classified into two functional types of facilities:

Basic Freeway Segments. These are uninterrupted-flow facilities with multiple lanes available in each direction since traffic only stops during the most congested periods or when breakdowns occur.

Urban and Suburban Arterials. These are multi-lane streets that have traffic signals less than two miles apart on average. Volume-to-capacity ratios are used to estimate level of service. The advantage of this approach is that volume-to-capacity ratios are easily determined.

2.2.3 Definition of Roadway Segments

The segments of the CMP network that will be analyzed are included in Appendix A. For the principal arterials, a "responsible jurisdiction" has been designated. The jurisdiction named is the one with the greatest segment mileage. This jurisdiction is responsible for preparing any deficiency plans that may be required, as well as complying with all other requirements of the CMP legislation related to that segment. Other jurisdictions through which the segment travels are expected to work in a cooperative fashion with the responsible jurisdiction, and bear a pro-rata share of the cost of any improvement to the facility based on the approximate cost of improvements in their jurisdiction. In the event that funding is needed for a program, each jurisdiction would contribute its fair share of the cost based on segment mileage within the jurisdiction.

2.2.4 Identification of "Grandfathered" Roadway Segments

"Grandfathered" roadway segments are those that were operating at a lower LOS than the standard at the time of its implementation in 1991.These segments are allowed to continue to operate at a lower LOS standard level until such time as they are improved or the traffic load is diverted. Freeway segments that operated at LOS F or arterial segments that operated at LOS E or F in the 1991 CMP qualify as "grandfathered" segments. The status of each segment in Marin County is listed in Table 1. The grandfathered segments are illustrated in Figure 2.

TAM, in its decision to grandfather the LOS F facilities, is recommending that an improvement plan be developed to address congestion on U.S. 101 and for grandfathered segments of other roadways. An improvement plan consists of a description of the actions required to improve the LOS on the facility, either by increasing capacity or managing the demand for travel in a manner that effectively improves LOS.

2.2.5 2005 Monitoring Results

The results of the survey suggest different actions in monitoring for four different categories of roadways. Table 2 illustrates the actions that should be taken on each segment.

The first category includes the non-grandfathered roadway segments with satisfactory status for now and for which no action is needed. These are nine of these segments.

The second category includes those roadways that currently operate worse than the LOS standards (as defined by general lane capacities for arterial streets) but were not grandfathered in the CMP. Any roadway segments in this category should be highlighted for future evaluation, and then TAM should decide whether deficiency plans or improvement plans are required. One segment fell under this category, Novato Blvd, Grant to Diablo. A more detailed intersection level analysis of the segment found that it currently operates at LOS D (acceptable). See Appendix F for additional information.

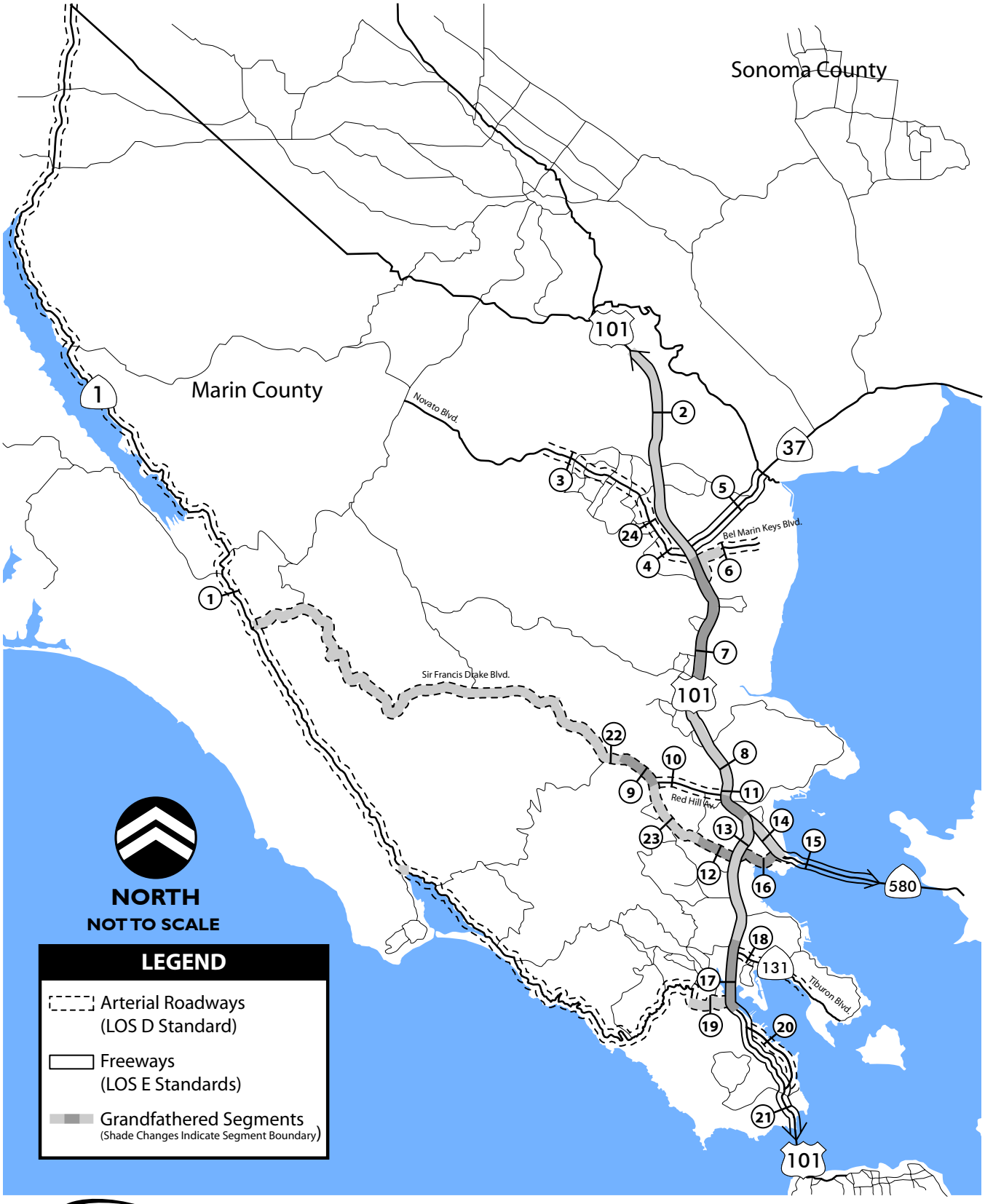
The third category includes those roadway segments that operate at acceptable levels of service but were originally included in the grandfathered segments in the CMP. These roadway segments should continue to be monitored bi-annually and made subject to the requirements of the CMP. Improvement plans may not be necessary at this time but may be required in the future. Five roadway segments fall under this category.

The fourth category includes nine locations that are grandfathered roadway segments in the CMP and were found to currently operate worse than the LOS standard. The segments that are grandfathered and operate worse than the LOS standard are recommended to have an improvement plan developed. It is recognized that certain cities and towns have made policy decisions to not widen certain roadways in their jurisdiction. These cities' and towns' improvement plans could consist of appropriate Transportation Demand Management (TDM) and Traffic/Transportation System Management (TSM) options, selected to improve levels of service or reduce the future worsening of levels of service.

After screening for "grandfathered" facilities, no Marin County jurisdiction is considered out of conformance at this time.

Table 1 – "Grandfathered" Status of Segments

Segment #	Type	Segment	Grandfathered?
1	Principal Arterial	Shoreline Highway (State Route 1), from Sir Francis Drake Blvd to Pt. Reyes Station	No
2	Basic Freeway	U.S. 101, from Atherton Ave. to Sonoma County Line	Yes
3	Principal Arterial	Novato Blvd. from San Marin Dr./Sutro Ave to Wilson Ave.	No
4	Principal Arterial	South Novato Blvd. from U.S. 101 to Novato Blvd.	No
5	Basic Freeway	State Route 37, from U.S. 101 to Atherton Ave	No
6	Principal Arterial	Bel Marin Keys, from U.S.101 to Commercial Blvd	Yes
7	Basic Freeway	U.S. 101, from N. San Pedro Rd. to State Route 37	Yes
8	Basic Freeway	U.S. 101, from Mission Ave. to N. San Pedro Rd.	Yes
9	Principal Arterial	Sir Francis Drake Blvd., from San Anselmo Ave. to Red Hill Ave.	Yes
10	Principal Arterial	Red Hill Ave. from Sir Francis Drake Blvd.to Hilldale Dr.	No
11	Basic Freeway	U.S. 101, from Interstate 580 to Mission Ave.	Yes
12	Principal Arterial	Sir Francis Drake Blvd., from College Ave. to Wolfe Grade	Yes
13	Basic Freeway	U.S. 101 from Tiburon Blvd. (SR 131) to Interstate 580	Yes
14	Basic Freeway	Interstate 580, from Sir Francis Drake Blvd. to Bellam Blvd.	Yes
15	Basic Freeway	Interstate 580, from Sir Francis Drake Blvd. to Richmond/San Rafael Bridge	No
16	Principal Arterial	E. Sir Francis Drake Blvd., from U.S. 101 to Larkspur Landing Cir	Yes
17	Basic Freeway	U.S. 101, from Shoreline Highway (SR 1) to Tiburon Blvd. (SR 131)	Yes
18	Principal Arterial	Tiburon Blvd. (State Route 131) from U.S. 101 to Strawberry Drive	No
19	Principal Arterial	Shoreline Highway (State Route 1), from Northern Ave. to Almonte Blvd.	Yes
20	Principal Arterial	Bridgeway Blvd.,from U.S. 101 to U.S. 101	No
21	Basic Freeway	U.S. 101 from San Francisco County Line to Shoreline	No
22	Principal Arterial	Sir Francis Drake Blvd.from Butterfield Rd. to State Route 1	Yes
23	Principal Arterial	Sir Francis Drake Blvd. from College Ave. to Toussin Ave.	Yes
24	Principal Arterial	Novato Blvd., from Wilson Ave. to Diablo Ave.	No



ENGINEERS
PLANNERS
ECONOMISTS
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Figure 2
MARIN COUNTY 2005 CMP GRANDFATHERED ROADWAYS
531950/BASE - 06/24/05

Table 2 – Actions Recommended by Segment

Segment #	Segment	Peak Direction	Peak Direction LOS	Action Needed
Non-Grandfathered, Satisfactory				
1	Shoreline Highway (State Route 1), from Sir Francis Drake Blvd to Pt. Reyes Station	NB	A	Within LOS Standard; No Action
3	Novato Blvd. from San Marin Dr./Sutro Ave to Wilson Ave.	NB	A	Within LOS Standard; No Action
4	South Novato Blvd. from U.S. 101 to Novato Blvd.	NB	A	Within LOS Standard; No Action
5	State Route 37, from U.S. 101 to Atherton Ave	EB	C	Within LOS Standard; No Action
10	Red Hill Ave. from Sir Francis Drake Blvd.to Hilldale Dr.	WB	C	Within LOS Standard; No Action
15	Interstate 580, from Sir Francis Drake Blvd. to Richmond/San Rafael Bridge	WB	C	Within LOS Standard; No Action
		EB	D	Within LOS Standard; No Action
18	Tiburon Blvd. (State Route 131) from U.S. 101 to Strawberry Drive	EB	C	Within LOS Standard; No Action
20	Bridgeway Blvd.,from U.S. 101 to U.S. 101	NB	B	Within LOS Standard; No Action
21	U.S. 101 from San Francisco County Line to Shoreline Highway (SR1)	NB	C	Within LOS Standard; No Action
		SB	B	Within LOS Standard; No Action
24	Novato Blvd., from Wilson Ave. to Diablo Ave.	NB	E[1]	Improvement plan or deficiency plan recommended
Grandfathered, Satisfactory				
2	U.S. 101, from Atherton Ave. to Sonoma County Line	NB	D	Grandfathered; No Action
6	Bel Marin Keys, from U.S.101 to Commercial Blvd	WB	C	Grandfathered; No Action
7	U.S. 101, from N. San Pedro Rd. to State Route 37	NB	E	Grandfathered; No Action
12	Sir Francis Drake Blvd., from College Ave. to Wolfe Grade	WB	B	Grandfathered; No Action
16	E. Sir Francis Drake Blvd., from U.S. 101 to Larkspur Landing Cir	EB	C	Grandfathered; No Action
Grandfathered, Improvement Plan Recommended				
8	U.S. 101, from Mission Ave. to N. San Pedro Rd.	NB	F	Grandfathered; Improvement Plan Recommended
9	Sir Francis Drake Blvd., from San Anselmo Ave. to Red Hill Ave.	WB	E	Grandfathered; Improvement Plan Recommended
11	U.S. 101, from Interstate 580 to Mission Ave.	NB	F	Grandfathered; Improvement Plan Recommended
13	U.S. 101 from Tiburon Blvd. (SR 131) to Interstate 580	NB	F	Grandfathered; Improvement Plan Recommended
14	Interstate 580, from Sir Francis Drake Blvd. to Bellam Blvd.	EB	F	Grandfathered; Improvement Plan Recommended
17	U.S. 101, from Shoreline Highway (SR 1) to Tiburon Blvd. (SR 131)	NB	F	Grandfathered; Improvement Plan Recommended
19	Shoreline Highway (State Route 1), from Northern Ave. to Almonte Blvd.	NB	F	Grandfathered; Improvement Plan Recommended
22	Sir Francis Drake Blvd.from Butterfield Rd. to State Route 1	WB	E	Grandfathered; Improvement Plan Recommended
23	Sir Francis Drake Blvd. from College Ave. to Toussin Ave.	WB	F	Grandfathered; Improvement Plan Recommended

[1]More detailed intersection level analysis indicated that this segment operates at LOS D (acceptable)

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CHAPTER 3 – PERFORMANCE MEASURES ELEMENT

3.1 Purpose and Intent of Legislation

The California Government Code requires TAM to establish performance measures to evaluate current and future multimodal system performance for the movement of people and goods.[4] Consistent with the 2003 Marin County CMP, eight performance measures were included in this CMP and are described in this chapter. The measures in this chapter should not be confused with "standards," as no level of performance is required. Rather, a measure simply indicates the level of performance at a given time.

This first part of this section describes the current transit system in Marin. The next section describes the following eight performance measures:

1. Highway Level of Service
2. Peak-Hour Travel Time
3. Person Throughput
4. Vehicle Miles Traveled on Congested Highways
5. Jobs/Housing Balance
6. Transit Headways
7. Transit Coordination
8. Pedestrian and Bicycle Investment

The performance measures help determine whether the goals of the CMP are being met: supporting mobility, air quality, land-use, and economic objectives. The measures shall be used in the development of the Capital Improvement Program, deficiency plans, and the land-use analysis program. A *Performance Measures Monitoring Report* prepared in July 2005 contains detailed information on these measures. This report can be found in Appendix F of this document.

3.2 Existing Transit Operations in Marin County

The transit network is comprised of a variety of services within Marin County. These include:

- General public transit bus service for both inter- and intra-county trips;
- General public ferry service, provided by two operators, serving trips between Marin County and San Francisco;
- Specialized transit services aimed at serving the needs of the elderly and disabled populations in the County; and
- Privately operated services, providing targeted service between specific locations, such as the service between Marin County and San Francisco International Airport.

[4] California Government Code Section 65089(b)(2)

The criteria used to establish CMP routes are:

- One-way, monthly ridership is greater than 5,000.
- Inter-county transit service using modes other than buses.

The following sections provide a brief description of the transit services offered in Marin County.

3.2.1 General Public Transit Services

3.2.1.1 Golden Gate Transit

Golden Gate Transit (GGT) is the primary operator of public transit services in the county, serving intra-county trips between Marin County and Sonoma, San Francisco, and Contra Costa Counties. GGT services are operated by the Golden Gate Bridge, Highway and Transportation District. The District provides three major types of service: basic, local and commute.

The primary categories of bus service provided by GGT include:

- **Basic Service.** There are six "basic service" routes operating in Marin County. Basic service routes operate all day, seven days per week, providing wheelchair accessible trunkline service between the Transbay Terminal and Civic Center in San Francisco and various suburban centers within Marin and Sonoma Counties. These six routes provide the "Backbone" of service both within Marin County, and between Marin and neighboring counties. The six routes are 10,40,42,70,71, and 80.
- **Commute Service.** This service provides twenty-one routes that operate on weekdays except holidays, between the residential neighborhoods within Marin County and the San Francisco Financial District and Civic Center employment centers during the A.M. and P.M. commute periods. Commute service is generally operated in one direction only during commute hours and is not run at all during the midday and off-peak hours.
- **Local Service.** Thirteen routes operate entirely within Marin County on weekdays, with limited weekend service, under contract with the Marin County Transit District (MCTD). An additional 13 routes operate school service on school days only, as detailed below.

In addition to these primary bus services, GGT operates four additional services that have not been included in the CMP transit network. These are:

- **Recreational Service.** Two routes traveling between suburban centers located at basic trunkline bus connecting points and several of the principal parks and recreation areas in West Marin County. Schedules on these routes are adapted to the weekend and seasonal characteristics of the recreational travel demand.
- **School Service.** Routes 107, 113, 115, 117, 123, 125, 126, 127, 131, 132, 139, 143, and 153 provide limited service on school days within Marin County.

- **Special Service.** These routes are provided to the general public for certain special events throughout the year, such as the special express service to 49ers games at Candlestick Point. These routes are not part of the permanent schedule and are not included in the transit network.
- **Golden Gate Ferry Service.** Golden Gate Ferry operates ferry services from Larkspur to San Francisco and from Sausalito to San Francisco.

3.2.1.2 Other General Public Transit Services

- **Stagecoach Shuttle.** The Marin County Transit District operates the successful, weekday "Stagecoach" shuttle service in West Marin. The Stagecoach also serves as a partial paratransit service, offering free pickup service to ADA certified passengers who live within ¾ of a mile from the Stagecoach route.
- **County Shuttle.** This service is operated by Marin County Division of Health and Human Services (HSS). It provides service from the San Rafael Transit Center to the county social services building.
- **Sonoma County Transit.** Sonoma County Transit operates one commuter route (one outbound A.M bus and one inbound P.M. bus) from the Sonoma Valley to San Francisco.
- **Greyhound.** Greyhound runs interregional service routes down the 101 corridor. This includes 3 routes daily departing from the San Rafael Transit Center to downtown San Francisco.
- Other general public shuttle transit services in operation include the "EZ Rider" in Novato and the "Sally" in Sausalito.

3.2.2 Specialized Transit Services

3.2.2.1 Whistlestop Wheels

The Marin County Transit District contracts with the Marin Senior Coordinating Council to provide a local paratransit service known as "Whistlestop Wheels." Service is provided within the county seven days a week. About 85,000 patrons use the service annually.

Inter-county paratransit service is provided seven days a week, under an agreement with Golden Gate Transit and Marin County Transit District. The inter-county service area includes Sonoma, San Francisco, and Contra Costa counties in addition to Marin County.

Services are available from 6 A.M. to 1 A.M., seven days a week. Approximately 40 lift-equipped vehicles are used to provide service, which is a door-to-door ridesharing program.

3.2.2.2 Other Specialized Providers

There are a number of other agencies that provide specialized transportation in Marin County. The vast majority of these services is provided as access to specific programs and is not used for

general-purpose trips. These latter services are operated primarily by non-profit and volunteer organizations, and their eligibility criteria, cost, and availability vary widely.

3.2.3 Private Transportation Operators

3.2.3.1 Marin Airporter

Marin Airporter is the largest private provider of transit services in Marin County. Their service area includes Novato, Ignacio, Larkspur, Mill Valley and Sausalito. Airport service to San Francisco International Airport is provided on a fixed schedule every 1/2 hour from 4:30 A.M. until 11:00 P.M. every day. In addition to the airport service, Marin Airporter manages a charter operation.

3.2.3.2 Blue and Gold Fleet

Blue and Gold Fleet provides ferry services between Tiburon and the San Francisco Ferry Terminal and also between Sausalito and Fisherman's Wharf.

3.3 Performance Measures

The eight performance measures described below allow TAM to measure the transportation system performance in Marin County.

3.3.1 Roadway Level of Service

This performance measure provides an overview of the operating level of the roadway system in Marin County. It is described in detail in Chapter 2.

3.3.2 Aggregate Peak Hour Travel Time

This performance measure will determine the amount of time required to travel through selected corridors on a variety of modes. Because single-occupant, high-occupant, and transit vehicles travel at different speeds, aggregate travel time between two points for all modes effectively describes the system's performance. To determine peak-hour travel times by single-occupant and high-occupant vehicles, travel time runs would be required for two given days at the peak hour in the peak direction. Transit schedules were used to determine travel times via buses. In Marin County, aggregate travel times were developed for four segments:

1. U.S. 101 between the Sonoma County line and San Rafael Transit Center
2. U.S. 101 between San Rafael Transit Center and the Golden Gate Bridge
3. Sir Francis Drake Boulevard between Butterfield Road and U.S. 101
4. Red Hill Avenue, Second and Third streets between Sir Francis Drake Boulevard and San Rafael Transit Center

3.3.3 Person Throughput

This performance measure identifies the number of people, not vehicles, who are able to move over a given facility in the peak period. As a combination of vehicle occupancy and level of service, this measure allows for recognition that transit service and HOV lanes can benefit corridor capacity. Roadways were defined in terms of vehicles per hour, and HOV lanes would be assumed to carry more persons per lane than a mixed-flow lane. Finally, buses would be defined as additional roadway capacity. This measure can be estimated for future years by analyzing Marin Travel Model outputs.

Existing conditions for this measure can be obtained through a monitoring process. Monitoring of this measure would require that the number of riders and the seats on buses in a peak hour in each direction be defined. It would require observing travel volumes, as well as the average vehicle occupancy on a given mixed-flow or HOV lane. These locations are on CMP facilities that are representative congestion points, including:

- U.S. 101 between Interstate 580 and Central San Rafael
- U.S. 101 between Paradise Drive and the Tiburon Boulevard
- U.S. 101 north of Atherton Avenue
- Sir Francis Drake Boulevard west of U.S. 101
- Sir Francis Drake Boulevard north of Red Hill Avenue
- Red Hill Avenue east of Sir Francis Drake Boulevard

3.3.4 Vehicle Miles of Congested Highway

This performance measure, derived from the Marin Travel Model, measures vehicle miles traveled on congested segments of the freeway system in Marin County. Congested segments are highway segments at LOS E or worse (volume-to-capacity ratio greater than one). This measure provides an understanding of the relative extent of congestion on the freeway portion of the CMP roadway system.

3.3.5 Jobs/Housing (Employed Residents) Balance

This performance measure considers the balance between projected employed residents and projected jobs within different planning areas of the county. Achieving a balance between jobs and housing within a community or area can help the regional transportation system by reducing the length of trips and traffic congestion. This measure is discussed in more detail in Chapter 4.

3.3.6 Transit Headway

This performance measure presents the time intervals, or headways, between transit vehicles. Proper headways ensure that individual routes operate at frequencies that are appropriate to the type of service they provide and adequately address both existing and potential ridership demand.

3.3.6.1 Golden Gate Bus Service

Golden Gate Transit Bus Service was reduced significantly between March and December of 2003. Since December 2003, the number of routes in service has remained roughly constant, though some headways have been reduced. Table 3 details the service alterations between December 2003 and March 2005. Detailed information on current schedules may be viewed on the Golden Gate Bridge, Highway & Transportation District website at http://www.goldengate.org.

The response to budget cuts since 2003 has also included organizational downsizing (reducing the size of the organization by 20%) and several fare increases. The most recent fare increase is a 5% fare increase effective July 1, 2005. This increase is expected to generate about $600,000 in added annual revenue to assist in meeting the agency's operating expenses for fiscal year 2006 and beyond.

Table 3 – Golden Gate Transit Bus Service Changes Since 2003

After December 2003			As of March 2005			
Route	Route Type Description	Approx Minimum Headway	Route	Route Type Description	Approx Minimum Headway	Change
1	Cancelled (See Routes 29, 55, 57 & 59)		1	Remain Cancelled		No
2	Commute: Headlands to San Francisco	26 Min.	2	Commute: Headlands to San Francisco	21 Min.	Yes
3	Commute: Sausalito Ferry to Tamalpais Valley		3	Cancelled		Yes
4	Commute: Mill Valley to San Francisco	10 Min.	4	Commute: Mill Valley to San Francisco	10 Min.	No
5	Cancelled (See Route 10)		5	Remain Cancelled		No
8	Commute: Tiburon to San Francisco	34 Min.	8	Commute: Tiburon to San Francisco	36 Min.	No
9	Commute: Tiburon Ferry to Strawberry	50 Min.	9	Commute: Tiburon Ferry to Strawberry	50 Min.	No
10	Basic: Sausalito to Tiburon	60 Min.	10	Basic: Sausalito to Tiburon	60 Min.	No
11	Cancelled (See Route 9)		11	Remain Cancelled		No
13	Cancelled (See Route 10)		13	Remain Cancelled		No
15	Local: Strawberry to San Francisco	60 Min.	15	Local: Marin to Tiburon	55 Min	Yes
117	East Corte Madera to Neil Cummins School: to Hall Middle School	11 Min.	117	East Corte Madera to Neil Cummins School: to Hall Middle School	11 Min.	No
18	Commute: College of Marin to San Francisco	20 Min.	18	Commute: College of Marin to San Francisco	20 Min.	No
19	Cancelled (See Route 29)		19	Remain Cancelled		No
20	Cancelled (See Routes 22, 23, 35, 70, & 80		20	Remain Cancelled		No
21	Basic: Marin Gen Hospital to Strawberry	60 Min.	21	Local: Marin Gen Hospital to Strawberry	60 Min.	Yes
22	Basic: San Anselmo to Sausalito	60 Min.	22	Basic: San Anselmo to Sausalito	60 Min.	Yes
23	Basic: Fairfax to San Rafael	30 Min.	23	Local: Fairfax to San Rafael		Yes
24	Commute: Fairfax to San Francisco	5 Min.	24	Commute: Fairfax to San Francisco	5 Min	No
25	Cancelled (See Routes 26 & 27		25	Remain Cancelled		No
26	Commute: Sleepy Hollow to San Francisco	14 Min.	26	Commute: Sleepy Hollow to San Francisco	14 Min	No
127	Sleepy Hollow to White School	10 Min.	127	Sleepy Hollow to White School	10 Min.	No
28	Cancelled (See Route 36)		28	Remain Cancelled		No
29	Basic: San Rafael to San Anselmo	30 Min.	29	Local: San Rafael to San Anselmo	30 Min.	Yes
30	Cancelled		30	Remain Cancelled		No
31	Cancelled		31	Remain Cancelled		No
32	Commute: Peacock Gap to San Rafael	24 Min.	32	Commute: Peacock Gap to San Rafael	24 Min	No
33	Basic: San Venetia to San Rafael	60 Min.	33	Local: San Venetia to San Rafael	15 Min.	Yes
34	Commute: San Venetia to San Rafael	27 Min.	34	Commute: San Venetia to San Rafael	30 Min.	Yes
35/36	Basic: East San Rafael to San Rafael to Marin City	15 Min.	35/36	Local: East San Rafael to San Rafael to Marin City	15 Min.	Yes
37	Canceled (See Route 29)		37	Remain Cancelled		No
38	Commute: Terra Linda to San Francisco	25 Min.	38	Commute: Terra Linda to San Francisco	25 Min.	Yes
139	School: Lucas Valley to Terra Linda High	20 Min.	139	School: Lucas Valley to Terra Linda High	20 Min.	No
40/42	Basic: San Rafael to Del Norte BART	23 Min.	40/42	Basic: San Rafael to Del Norte BART	23 Min.	No
41	Cancelled		41	Remain Cancelled		No
107	St. Hilary's School: to Tamalpais High to Marin City	19 Min.	107	St. Hilary's School: to Tamalpais High to Marin City	19 Min.	No
44	Commute: Lucas Valley to San Francisco	25 Min.	44	Commute: Lucas Valley to San Francisco	25 Min.	No
113/115	Paradise Cay/ Tiburon to Redwood High	20 Min.	113/115	Paradise Cay/ Tiburon to Redwood High	20 Min.	No
48	Cancelled		48	Remain Cancelled		No
50	Cancelled (See Routes 10, 29, 53, 57, 59, 70, & 80		50	Remain Cancelled		No
51	Cancelled (See Routes 54 & 58)		51	Remain Cancelled		No
53	Basic: San Marin to Novato	60 Min.	53	Local: San Marin to Novato	60 Min.	Yes
54	Commute: San Marin to San Francisco	13 Min.	54	Commute: San Marin to San Francisco	15 Min.	No
55	Local: Ignacio to Novato	60 Min.	55	Local: Ignacio to Novato	60 Min.	No
56	Commute: Novato to San Francisco	15 Min.	56	Commute: Novato to San Francisco	20 Min.	Yes
57/59	Local: Novato to San Rafael	17 Min.	57/59	Local: Novato to San Rafael	17 Min.	No
60	Commute: San Rafael to San Francisco	30 Min.	60	Commute: San Rafael to San Francisco	30 Min.	No
63	Local: Marin City to Stinson Weekends	123 Min.	63	Local: Marin City to Stinson Weekends	123 Min	No
70	Basic: Novato to San Francisco	30 Min.	70	Cancelled: see route 80		Yes
71	Cancelled: See route 80		71	Remain Cancelled: See route 80		No
72	Commute: Santa Rosa to San Francisco	5 Min.	72	Commute: Santa Rosa to San Francisco	15 Min.	Yes
73	Commute: Santa Rosa to San Francisco	29 Min.	73	Commute: Santa Rosa to San Francisco	30 Min.	No
74	Commute: Santa Rosa to San Francisco	21 Min.	74	Commute: Santa Rosa to San Francisco	21 Min.	No
75	Commute: Santa Rosa to East San Rafael	23 Min.	75	Commute: Santa Rosa to East San Rafael	23 Min.	No
76	Commute: East Petaluma to San Francisco	5 Min.	76	Commute: East Petaluma to San Francisco	5 Min.	No
78	Cancelled		78	Remain Cancelled		No
80	Basic: Santa Rosa to San Francisco	29 Min.	80	Basic: Santa Rosa to San Francisco	30 Min.	No
90	Cancelled		90	Remain Cancelled		No
93	Commute: GG toll plaza to Mission St.	25 Min.	93	Commute: GG toll plaza to SF Civic Center	20 Min.	Yes
97	Commute: Larkspur Ferry to San Rafael	1 run	97	Commute: Larkspur Ferry to San Rafael	1 Run	No
126	School: San Rafael to Brookside Schools	9 Min.	126	School: San Rafael to Brookside Schools	9 Min	No
132	Peacock Gap to San Rafael High	1 Run	132	Peacock Gap to San Rafael High	1 Run	No
143	School: Sausalito to Tamalpais High	60 Min.	143	School: Sausalito to Tamalpais High	60 Min.	No
153	Did not exist		153	School: Novato to San Marin High School	2 Runs	Yes

3.3.6.2 Golden Gate Transit Ferry Service

Golden Gate Transit operates ferry services from two ports in Marin County:

- Larkspur to San Francisco (30 minute peak headways)
- Sausalito to San Francisco (80 minute peak headways)

3.3.6.3 Blue and Gold Ferry Service

Blue and Gold Ferry operates from two ports in Marin County:

- Tiburon to San Francisco (60 minute peak headways)
- Sausalito to San Francisco (120 minute peak headways)

3.3.7 Transit Coordination

This performance measure considers the extent to which transit service is integrated between service types and modes and with other transit services within the county or in adjacent counties. The coordination of regional transit services enhances seamless regional transit travel. Transit schedule coordination can be measured at key transfer facilities between local and regional services.

3.3.8 Pedestrian and Bicycle Investment

The purpose of this measure is to ensure that pedestrian and bicycle travel is being accommodated in new transportation improvement projects. Because the Capital Improvement Program is a component of the CMP and pedestrian and bicycle improvements contribute to improved transportation system options, a separate measurement of pedestrian and bicycle improvement is recommended. This measure will reflect the extent that pedestrian and bicycle facilities are included in the design of all transportation projects, as appropriate, in the CMP's Capital Improvement Program.

CHAPTER 4 – TRAVEL DEMAND MANAGEMENT ELEMENT

4.1 Purpose and Intent of Legislation

California Government Code section 65089(b)(3) requires that a Travel Demand Management (TDM) element be a part of every CMP. Assembly Bill 2419, which became effective on January 1, 1997, eliminated the requirement for a "trip reduction" component to this element, leaving only the "travel demand" component. According to the revised CMP legislation, the TDM element should promote:

- Alternatives to the single-occupant automobile, e.g., carpools, vanpools, transit, and bicycles
- Increased use of park-and-ride lots
- Improvements in the balance between jobs and housing
- Other strategies for reducing vehicle trips, including flexible work hours, telecommuting, and parking management programs

The agency must also consider parking cash-out programs during the development and update of the travel-demand element.

Transportation Demand Management (TDM) focuses on reducing the number of vehicles on highways during peak periods through ridesharing, increased use of transit, and flexible work hours. Such measures can be integrated into the land-use planning process by providing incentives to developers, such as reduced parking requirements or reduced development impact fees when certain trip-reduction techniques are implemented. TDM is an approach to solving transportation problems by improving the efficiency of the existing transportation system by better managing the demand for transportation facilities. TDM views existing streets and highways, railways, parking facilities, bike and pedestrian facilities, and public and private vehicles as elements of a single transportation system. TDM attempts to organize these elements through operating, regulatory, and pricing policies into an efficient, productive, and integrated transportation system.

The responsibility for planning future land-use and zoning patterns and for reviewing proposed development plans rests with local government. Both the long-range planning and development-review phases of local planning offer opportunities for local governments to ensure that TDM measures are implemented. Although not required, local governments may choose to support (by resolution or other means) regional TDM measures, such as carpool lanes and ridesharing facilities that would be implemented by other agencies (e.g., Caltrans).

Peak-period traffic in Marin County is getting worse. The roads in the county, many of which were designed when the Bay Area's population was much lower, do not have the capacity to carry the demands placed upon them by motorists. Along with adding highway capacity and improving local transit service in response to this growing traffic, it is also important to improve the operating efficiency of the existing transportation system through TDM measures. The TDM element of the CMP has several goals including a coordinated countywide TDM program and the establishment of an on-going process that promotes local and regional planning to reduce traffic congestion.

4.2 Travel Demand Management in Marin County

The intent of this element is to give the widest possible range of choices to the County and its eleven cities in implementing the overall goal of reduced peak-hour usage of single-occupant vehicles. The proposed TDM measures fall into four broad categories:

- Traffic operation improvements that improve traffic flow. These improvements could come through such diverse sources as increased ridesharing or minor modifications to the highway system.
- Transit improvements that attract more riders to transit systems.
- Traffic mitigation measures that are intended to reduce the amount of traffic generated by a development or planning area and are applied through employers or developers.
- Land-use planning and regulation that seek to limit the demand for transportation or to mandate the implementation of traffic mitigation techniques through the land-use planning or approval processes.

These classifications overlap to some extent. For example, development permit approval may require traffic mitigation measures, and traffic mitigation may include greater use of public transit. The classification system focuses primarily on the entity responsible for implementation. Implementation responsibilities are shown in Table 4 below. In general, traffic operational improvements are implemented by state and local highway departments; transit improvements are the province of transit operators; traffic mitigation measures are implemented by employers or developers; and planning and regulatory techniques fall under the jurisdiction of local planning agencies. Effective traffic mitigation requires coordinated and systematic action by both the public and the private sectors.

Table 4 – Responsible Entities for Implementing Measures

Responsible Entity	Traffic Operational Improvements	Transit Improvements	Traffic Mitigation Measures	Land-Use Planning and Regulation
Cities	◆	◆	◆	◆
County	◆	◆	◆	◆
Caltrans	◆		◆	
Transit Operators		◆		
Private Sector		◆	◆	

Source: Marin County, 2003 Congestion Management Program

4.3 Consistency with Pertinent Air Quality Plans, as Incorporated in the RTP

The Bay Area's Regional Transportation Plan (RTP) incorporates Transportation Control Measures (TCMs) contained in the federal and state air quality plans to achieve and maintain the respective standards for ozone and carbon monoxide. The statutes require that the Capital Improvement Program (CIP) of the CMP conform to transportation-related vehicle emission air quality mitigation measures. CMPs should promote the region's adopted TCMs for the federal and state clean air plans. In particular, TCMs that require local implementation should be identified in the CMP, specifically in the CIP.

The Marin County CMP includes numerous project types and programs that are identified in the TCM plan. Table 5 below lists chapters of the Marin County CMP that address specific TCMs.

Table 5 – Correlation of Bay Area Clean Air Plan State/Federal TCMs with the Marin County CMP

TCM*	Description	Where Addressed in Marin County CMP
S1, F9	Support voluntary employer-based trip reduction programs.	Chapter 4, Travel Demand Management Element
S3, F3	Improve area wide transit service.	Chapter 7, Capital Improvement Program
S5	Improve access to ferries.	Chapter 7, Capital Improvement Program
S7	Improve ferry service	Chapter 7, Capital Improvement Program
S8, F4, F20	Construct carpool/express bus lanes on freeways.	Chapter 7, Capital Improvement Program
S9	Improve bicycle signage, access and facilities.	Chapter 7, Capital Improvement Program
S10	Youth transportation	Chapter 3, Performance Measures Element
S12	Improve arterial traffic management.	Chapter 7, Capital Improvement Program
S13, F21, F22	Transit use incentives	Chapter 3, Performance Measures Element
S14, F5	Improve rideshare/vanpool services and incentives.	Chapter 4, Travel Demand Management Element
S15	Local clean air plans, policies and programs	Chapter 5, Land-Use Analysis Program
S19	Pedestrian travel	Chapter 7, Capital Improvement Program
S20	Promote traffic calming measures.	Chapter 7, Capital Improvement Program
F7, F8	Develop Park-and-Ride lots.	Chapter 7, Capital Improvement Program
F24, F25	Maintain and expand signal timing.	Chapter 7, Capital Improvement Program

Source: Marin County 2003 Congestion Management Plan

*S=State Air Quality Transportation Control Measure, F=Federal Air Quality Transportation Control Measure

4.4 Support of the Jobs/Housing (Employed Residents) Balance Requirement

There is a growing emphasis throughout the state on encouraging communities to achieve a balance between job and housing growth as a technique to reduce traffic congestion. Ideally, from a transportation perspective, achieving such a balance would allow workers to live close to their job and to other services required on a daily basis. Banks, dry cleaners, and child care/school facilities are all examples of services that could be within walking or biking distance. Reducing travel distance would result in shortening trips, reducing the number of trips required, and allowing residents to use alternatives to motorized vehicles for their transportation needs.

- The jobs/housing (employed residents) balance is frequently measured in terms of simple numerical ratios. Such a simple test does not fully reflect the complexity of the issue:
- Jobs/housing balance must balance worker wage levels with housing affordability. Policies that encourage high-cost housing and low-wage jobs do not result in balanced commuter flows.
- Jobs/housing balance must be viewed at the sub-regional and not just the municipal level. This is most true where cities are contiguous (or nearly so). For example, it would not necessarily be bad for one city to have a surplus of jobs over housing if a neighboring city were to have a surplus of housing over jobs, since these two communities are nearby.
- Jobs/housing balance must be one of several factors a local government considers in making land-use decisions. Other factors include maintaining a local government's fiscal solvency; providing appropriate densities around transportation corridors; providing affordable housing; and implementing strategies that balance travel demand, reduce congestion, and improve air quality.

One of the guiding objectives in The Marin Countywide Plan was the development of a balanced residential environment including access to jobs, community facilities, and road services. Historically, both population and the number of housing units in Marin grew rapidly before 1970, but since then growth has slowed. While population and housing growth were slowing in the 1970s and 1980s, job growth was accelerating. Since the 1960s, the cost of housing has increased dramatically, the median age of the local population has risen, and family size has decreased. Additionally, different growth rates for jobs and housing have caused a jobs/housing imbalance that contributes to increasingly severe traffic congestion along the U.S. 101 corridor (the main link between Marin County and counties to the north where housing costs are lower).

To reduce this imbalance, Marin County developed housing-related measures to encourage development of affordable housing in Marin County. This affordable housing development is necessary to meet the county's share of the growth in regional housing demand, and to enhance social and economic diversity within Marin County. The newly revised *Draft Countywide General Plan* includes policies:

- CD-2, which calls for providing a variety of housing types and prices;
- CD-2.4, which calls for providing a range of jobs and salaries;
- CD-2.5, which calls for locating housing near jobs, transit routes, schools, shopping centers, and recreation;

- HS-3.a, which calls for a study of the linkage between jobs and housing;
- HS-3.1, which calls for an adequate supply and variety of housing for the work force;
- HS-3.3, which calls for larger projects ensuring local housing for employees;
- HS-3.4, which encourages Live/Work developments;
- HS-3.6, which encourages a variety of housing choices; and
- HS-3.11, which encourages incentives for transit oriented development.

CHAPTER 5 – LAND-USE ANALYSIS PROGRAM

5.1 Purpose and Intent of Legislation

California Government Code Section 65089(b)(4) requires that a CMP contain a program to analyze the impacts of land-use decisions made by local jurisdictions on the regional transportation system (both highways and transit).

The Land-Use Analysis Program must include an estimate of the costs to mitigate impacts of development on the highway and transit systems. The legislation allows the cost of mitigating interregional travel (trips that do not begin in Marin County or trips that travel entirely through Marin County) to be excluded from the mitigation cost estimate. Public and private (developer) contributions to regional transportation improvements may be credited.

The law does not change the role of local jurisdictions in making land-use decisions and in determining the responsibilities of project proponents to mitigate those impacts. However, TAM has the authority to withhold the gas tax subventions to local governments provided by Proposition 111 if a local jurisdiction fails to meet the requirements outlined in the Monitoring and Conformance chapter of the CMP (Chapter 8). Further guidance on the Land-Use Analysis Program can be found in the *Congestion Management Resource Handbook* (Caltrans, November 1990, pages 35-37).

The Land-Use Analysis Program is particularly important because it affects, or is affected by:

- The CMP Designated Transportation System and Roadway Level of Service Standards (see Chapters 1 and 2),
- Performance Measures (see Chapter 3),
- The Marin Travel Model, which is capable of analyzing land-use impacts on both highways and transit (see Chapter 6), and
- The Capital Improvement Program (see Chapter 7).

The intent of the Land-Use Analysis Program is to improve the linkage between local land-use decisions and regional transportation facility decisions; to better assess the impacts of development in one community on another; and to promote information sharing between local governments when the decisions made by one jurisdiction will have an impact on another.

The Land-Use Analysis Program in Marin County is a process designed to improve upon decisions about land-use and the spending of funds on highway and transit improvements in the county. The process is intended to work in a positive, cooperative fashion that supports the needs of local, county, regional and state governments.

TAM acts as a resource to local governments in performing transportation analyses of land-use changes on the CMP designated transportation network. The Marin Travel Model is used to analyze local general plan updates and amendments and other major development decisions. The

California Environmental Quality Act (CEQA) provides a framework for such assessment. To avoid duplication, the Land-Use Analysis Program is intended to make maximum use of the CEQA process.

Cities can develop and maintain their own transportation models for use in local forecasting or impact analysis. However, their models should be approved by TAM for consistency with countywide and regional transportation models.

5.2 Land Development Projects Subject to Analysis

MarinMap, a consortium of public agencies, maintains a data table of land use information for parcels for the entirety of Marin County. Each local government is responsible for updating the existing and "build out" land use information of parcels within its jurisdiction. Data from this table is used to provide the inputs to the Marin Transportation Model. In addition, local governments are required to submit land use information for any General Plan amendment or zoning change that would result in an increase of 100 or more evening peak hour trips.

Large projects requiring a city or county general plan update or amendment should, however, be analyzed using the model. This approach is particularly attractive for four principal reasons:

1. General plan updates and amendments are normally processed well before any construction takes place. This provides more time for transportation impacts to be analyzed and mitigation measures developed than would occur if the analysis took place closer to actual project construction.
2. Existing general plans have already been incorporated into the Year 2020 land-uses for the countywide model, as well as for the MTC regional travel model. Thus, any land-development project that conforms to the general plan should not materially alter the forecasted results generated by computer analysis already completed for the CMP. Only *changes* in (or amendments to) existing general plans could cause any significant change in the Year 2020 model forecasts.
3. A city or the county may consider general plan updates or amendments no more than four times during any year according to state law. This reduces the number of possible model runs that would be required.
4. Most (but not all) general plan updates or amendments are for developments of significant size.

5.3 The Land-Use Analysis Program: Analysis Tiering

A two-tiered information and analysis process of local land-use impacts has been successfully instituted. Under "Tier I," local governments forward information on proposed general plan updates or amendments to TAM during the period when the local jurisdiction is reviewing the application. "Tier II" includes biannually updating projected land uses for 10 years in the future to be used for modeling both traffic and transit impacts. This two-tiered approach is discussed in more detail below.

5.3.1 Tier I

For Tier I, local governments forward to TAM information on all general plan updates or amendments concurrent with the local governments' approval process. By analyzing general plan updates or amendments rather than specific projects permitted under existing general plans, local governments can proactively plan development by taking into account regional transportation impacts and providing ways to finance transportation costs in advance of development proposals. Every application for a general plan update or amendment or major development proposal that would generate a net increase or decrease of 100 vehicle trips during the P.M. (afternoon) peak hour is to be forwarded to TAM for analysis. The local jurisdiction is responsible for determining which projects meet these criteria. The P.M. peak hour volume is the most appropriate measurement in Marin County because for most roadway segments, traffic levels of service are worse during the P.M. peak hour than in the A.M. peak hour. Examples of projects that typically meet the 100 PM peak hour trip threshold include 100 single-family homes, 150 apartment units, 5,000 square feet of retail space, or 40,000 square feet of office space.

The Marin County Community Development Agency (CDA) has in place an inventory of proposed development projects, known as "PROPDEV." PROPDEV includes all projects with at least five residential units or at least 5,000 square feet of non-residential use. The PROPDEV database file covers 40 items of information including location, project sponsor, acreage, zoning, square feet of building area, and status of development application. Local jurisdictions are still responsible for reporting information to CDA for projects in the PROPDEV inventory, which has a significantly lower threshold for all uses except retail space. Small projects in PROPDEV below the 100-trip threshold do not warrant a run of TAM's transportation model. Only large development proposals requiring general plan updates or amendments create a significant difference in the previously forecasted Year 2030 levels of service, which are based on the land-use assumptions of current general plans. The information on each general plan update or amendment that would generate a net increase or decrease of 100 PM peak hour trips that should be forwarded to TAM includes:

- Precise location of the project(s), mapped, including street access location;
- Project land use(s) and number of dwelling units or square footage of development;
- Any available traffic studies, including trip generation rates assumed in determining whether the general plan update or amendment met the 100 PM peak hour-trip threshold; and
- Expected occupancy of each land-use in Year 2030, with completion date and phasing.[5]

The TAM model run is to be incorporated into the local development review process. The local jurisdiction is responsible for identifying mitigations and costs as part of the Negative Declaration or Environmental Impact Report for the project. The local jurisdiction sends the

[5] General Plans normally focus on build out conditions. Since CMPs focus on a 7-Year CIP and a 7-10 year transportation modeling horizon, it is critical that the timing of development in the general plan update or amendment be addressed.

environmental document to TAM for referral and comment. TAM provides data on the number and percentage of interregional trips on facilities for which mitigations have been recommended.

Following approval of the general plan update or amendment or qualifying major development proposal, the local jurisdiction sends final project information and documentation to TAM so that TAM can conduct "Tier II" of the Land-Use Analysis Program.

5.3.2 Tier II

TAM biannually runs the countywide computer model on the updated land-use and transportation network information provided by the planning departments of each local government in Marin County. This analysis would be based on all general plan updates or amendments received during the past two years, as well as an assessment of the actual amount of development likely to be in place 10 years in the future based on PROPDEV's listing of "Approved" projects. Local governments are also responsible for advising TAM of all changes to the highway network and transit system based on their knowledge of developer mitigations, ordinance approvals, or changes to the circulation element of their general plan.

5.3.3 Tier I and Tier II Compliance

In order to comply with the requirements of Tier I and Tier II of the Land-Use Analysis Program, all jurisdictions in the county need to:

1. Annually (in accordance with the CDA PROPDEV update schedule):

    - Submit a complete account of all residential and commercial projects approved during the preceding year, and
    - Continue to participate in the CDA PROPDEV inventory.

2. During CEQA scoping process, submit information on all general plan updates and amendments and major project proposals involving a net change (increase or decrease) of 100 or more P.M. peak-hour trips, as described in Section 5.3.1.

3. As appropriate:

    - Submit information on all highway network and transit system changes in their jurisdiction that result from: (1) project mitigations, (2) ordinance approvals, or (3) changes to the circulation element of their general plan.
    - Adopt traffic LOS standards that are consistent with or more restrictive than the LOS standards in the CMP.
    - Develop a 7-year Capital Improvement Program designed to meet the adopted LOS standards and support alternate modes of transportation.
    - Participate in TAM's TDM Program (outlined in Chapter 4).
    - Comply with monitoring and conformance requirements as outlined in Chapter 8.

5.3.4 Example of the Process

Entirely hypothetical examples are provided to show how this process would work:

1. Based upon the jurisdictions' land-use data provided to TAM under Tier II and the proposed Capital Improvement Program, a run of the Marin Traffic Model indicates that there would be no further reductions in level of service below the standards adopted in the CMP. In that case, local jurisdictions would be free to make any land-use changes or approvals without TAM analysis, provided that whatever decisions they make are consistent with the information that has been provided to TAM.

2. At some time in the future, a local government decides that it wishes to amend its general plan to include 100 acres of land that had formerly been included in the Tier II land-use information that had been given to TAM. This area had been formerly zoned for agriculture but is proposed under the general plan amendment for single-family homes at six units per acre. These 600 proposed units would generate more than the threshold of 100 net new P.M. peak-hour trips, so the local government planning director, public works director, or traffic engineer forwards all of the general plan amendment application materials to TAM. Because of the size of the project, the local government also decides to hire (or have the applicant hire) a traffic engineer to prepare a detailed, comprehensive study of the proposed general plan amendment.

   Under Tier I review, TAM would make modifications to its land-use database used in the Marin Travel Model. The model would be run, including all highway and transit improvements (not just those on CMP designated facilities) for which funds seem reasonably secure, and also any improvements the applicant is willing to pay for as a condition of development approval. Assume that the model run indicates that some arterial segments of the CMP designated roadway system would operate worse than the LOS D standard as a result of general plan amendment approval.

   TAM would forward this information to the local agency, which would consider the reduction in level of service in making their decision to approve or not to approve the general plan amendment. In developing conditions for project approval, the local jurisdiction would then have the option of:

   - Requiring additional mitigations from the developer, such as TDM measures (e.g., transit service, flex time, etc.), roadway improvements that would improve the LOS to the adopted standard, or other system improvements that would improve air quality as allowed by the CMP legislation.
   - Delaying the project until certain highway or transit projects are constructed.
   - Working closely with TAM on development of a Deficiency Plan if it appears that a CMP system segment will not meet the adopted LOS standard.
   - Choosing not to implement any of the above measures and risk having the LOS not meet the adopted standard on certain roadway segments. In this case, the local

government could risk losing the additional increment of gasoline taxes provided by Proposition 111.

5.4 Relationship of the Land-Use Analysis Program to CEQA

Local governments continue to have lead agency responsibility for performing Environmental Impact Reports and Negative Declarations and conducting transportation analyses as part of these documents. Local government should continue to propose and analyze mitigation strategies. TAM may comment through the CEQA process, keeping local governments informed as to the adequacy of the analysis and approving any transportation models that are used for the analysis. TAM may also provide local governments with information on cumulative impacts.

5.5 Congestion Management Agency Experience with the Process

TAM has reviewed a number of land-use plans and projects since the adoption of the CMP. They include:

- Central Marin Ferry Connection Project (April 2004)
- Marin Countywide Plan- Transportation Analysis for the Final Preferred Alternatives (March 2004)
- San Rafael General Plan 2000, EIR 2020, and EIT 2020L (October 2003)
- New Proposed Casino/Hotel and Sears Point (June 2003)
- Cal Park Hill Tunnel and Bicycle/Pedestrian Pathway Study (December 2002)
- St. Vincent's Village Plan (April 2002)
- 2000 Larkspur Landing Circle Project (September 2001)
- Ranchitos Park Development Study (June 2001)
- Oakview Project EIR Transportation Project (February 2001)
- Marin County Traffic Patterns (January 2001)
- Hanna Oaks Center EIR – Rowland Extension Model Run (December 2000)
- Greenbrae Interchange Alternatives (September 2000)
- Downtown Novato Redevelopment Plan Environmental Impact Report (February 1999)
- Transportation Impacts of the Novato General Plan Revision (March 1996)
- Lucasfilm, LTD. – Grady/Big Ranch ADEIR Traffic Study (June 1995)
- Golden Gate Transit- Larkspur Ferry Terminal Access Improvement Study (January 1995)

CHAPTER 6 – TRAVEL DEMAND MODEL

6.1 Purpose and Intent of Legislation

California Government Code Section 65089(c) requires that every CMA (such as TAM), in consultation with the regional transportation planning agency (MTC), cities, and the county, develop a uniform database on traffic impacts for use in a countywide travel demand model. It also requires that the countywide model be the basis for transportation models used for county sub-areas and cities, and that all models be consistent with the modeling methodology and databases used by the regional transportation planning agency. TAM should also approve sub-county area transportation models, and models used by local jurisdictions for land-use impact analysis, if local jurisdictions decide to perform this work on their own.

The purpose of this requirement is to guide TAMS's decision making process in identifying the most effective balance of transportation programs and projects that maintain LOS standards. This includes the consideration of the benefits of transit service and TDM programs, as well as the need for projects that improve congestion on the CMP designated network. The modeling requirement is also intended to assist local agencies in assessing the impact of new development on the transportation system. TAM will need to consider the nature of the analysis, functions of specific analytic tools, and its available resources when deciding how to fulfill this requirement of the statutes.

6.2 Local Agency Requirements

At this time, there are no specific requirements of local agencies, other than supplying the base-year land-use information that is noted in the land-use analysis chapter (Chapter 5). It is expected that TAM will continue to operate its own countywide model, although cities may also create and use their own model, subject to the legislative requirements above.

TAM staff is continually refining and updating the Marin Travel Model. This includes meeting with MTC regularly to review model consistency procedures and participating in the regional Modeling Coordination Subcommittee of the Bay Area Partnership. This also includes periodically reviewing network and land-use assumptions for base and future years for every model run performed for the Land-Use Analysis Program.

NOTE: Many technical terms are used in this chapter. A glossary of terms has been included in Appendix B.

6.3 Introduction

A distinct and measurable relationship between travel demand, land-use patterns, and transportation systems is the basis for modern transportation planning practice. Transportation models were developed as the best tools available to quantify those relationships. The nature of those relationships is fairly complex, and research on more effective transportation modeling is still evolving.

The implementation of CMP legislation requires that a specific technical requirement be met: consistency with the regional model. This document is intended to explain the current status and development of consistency in Marin County modeling efforts and how the consistency issue corresponds to the other more traditional measure of model reasonableness – validation to actual traffic counts, regional trip patterns, and transit ridership.

6.4 Existing and Past Programs

The history of Bay Area modeling has been dominated by extensive travel behavior studies and model development by the Metropolitan Transportation Commission (MTC), the recognized Metropolitan Planning Organization for the Bay Area. MTC has had the charge and the funding at the federal level to develop models of travel behavior since the early 1970's. Marin County, in development of its own travel demand model, has built upon the information and logic from the MTC model.

MTC is required to review any sub-regional model for consistency with the MTC model. TAM staff assists with any revisions to the model. The remainder of this chapter contains the MTC checklist and responses for model consistency. Items from the MTC checklist are provided in *Italics* in Section 6.5 below.

MTC's goal is to establish a regionally consistent model "set" for application by MTC and the Bay Area CMAs. The Bay Area Partnership finalized a report on modeling consistency issues recommending that MTC develop and the CMAs incorporate a consistent set of model components on desktop computers (termed BAYCAST). For immediate use for this CMP, the study recommended that the current MTC checklist format be utilized, proposing specific tolerances. This revised MTC checklist incorporates the results of testing those specific tolerances, as well as additional analyses.

On June 1, 2005, TAM submitted a letter to MTC regarding the MTC Checklist for Modeling Consistency. That letter includes additional information regarding the differences between the MTC model and the Marin Travel Model (MTM) that are not included in this document.

6.5 MTC Checklist for Modeling Consistency

This Checklist guides the Congestion Management Agencies through their model development and consistency review process by providing an inventory of specific products to be developed and submitted to MTC, and by describing standard practices and assumptions to be followed. North Bay counties are not subject to Products 3, 5, 12 and 15, although the assumption used should be described.

Because of the complexity of the topic, the MTC checklist may need additional detailed information to explain differences in methodological approach or data. Significant differences will be resolved between MTC and TAM, taking advantage of the Modeling Coordination Working Group standard formats for model comparisons that were developed.

6.5.1 Incremental Updates

The Congestion Management Agency forecasts must be updated every two years to be consistent with MTC's forecasts. Alternative approaches to fully rerunning the entire model are available, including incremental approaches through the application of factors to demographic inputs or to trip tables. Similarly, the horizon year must be the same as the TIP horizon year; however, interpolation and extrapolation approaches are acceptable, with appropriate attention to network changes. These alternatives to full re-running of the model should be reviewed with MTC.

6.5.2 Defining the MTC Model Sets

Unless otherwise specified, the MTC model sets referred to below will be defined as those in use on October 1st of the year preceding the CMP update.

6.5.2.1 Approach to Travel Demand Modeling by TAM

Describe the model, and its relationship to the MTC model. If the model is based on MTC's model, describe any adjustments to model constants, coefficients, k-factor or friction factor re-estimation, market segmentation, trip purposes, etc.

TAM has operated and updated its own countywide travel demand model based on the information and logic from the MTC model. For the CMP, the Marin Travel Model (MTM) contains 117 traffic analysis zones (TAZs) within the county, 83 TAZs for San Francisco, 69 TAZs for Sonoma, and 24 TAZs corresponding with the MTC super-district level for other Bay Area counties. This model is prepared using EMME/2 software for the P.M. peak hour, A.M. peak hour, and Average Daily Traffic.

This model is a "focused" model, meaning that the network contains different structures inside and outside of the focus area. The inside or focused counties for the MTM are San Francisco, Marin, and Sonoma Counties. Other Bay Area counties are outside of the focused area. The primary difference is that the more detailed MTC network structure is included in focused areas, while a skeleton roadway network is structured outside of the focused areas. Because the network outside of the focused areas is reduced, the speeds on the skeleton roadway network are fixed (not variable depending on capacity) and are not expected to represent actual traffic volumes on those roadway links.

To ensure regional consistency, the MTM utilizes a technique referred to as "balancing." The balancing is done to guarantee that the trip-end estimates and forecasts are roughly equal between the MTC regional model and the MTM, and guarantees that the trip flows between counties are also equal between the two models.

The MTM mode-choice procedure occurs after the person-trip generation and trip-distribution steps. It includes a detailed mode-choice analysis that divides trips into transit-person trips, 2-person vehicle-person trips, 3+ person vehicle-person trips, or drive alone vehicle-person trips for home-based-work trips. Simpler formulas for vehicle-person trips are used for all other trip purposes, which are home-based shop/other trips, home-based social-recreational trips, home-

based school trips, and non-home-based trips based on the San Francisco Bay Area Travel Survey 2000 – Regional Travel Characteristics Report (August 2004).

6.5.2.2 Demographic/Economic/Land-Use Forecasts

Use exact Association of Bay Area Governments (ABAG) Projections 2003 for other Bay Area counties, and control totals (within one percent) for the county for population, households, jobs, and employed residents. Congestion Management Agencies may reallocate growth forecasts within their own county in consultation with cities, MTC, and ABAG. The latest set of ABAG's Projections must be used for all new demographic databases developed for baseline travel demand forecasting purposes after August 1 of the year preceding the CMP update. Future year forecasts should address the latest available ABAG Projection series. MTC, in consultation with the Modeling Coordination Working Group, will develop factors that may be used to achieve consistency with the most recent ABAG demographics. Congestion Management Agencies may also, of course, analyze alternative land-use scenarios in addition to these forecasts. If a land-use based model is utilized, production and attraction comparisons will be made with the MTC model.

The MTM is based on ABAG *Projections 2003* land-use data. The MTM structure requires that land uses be allocated at a finer detail for Marin, Sonoma, and San Francisco counties than ABAG *Projections 2003* provides. In the disaggregating process, Marin County has recognized some inconsistencies in Marin County land uses by census tract and has made corresponding adjustments. Still, the overall land-use attributes for Marin County as a whole are consistent with ABAG. The difference between the MTM and ABAG *Projections 2003* is less than one percent for all the land-use categories. Land-use data outside of Marin was obtained from ABAG *Projections 2003*, so land-use information from the MTM is identical.

Future-year allocations by census tract provided by ABAG have been similarly refined. For this reason, individual census tracts do not contain land-use attributes identical to ABAG *Projections 2003*, but the overall county total for 2015 and 2030 is consistent with ABAG.

6.5.2.3 Pricing Assumptions

Use MTC's auto operating costs, transit fares, and bridge tolls.

The MTM has made adjustments for these regional pricing assumptions:

- **Bridge Tolls.** The model is run with assumptions from ABAG Projections 2003. This assumes the $5.00 Golden Gate Bridge toll and $3.00 Richmond-San Rafael Bridge toll, adjusted to 1980 dollars.
- **Auto Parking Costs.** Auto parking costs have been kept at the 1980 fixed costs obtained from the 101 Corridor Study. The 101 Corridor Study set parking costs for San Francisco ranging from 50 cent per day to $2.60 per day in 1979 dollars. No other auto parking costs were assumed in the focused area.
- **Auto Operating Costs.** An auto operating cost of 13.12 cents per mile in 1980 dollars is assumed to conform to the MTC model.

6.5.2.4 Network Assumptions

Use MTC's regional highway and transit network assumptions for other Bay Area counties. Congestion Management Agencies should include more detailed network definition relevant to their own county in addition to the regional highway and transit networks. For the CMP horizon year, to be compared with the TIP interim year, regionally significant network changes in the base case scenario shall be limited to the current Transportation Improvement Program (TIP) for projects subject to inclusion in the TIP.

The MTM was first developed in 1987 and was revalidated for 2000. The MTM uses the MTC model structure facility types and numbers of lanes for Marin County. Some additional detail in the roadway network has been added where appropriate within Marin County.

The MTM includes representations of these major roadway gateways in Marin County:

- Highway 101 – (Golden Gate Bridge) San Francisco
- Interstate 580 – (Richmond/San Rafael Bridge) Contra Costa County
- Highway 37 – Sonoma County
- Highway 101 – Sonoma County
- Highway 1 – Sonoma County

In addition, the ferry connections from Larkspur, Tiburon, and Sausalito to San Francisco are also provided as gateways.

Because this model is a focused model, the East Bay and South Bay highway network are much less detailed than in the MTC model. A skeleton network in these locations significantly reduces run time for the model, as well as enables the model to be of a size small enough to be operated on Marin County computers. The impact of this network reduction is considered negligible to congestion in Marin County.

6.5.2.5 Auto Ownership Assumptions

Use MTC auto-ownership models or forecasts, or submit alternative models to MTC for review and comment.

The MTM utilizes MTC and ABAG's Projection 2003 information on auto ownership for mode split.

6.5.2.6 Trip Generation

Use the BAYCAST person trip generation models for home-based work and non-work, and non-home based trips, or submit alternative models to MTC for review and comment. Results may be adjusted sub-regionally through calibration or modal constant adjustments.

The MTM uses a household size and income quartile cross-classification modeling. The MTM then revises the results using adjustment factors designed to replicate actual MTC trip generation patterns between counties into the model. In this way, aggregate trip generation by county is also consistent with the MTC model. The difference in trip productions or attractions (by type of trip) between the MTM and the MTC model is never greater than 1.0 percent.

6.5.2.7 Trip Distribution

Work trip distribution models must be calibrated to the 1990 Census Journey-to-Work commuter matrices. Trip distribution results must be balanced to productions, and attraction-balancing problems should be discussed with MTC.

The MTM uses the MTC trip distribution patterns between counties. In this way, aggregate trip distribution by county is completely consistent with the MTC model. By utilizing this technique, Marin County has achieved a closer trip distribution match with the MTC model than is normally expected with this focused model structure. For home-base work trips, there is less than a one-percent difference in any of the model years.

6.5.2.8 Mode Choice

If a logit mode choice model is to be used, MTC's BAYCAST should be used, or submit alternative methodology for MTC review.

The MTM mode choice analysis is consistent with MTC methodology. For home-based work trips, the MTM contains a Home-Based Work Mode Choice Model "TOT_TW." It contains a multinomial logit model structure for work trips, using drive alone, 2 person, 3+ person and transit. Non-work trips are assigned to auto and transit with auto occupancies inputted at this stage.

6.5.2.9 Traffic Assignment

Use capacity restraint assignment for peak-hour (or period) traffic assignments, or submit alternative methodology for MTC review.

The MTM provides A.M. peak, P.M. peak, non-peak, Average Daily Traffic, traffic and transit assignments similar to MTC methodology, with the same A.M. and P.M. peak-hour factor assumptions and external trip matrices.

6.6 Relationship to the Capital Improvement Program

The 2025 model run for the MTM includes all relevant projects listed in the State Transportation Improvement Program. These projects are incorporated into the 2015 base network in the MTM.

The MTM will be used for capital improvements programming. The CMP statutes stipulate three criteria for projects selected for the Capital Improvement Program (CIP):

- To maintain or improve the traffic level-of-service and transit performance standards,
- To mitigate land-use impacts, and
- To conform to vehicle emissions air quality mitigation measures.

Toward that end, the model results will be used to evaluate projects in the CIP chapter (Chapter 7), to prepare a project list for Regional Transportation Improvement Program consideration, and assist in the development and programming of any supplementary sources of revenue.

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CHAPTER 7 – CAPITAL IMPROVEMENT PROGRAM

7.1 Purpose and Intent of Legislation

California Government Code section 65089(b)(5) requires that a CMP contain a 7-year Capital Improvement Program (CIP) to maintain or improve the performance of the multimodal system for the movement of people and goods and to mitigate regional transportation impacts identified through the Land-Use Analysis Program. Capital improvement projects must conform to transportation-related vehicle emissions and air quality mitigation measures. These transportation control measures (TCMs) are contained in the *Bay Area 2000 Clean Air Plan*.

7.2 Relationship to the Regional Transportation Plan (RTP)

Since the CMP will ultimately be incorporated into the *Regional Transportation Plan* (RTP) Action Elements, projects selected for Marin County's CIP will need to be consistent with the assumptions, goals, policies, actions and projects identified in the RTP. The RTP is the basic statement of transportation policy by MTC. Because of the interdependence of transportation planning and land-use planning, a major effort was made by MTC to adopt policies that complement and support programs of federal, state, and regional agencies.

MTC's most recent RTP is the *Transportation 2030: Mobility for the Next Generation* plan. This plan was completed early in 2005 and was adopted by the Commission on February 23, 2005. This CIP is developed with information from the 2005 RTP.

7.3 Relationship to the Regional Transportation Improvement Program (RTIP)

The CIP is the basis for determining which projects are included in the Regional Transportation Improvement Program (RTIP). Inclusion of a project in the RTIP is the first step in obtaining a funding commitment from the State. Projects that MTC includes in the RTIP are then recommended to the California Transportation Commission (CTC) for inclusion in the State Transportation Improvement Program (STIP). If the CTC includes the project in the STIP, it has approved the project for the necessary environmental studies and project design, which ultimately lead to a final decision on whether or not to build the project. Projects that are to be included in the RTIP must be found consistent with the County's CMP. However, it is important to note that MTC is responsible for assembling the RTIP and that the RTIP is a funding-constrained document. This CIP is developed with information from the 2004 RTIP.

7.4 Relationship to Air Quality Attainment Plans

Marin County's CIP, included as part of the CMP, is closely related to air quality attainment plans. The *Bay Area 2000 Clean Air Plan* is the current adopted plan. A variety of Transportation Control Measures (TCMs) have been adopted as a part of this plan. MTC will give priority to the proposed projects that support or help implement any of the TCMs (see TDM Chapter 4 for more discussion on TCMs). Examples of such projects include High Occupancy Vehicle (HOV) lanes and ramp meter bypass lanes for HOVs.

7.5 CIP Development: Process and Criteria for Project Priority Ranking

In February 2003, the CMA (predecessor to TAM), the Marin County Board of Supervisors, and the Marin County Transit District jointly produced *Moving Forward: A 25-Year Transportation Vision for Marin County* in February 2003. This document lays out the scope of transportation needs and desires for the County in specific areas, such as bicycle and pedestrian improvements, bus transit improvements, rail transit implementation, TDM expansion, regional highway improvements, and local street rehabilitation and maintenance. This document also addressed funding shortfalls and ways in which the County can pursue other funding sources.

Given the situation with the State Highway Account, the California Transportation Commission (CTC) has implemented allocation criteria for the State Transportation Improvement Program (STIP) that focuses its funds on major corridor improvements. Recognizing that the CTC will likely continue to use allocation criteria to select which projects to fund, TAM's priorities for the 2006 STIP are U.S. 101 corridor and interchange capacity increasing projects.

Mainline U.S. 101 projects could also be eligible for other funds, such as the Interregional Transportation Improvement Program (ITIP) or federal discretionary funds.

Projects on Marin County's arterial roadway system, e.g., Sir Francis Drake Boulevard, will also continue to be a priority for scarce transportation funds. These projects are eligible for federal and state transportation funding programs and could also be eligible for funds from new local tax mechanisms including Measure A Sales tax revenue.

TAM proposes to continue the same method of project prioritization that is familiar to and accepted by supervisors, council members, public works directors, planning directors, and the general public. In general, funds are to be programmed proportionately based on unmet modal needs, geographic equity, and cost effectiveness. More specifically, overall, transportation projects are likely to be guided by these integration principles:

- Consider all modes in a corridor simultaneously.
- Focus on "seamless" connectivity between modes to maximize utility of all improvements.
- Focus on connectivity between modes and eliminating unnecessary duplication.
- Take advantage of the initial investment in a publicly controlled right-of-way by committing to a high-capacity transit project that maximizes use of the corridor by adding a multi-use pathway, where feasible.
- Consider opportunities for phasing to get results as early as possible.
- Consider contingency for projects unable to complete environmental clearance.
- Prioritize local transportation solutions (school bus, bicycle and pedestrian projects, bus transit, rail, and ferry) that bring people from neighborhoods in Marin County to destinations in Marin County.
- Provide for comprehensive TDM programs focused towards Marin County employers to encourage carpools and other higher occupancy vehicle commuting.

- Build on the county-wide Safe Routes to Schools program bicycles, pedestrian programs and school busing that will encourage parents to stop driving their children to school.

For the CMP roadway network, a subset of projects also requires programming and funding. The procedure for identifying specific highway and arterial projects will consider:

- Improvements that reduce traffic congestion to acceptable levels for the most vehicles,
- Improvements that are the most cost effective,
- Improvements on facilities with higher existing traffic volumes,
- Improvements on facilities that are operating poorly based on existing traffic (not projected growth), and
- Improvements that are lower cost.

Two other considerations when identifying potential projects for purposes of this CIP are:

- **Operational characteristics.** If the project would result in shifting a capacity problem to another location, the effects of the downstream bottleneck are considered when setting priority for the project that ranks highest for cost effectiveness
- **Current deficiencies.** Projects that would eliminate existing deficiencies are prioritized above those that would eliminate future problems.

The lists of projects that result from this evaluation are shown in Tables 6 and 7 on the following pages. Table 6 lists the 2005 CIP projects that currently have full or partial funding. Table 7 summarizes the un-prioritized Marin County projects that are candidates for future funding. Pedestrian and bicycle projects included in locally adopted pedestrian and bicycle plans are incorporated into the CMP by reference and are not listed separately in these tables. (See Appendix D for a list of adopted Marin pedestrian and bicycle master plans

Table 6 – Existing Funded Capital Improvement Programs 2005

Sponsor	Mode	Project Name/Description	Estimated Cost	External Funding
Caltrans	State Hwy	U.S 101: Widen SB Off-Ramp to East Blithedale for additional lane (FY 2006)	$2,274,000	SHOPP
Caltrans	State Hwy	U.S 101: Upgrade Various Traffic Barrier & Guard rail end terminals (FY 2005)	3,973,000	SHOPP
Caltrans	State Hwy	U.S 101: Resurface Pavement S. of Lucky Drive to N. San Pedro Rd. (FY 2005, 2007)	5,150,000	SHOPP
Caltrans	State Hwy	U.S 101: Highway Planting Restoration S. of Spenser to Lucky Dr. (FY 2005)	1,951,000	SHOPP
Caltrans	State Hwy	U.S 101: Install Traffic Operation systems- Var. locations near Novato (FY 2005)	1,947,000	SHOPP
Caltrans	State Hwy	U.S 101 HOV NB & SB HOV Lanes – Lucky to N. San Pedro (Gap closure)	163,365,774	TCRP, STIP, DEMO, CMAQ
Caltrans	State Hwy	Wildlife crossing at Giacomini Gulch on Rt 1	775,000	ITIP
Caltrans	State Hwy	GG Botanical Mang. Area - 101 to Rodeo	300,000	ITIP
Caltrans	State Hwy	U.S 101 HOV Lanes - Marin/Sonoma Narrows (ENV & PS&E)[6]	45,100,000	TCRP, ITIP, STIP, DEMO
Corte Madera	Local Roads	Lucky Drive Fifer Ave Pavement Rehab	107,000	STP
Corte Madera	Local Roads	Madera Boulevard Rehabilitation	3,629	STP
Fairfax	Local Rds	Center Boulevard Rehabilitation	528,000	STP
Fairfax	Local Rds	Sir Francis Drake Boulevard Rehabilitation	118,000	STP
FHWA	Local Rds	Point Reyes Lighthouse Transportation Improvements	1,876,000	FLHP
FHWA	Local Rds	West Bunker & Mitchell Rd Rehab	$6,502,313	FLHP
FHWA	Local Rds	Chimney Rock Lighthouse Rehabilitation	6,055,000	FLHP
FHWA	Local Rds	Stinson Beach Access Road Rehab	2,803,000	FLHP
GGBHTD	Transit	Acquire 82 Bus Catalyst Devices	3,341,200	FTA, CMAQ
GGBHTD	Transit	Fleet Preventive Maintenance Program	11,526,000	FTA
GGBHTD	Transit	Bus Radio Communications Sys Replacement	9,409,101	FTA
GGBHTD	Toll Bridge	Physical Suicide Deterrent System	2,000,000	STP
GGBHTD	Transit	Fixed Guideway Connectors	5,864,630	FTA
GGBHTD	Transit	Ferry Major Components Rehabilitation	3,912,000	FTA, STP
GGBHTD	Transit	Ferry Vessel (Replace MV Marin with similar vessel)	12,501,000	FTA
GGBHTD	Transit	Ferry channel & berth dredging	12,736,000	FTA

[6] Total forecasted cost for the Marin/Sonoma Narrows project is $450 M. shared between Sonoma, Marin and the State.

Sponsor	Mode	Project Name/Description	Estimated Cost	External Funding
GGBHTD	Toll Bridge	Golden Gate Seismic Retrofit, Ph: 1-3A	352,713,075	TCRP, DEMO, DBR, HBRR, STIP
GGBHTD	Toll Bridge	Golden Gate Seismic Retrofit, Ph: 3B	137,500,000	HBRR
GGBHTD	Transit	Replace (6) 1997 Paratransit Vans	440,000	FTA
GGBHTD	Transit	Replace (8) Paratransit Vans	603,000	FTA
GGBHTD	Transit	Golden Gate Reg Transfer & Toll Plaza/ Merchant Rd	435,000	STIP
GGBHTD	Transit	4 Replacement Express Buses	1,600,000	RM2
GGBHTD	Toll Bridge	GG Bridge moveable median Barrier	23,800,000	FTA, Toll Bridge
Larkspur	Bike Ped	East Sir Francis Drake Bicycle/Pedestrian Multi Use Wooden Bridge Rehabilitation	97,500	Other Fed
Marin Co	Transit	Marin Parklands Visitor Access Improvements	7,647,483	FTA, FLHP, CMAQ, STIP, TCSP
Marin Co.	Transit	Bus Stop Improvements	128,500	Other Fed
Marin Co	Local Rds	Sir Francis Drake Blvd. Laurel / Elm Rehabilitation	$1,165,000	STP
Marin Co / BCPUD	Bike/Ped	Olema Bolinas Bike Path[7]	40,000	TFCA
MCTD	Transit	Local Marin Bus service enhancements	6,965,000	FTA
Mill Valley	Local Rds	Guardrails HES	132,700	HES
Novato	Local Rds	Redwood Blvd Rehab between Lamont Ave & Olive Ave	707,000	STP
Novato	Local Rds	Grant Avenue Rehabilitation	4,500,000	STIP,STP
Novato	Local Rds	Ignacio Boulevard Rehabilitation	627,000	STP
Ross	Local Rds	Lagunitas Bridge Replacement	1,992,000	HES
San Anselmo	Local Rds	Sir Francis Drake Boulevard Rehabilitation	194,000	STP
San Rafael	Local Rds	East San Rafael Phase III Francisco Blvd E widening (Scotland Yard)	1,742,000	
San Rafael	Local Rds	Lincoln/Linden Lanes Traffic Signal Improvements	200,000	
San Rafael	Local Rds	Medway/Canal Enhancements	1,017,000	CMAQ, TEA
San Rafael	Local Rds	Fourth Street Rehabilitation	779,000	STP
San Rafael	Local Rds	Street Resurfacing 05-06 (Slurry/Cape Seal)	50,000	
San Rafael	Local Rds	Third/Union Intersection Improvements	900,000	
San Rafael	Local Rds	Nova Albion & Las Gallinas Signal & Int. Imps.	330,000	

[7] Project was not included in the Marin County Bicycle/Pedestrian Plan. The BAAQMD required that the project be added to the CMP to be eligible for TFCA funds.

Sponsor	Mode	Project Name/Description	Estimated Cost	External Funding
San Rafael	Local Rds	Northgate Dr. & Los Ranchitos Signal & Int. Imps.	190,000	
San Rafael	Local Rds	Traffic Controller Replacement Project 03-04	60,000	
Sausalito	Local Rds	Spencer Avenue Rehabilitation	125,000	STP
TAM	State Hwy	Sir Francis Drake Blvd Widening	429,000	RM2
TAM	Local Rds	Central Marin Ferry Access Improvements	8,531,000	RM2
TAM	State Hwy	Greenbrae Interchange Improvement	$48,948,000	RM2
Tiburon	Local Rds	Mar West Street Rehabilitation	450,000	STP

Table 7 – Un-prioritized Marin County Projects: Candidates for Future Funding[8]

Jurisdiction	Local Road	Highway
Belvedere	• Peninsula Rd	
Corte Madera		• Greenbrae interchange
Fairfax	• Cascade Rd stabilization (near #570) • Center Blvd Redesign Phase I &II • Fairfax Creek Restoration • Measure K Street and Storm Drain Rehabilitation • Pavement Repairs on Broadway • Scenic Dr Retaining Wall (near #185) • Sir Francis Drake Blvd Pavement Repairs • Tree Maintenance Program	
Larkspur	• Sir Francis Drake Trestle clean up restriping	• Greenbrae interchange
Marin Co	• Lucas Valley Rd (2002 storm damage) • Marin Ave at Flamingo Drainage Study • Marin City Bus Stop Repair • Muir Wood Rd slide repair • Park Street Culvert Restoration Project • Paradise Dr at Taylor • Paradise Dr Drainage Impr. MP5.38 & 5.49 • Paradise Dr Retaining wall MP6.57 • Portola Ave Retaining wall Repair • Pt Reyes Petaluma Debris removal • San Francisco Ave Drainage Improvements • Seminary at Ricardo Drainage Study • SFD rehabilitation through Samuel Taylor Park • SFD Bank stabilization MP25.29-28.87	• Greenbrae interchange • Marin Sonoma Narrows • Tiburon Interchange

[8] As described in Section 7.7, Pedestrian and Bicycle projects in the individual jurisdictions' Bicycle and Pedestrian Master Plans are candidate projects incorporated by reference

Jurisdiction	Local Road	Highway
	• Van Winkle 60" Culvert replacement • Woodacre Triangle Drainage Study • #346 Laverne Ave Retaining Wall • Tiburon Blvd at Cal Park slide stabilization	
Mill Valley	• HES Guardrails various locations • Thermo plastic for arterials	
Novato	Measure B Bond Pavement Rehabilitation Group 4 (25 residential streets) • Alameda Del Prado Improvements and Pavement Rehabilitation Group 6 (12 residential streets) • Mill Road Improvements and Pavement Rehabilitation Group 5 (18 residential streets) • Novato Boulevard Between Diablo Avenue and Grant Avenue • Rowland Boulevard/Rowland Way Capacity Improvements	Improvements to Redwood Boulevard and US 101 Southbound Ramps at San Marin Drive. • US 101 at Atherton Avenue Modify Northbound Ramps
Ross	• Lagunitas Bridge Replacement	
San Rafael		• Lucas Valley / Smith Ranch Interchange
Tiburon	• Trestle Glen rehabilitation	

7.6 Transit Projects

TAM continues to support the enhancement of transit facilities through its support of the Golden Gate Bridge, Highway, and Transportation District's and Marin County Transit District's Short-Range Transit Plans. The plans include bus replacement, improvements to the bus facilities, and enhancement to ferry terminals. Funding for these projects has been identified from a variety of sources, including the Federal Transit Administration formula grants, STP/CMAQ funds, and State funds.

TAM also continues to support the development of the Northwestern Pacific rail right-of-way. This right-of-way will enable Marin to use the corridor to provide an alternative transportation route to the congested highway, U.S. 101. Sonoma Marin Area Rail Transit District (SMART), a Sonoma County and Marin County transportation agency, is currently developing a proposal for startup rail service between the Larkspur Ferry Terminal and Cloverdale. Specific technology, station locations, operating plans, and funding recommendations are being studied. This project is included in the Regional Transit Expansion Program adopted by MTC (Resolution No. 3434). The completion of this project is dependent on funding from a local sales tax which is scheduled to be on the ballot in Marin and Sonoma counties in November 2006.

TAM developed a Local Transit Master Plan ("Marin Transit Futures") in 2000. This plan produced estimates of future revenue and operating and capital costs. An update of the plan for Marin is being prepared by Marin County Transit District, and their Short Range Transit Plan should be complete by the end of 2005.

7.7 Bicycle and Pedestrian Projects

TAM has a significant commitment to bicycle and pedestrian facilities. In 2003 the CMA (predecessor to TAM) developed a draft Countywide Pedestrian and Bicycle Master Plan to be used by local communities in developing individual plans. Most local communities adopted complementary plans in the last two years. Locally adopted pedestrian and bicycle plans, which are listed in Appendix D, are incorporated into the CMP herein by reference. If independently programmed, funding for these projects has been identified from a variety of sources, including Federal CMAQ funds and State program funds, such as Transportation Enhancement Activities (TEA), Transportation for Livable Communities (TLC), the Bicycle Transportation Account (BTA), and Safe Routes to School (SR2S). These projects may also be integrated into roadway projects, where feasible.

Pedestrian and Bicycle modes continue to be referenced and incorporated into the Congestion Management Plan (CMP), so all projects for these modes continue to be eligible for funds. Additionally on April 28, 2005, TAM allocated $40,000 Transportation Funds for Clean Air (TFCA) funds to the Bolinas CPUD Land Bicycle Path. This project was not included in the Marin County bicycle and pedestrian plan and therefore must be shown in the CIP in the current update.

In addition, Marin County was designated to receive a $25 million dollar "Nonmotorized Transportation Pilot Program" grant during the 2005 Federal transportation budget reauthorization. This money is meant to "demonstrate the extent to which bicycling and walking can carry a significant part of the transportation load, and represent a major portion of the transportation solution within selected communities." The grant will greatly assist bicycle and pedestrian planning efforts within the county.

7.8 Funding Deficiencies

Marin County is facing the continuing challenge of a multi-million dollar deficit in the coming decade. Public acknowledgement of the need to move aggressively to close this deficit became apparent during the 2004 election. At this time, 71% of Marin voters approved the 2004 ballot passing of "Measure A," implementing a half-cent sales tax increase to raise money for transportation improvements. Measure A is expected to generate $332 million dollars over the 20-year life of the measure, with this over half of this money dedicated to transit including local bus service, community shuttles, rural buses, clean fuel vehicles, and discount passes to low-income residents.

In addition, the 5% GGBHTD fare increase effective July 1, 2005 will help address the budget deficit, and help to prevent any further service cutbacks.

The CMP legislation requires that Congestion Management Agencies develop a program that is capable of estimating the cost of mitigating the impact of new development on the CMP designated system.

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CHAPTER 8 – MONITORING, IMPROVEMENT/DEFICIENCY PLANS AND CONFORMANCE

8.1 Purpose and Intent of Legislation

California Government Code sections 65089.3, 65089.4, and 65089.5 govern the conformance process. These sections require that, based on the information obtained through monitoring, TAM must biannually determine whether or not Marin County and its cities and towns conform to the requirements of the CMP. If TAM believes that a local government is not conforming to CMP requirements, it must then hold a noticed public hearing to determine areas of nonconformance. If after the public hearing TAM still believes that the local government is not conforming to CMP requirements, it must provide written notice to the local government citing the specific instances of nonconformance. The local government then has 90 days to remedy the instances of nonconformance. If after 90 days the local government has not remedied the nonconformance instances, TAM makes a finding of nonconformance and notifies the State Controller to withhold certain gas tax subvention funds.

8.2 Local Government Conformance Requirements

The CMP legislation makes the following requirements of a conformance determination for local jurisdictions:

- Maintaining the highway LOS standards outlined in the CMP (Chapter 2).
- Participating in a program to analyze the impact of land-use decisions, including the estimate of the costs associated with mitigating these impacts. Specific requirements and recommendations are outlined in the Land-Use Analysis Program element of the CMP (Chapter 5).
- Participating in adoption and implementation of a deficiency plan when highway and roadway LOS standards are not maintained on portions of the designated system.

If either Marin County or cities and towns in the county do not meet each of these CMP requirements by December 2005 when TAM will make its nonconformance determination for each jurisdiction,[9] the jurisdiction that is found in nonconformance may risk losing an increment in their gasoline tax subvention funds and not having projects programmed in the Regional Transportation Improvement Program (RTIP).

[9] "Jurisdiction" refers to the local government that has the greatest segment distance within its boundaries. Designation of a jurisdiction that has primary responsibility for the segment provides clear direction to who is responsible for preparation of deficiency plans.

8.3 Local Government Monitoring Requirements

TAM must take active steps, at least biannually, to ensure that Marin County and each city and town in Marin County conforms to each requirement of the CMP legislation. Monitoring must be done for several reasons:

- Congestion is projected to increase, which will waste valuable time and add to the transportation costs of goods and services.
- Congestion causes energy to be wasted and contributes to a worsening of our air quality.
- Coordinated growth management and transportation planning is essential to minimizing both travel time and costs.

The CMP legislation specifies that jurisdictions that do not demonstrate that they conform to the requirements will lose street and highway subvention money. Many jurisdictions would use this money for maintenance of existing streets and roads so that their transportation infrastructure does not go neglected for many years.

Outlined below is the recommended monitoring that each jurisdiction should undertake to document to TAM that it conforms to CMP requirements.

8.3.1 Maintaining the Highway Level-of-Service Standards

Each city and town is responsible for biannually monitoring the level of service on segments[10] of the CMP designated routes within its jurisdiction.[11] Marin County is responsible for overall CMP roadway network monitoring. Where a segment falls within two or more jurisdictions, the jurisdiction responsible for the segment is the jurisdiction with the greatest segment mileage. The monitoring program occurs during the P.M. peak hour (4:00 P.M. to 6:00 P.M.). Traffic counts should be taken in even numbered years between the start of school in September and a week before Thanksgiving, with any necessary follow-up actions completed between by the end of December. The results, relative to conformance with the adopted LOS standards, are to be reported to TAM at the next available meeting.

The LOS is to be based on the counts consistent with the methods for determining LOS outlined in the highway LOS standards (Chapter 2). In general, local governments are responsible for counts on the non-state maintained, CMP designated facilities, and Caltrans is responsible for counts on the state maintained, CMP designated facilities where either of the following conditions are met:

[10] Roadway segments are defined from interchange to interchange for freeways, and from major intersection to major intersection for non-freeway state highways (e.g., Highway 1) and principal arterials (e.g., Sir Francis Drake Boulevard). These segments, along with the designated "responsible" jurisdiction, are shown in Appendix A.

[11] Annual monitoring is required if a segment is found to operate at LOS D. Conversely, monitoring frequency is reduced to a tri-annual basis if the LOS is A, B or C.

- The "existing" run of the Marin Travel Model shows that there has been a volume-to-capacity (v/c) ratio change that places the facility within 0.05 of the cutoff between what is considered acceptable and what is considered deficient (i.e., if the v/c ratio exceeds 0.85 for principal arterials, as opposed to 0.90, or 0.95 for freeways and rural expressways, as opposed to 1.00). Specific segments meeting these criteria would be determined at least biannually by TAM.
- The jurisdiction has issued occupancy permits for developments that total 100 or more P.M. peak-hour trips. While the completed projects may have an impact on CMP designated facilities in adjacent jurisdictions, the need for counts on segments that extend beyond the jurisdiction's boundaries would be determined by biannually running the Marin Travel Model. The model is therefore run every other year, or more often in the case of a development with more than 100 P.M. peak-hour trips.

Transportation improvements or changed economic conditions may result in changes in LOS. If the LOS is determined to be A, B, or C for any year that is monitored, the monitoring frequency would then become every three years, until such time as the segment is found to operate at LOS D or worse. Any segment determined to operate at LOS D should then be monitored every year.

Certain facilities that currently operate at LOS F can be grandfathered and thus would not be subject to monitoring requirements, as provided for in the CMP legislation. These facilities are outlined in the highway LOS standard (Chapter 2). It is recommended that jurisdictions in cooperation with TAM develop "improvement plans" for these facilities. Improvement plans are envisioned as a description of construction plans, program options, or management techniques that a local jurisdiction intends to advocate for implementation by that jurisdiction or others (e.g., Caltrans for state facilities).

If a segment that has not been grandfathered is determined by TAM to not meet the adopted LOS standards (D for principal arterials; E for freeways), then that jurisdiction must:

- Immediately propose and designate funds for measures that improve the LOS to meet or be better than the adopted LOS standard which TAM would then incorporate into the CIP, or
- Create a "deficiency plan" in accordance with CMP requirements. A deficiency plan requires the local government to:
    1. Analyze the cause of the deficiency **AND** define improvements to the facility that maintain the LOS standard, **OR**
    2. Define improvements that have a measurable improvement on the transportation system's LOS or substantial air quality benefit **AND** determine the cost of the improvements.

Guidelines governing specific issues related to Deficiency Plan preparation are provided as Appendix C of this document.

TAM has grandfathered certain roadway segments currently operating at LOS F according to specified criteria, and recommended preparation of improvement plans for these roadway

segments. This exempts certain freeway and arterial segments from the congestion management requirements where TAM cannot identify viable transportation improvements for improving the operation of the deficient segment to meet the adopted LOS standard.

8.3.2 Maintaining Performance Measures

Performance measures have been required by the CMP legislation. The eight performance measures that are currently analyzed are:

- Roadway Level-of-Service
- Peak-Hour Travel Time
- Person Throughput
- Vehicle Miles Traveled in Congested Conditions
- Job/Housing Balance
- Transit Frequency
- Transit Coordination
- Pedestrian and Bicycle Investment

TAM, in cooperation with Marin County Transit District and Golden Gate Transit, Highway and Transportation District (Golden Gate Transit) staff, will determine biannually whether or not performance measures established in the Performance Element (Chapter 3) have been met. In making this conformance determination, TAM will have a coordination role with neighboring counties, MTC, Golden Gate Transit, Marin County Transit District, and the other transit operators in the county.

8.3.3 Maintaining a Program to Analyze the Impact of Land-Use Decisions

Land-use impact analysis monitoring requirements are detailed in the Land-Use Analysis Program (Chapter 5). Each jurisdiction is to be responsible for preparing and transmitting to CDA land-use data for use in the Marin Travel Model, as well as tracking the build-out of that land-use through issuance of planning and building permits. This requirement ties in with the CDA's existing property development ("PROPDEV") database that local governments are currently using, as well as, their Countywide Land-Use Database. TAM biannually runs the Marin Travel Model for updating future year LOS information in the CMP. Local governments can find this information very useful when updating the land-use and circulation elements of their general plans.

For any general plan update or amendment or major development proposal that would result in a net increase or decrease of 100 or more P.M. peak-hour vehicle trips, local governments are to forward information on the application to TAM and run the Marin Travel Model to obtain transportation impact information related to the application. The jurisdiction is responsible for conducting the model run, which could be performed: (1) by the jurisdiction, (2) by a consultant hired by the jurisdiction, or (3) by TAM staff , only if staff is available to do the work and the

jurisdiction requesting the model run reimburses TAM for the cost of the model run. Model results are useful to cities and the County as part of their current review and approval process, especially for purposes of defining the necessary mitigation measures.

Appendix A
CMP Designated Facilities

Table A-1: Facilities held to LOS D Standard

CMP Route	From	To	Jurisdiction[1]
SR 1	U.S. 101	Flamingo Road	Marin County
SR 1	Flamingo Road	Panoramic Hwy	Marin County
SR 1	Panoramic Hwy	Muir Woods Rd	Marin County
SR 1	Muir Woods Rd	Panoramic Hwy	Marin County
SR 1	Panoramic Hwy	SFD Blvd S	Marin County
SR 1	SFD Blvd S	SFD Blvd N	Marin County
SR 1	SFD Blvd N	Sonoma Co	Marin County
SR 131	U.S. 101	Redwd Frtg Rd	Marin County
SR 131	Redwd Frtg Rd	Blackfield	Marin County
SR 131	Blackfield	Trestle Glen	Tiburon
SR 131	Trestle Glen	San Rafael Ave	Tiburon
SR 131	San Rafael Ave	Beach Rd	Tiburon
Bel Marin Keys Bridgeway/Second Street/Sausalito Lat	U.S. 101 SB	Hamilton Dr	Novato
	U.S. 101	Glen Street	Sausalito
	Glen Street	Marinship Way	Sausalito
	Marinship Way	Harbor Drive	Sausalito
	Harbor Drive	U.S. 101	Sausalito
East SFD Blvd	U.S. 101	Larkspur Ferry	Larkspur
East SFD Blvd	Larkspur Ferry	Lspur Lndg E	Larkspur
East SFD Blvd	Lspur Lndg E	I-580	Marin County
Fourth Street	Ross Valley Dr	Marquard Ave	San Rafael
Novato Blvd	Sutro/San Marin	Grant Ave	Novato
Novato Blvd	Grant Ave	Diablo Ave	Novato
Red Hill Ave SF	D Blvd	Ross Valley Dr	San Anselmo
Rowland Blvd	S Novato Blvd	U.S. 101	Novato
Second Street	Marquard Ave	Hayes Street	San Rafael
Second Street	Hayes Street	U.S. 101	San Rafael
SF Drake Blvd	SR 1	Nicasio Valley Rd	Marin County
SF Drake Blvd	Nicasio Valley Rd	Olema Rd	Marin County
SF Drake Blvd	Olema Rd	Butterfield Ave	Fairfax
SF Drake Blvd	Butterfield Ave	Red Hill Ave	San Anselmo
SF Drake Blvd	Red Hill Ave	Bolinas Ave	San Anselmo
SF Drake Blvd	Bolinas Ave	College Ave	Ross
SF Drake Blvd	College Ave	Wolfe Grade	Marin County
SF Drake Blvd	Wolfe Grade	Bon Air Rd	Marin County
SF Drake Blvd	Bon Air Rd	U.S. 101	Marin County
S Novato Blvd	Diablo Ave	Rowland Blvd	Novato
S Novato Blvd	Rowland Blvd	Sunset Parkway	Novato
S Novato Blvd	Sunset Parkway	U.S. 101	Novato
Third Street	Hayes Street	U.S. 101	San Rafael

[1] Jurisdiction refers to the local government that has the greatest segment distance within its boundaries. Designation of a jurisdiction that has many primary responsibilities for the segment provides clear direction on who is responsible for preparation of deficiency plans

Table A-2: Facilities held to LOS E Standard

CMP Route	From	To
I-580	U.S. 101	Bellam Mlvd
I-580	Bellam Mlvd	Sir Francis Drake Blvd E
I-580	Sir Francis Drake Blvd E	Main Street
I-580	Main Street	Contra Costa County Line
U.S. 37	U.S. 101	Atherton Ave
U.S. 37	Atherton Ave	Sonoma County Line
U.S. 101	Golden Gate Bridge	Sausalito Lateral
U.S. 101	Sausalito Lateral	Spencer Ave
U.S. 101	Spencer Ave	Rodeo Ave
U.S. 101	Rodeo Ave	Bridgeway
U.S. 101	Bridgeway	SR 1
U.S. 101	SR 1	Redwood Rd
U.S. 101	Redwood Rd	Frontage Rd
U.S. 101	Frontage Rd	SR 131
U.S. 101	SR 131	Tamalpias Drive
U.S. 101	Tamalpias Drive	Madera Blvd
U.S. 101	Madera Blvd	Lucky Drive
U.S. 101	Lucky Drive	Sir Francis Drake Blvd
U.S. 101	Sir Francis Drake Blvd	I-580
U.S. 101	I-580	Irwin Street
U.S. 101	Irwin Street	Mission Street
U.S. 101	Mission Street	Lincoln-Villa Streets
U.S. 101	Lincoln-Villa Streets	San Pedro Rd
U.S. 101	San Pedro Rd	Manuel Freitas Pkwy
U.S. 101	Manuel Freitas Pkwy	Lucas Valley Rd
U.S. 101	Lucas Valley Rd	Miller Creek Rd
U.S. 101	Miller Creek Rd	Hamilton Field
U.S. 101	Hamilton Field	Ignacio Blvd
U.S. 101	Ignacio Blvd	SR 37/S Novato Blvd
U.S. 101	SR 37/S Novato Blvd	Rowland Blvd
U.S. 101	Rowland Blvd	De Long Ave
U.S. 101	De Long Ave	Atherton Ave
U.S. 101	Atherton Ave	Sonoma County Line

Appendix B
Key To Acronyms & Glossary of Technical Terms

Glossary of Technical Terms

ABAG: The Association of Bay Area Governments.

Attraction (Trip): The non-home end of the trip, which is the reason for the being made. Employment centers, stores, entertainment facilities, etc. all generate trip attractions.

Auto Driver Trips: The same as vehicle trips.

BAAQMD: Bay Area Air Quality Management District.

BART: Bay Area Rapid Transit.

Base Year: A year for which land use, demographic, and other information is assembled as a baseline, against which the entire modeling sequence can be calibrated. In the Sonoma County model, 1984 is the base year.

CBTP: Community Based Transportation Plan.

CMA's: Congestion Management Agencies.

CMAQ: Congestion mitigation and Air Quality Improvement Program.

Centroid: The theoretical center of activity in a zone.

DBR: Discretionary Bridge Replacement and Rehabilitation funding.

District: A grouping of contiguous zones that are aggregates to larger areas.

Driver Trips: Same as vehicle trips.

External Trip: A trip with one trip end outside the study area (in this case, outside Marin County)

FHWA: Federal Highway Administration

FLHP: Federal Lands Highways Program funds, used for public roads serving federal parks, reservations, etc.

FTA: Federal Transit Administration.

Gateway: An entry point to the study area (County). They are the points through which all external and through trips must pass at some point.

HBRR: Highway Bridge Rehabilitation and Replacement program, a program that in recent years has given highest priority to seismic retrofits.

HES: Hazard Elimination Safety Funding, a program that provides funds for safety improvements on any public road, any public surface transportation facility, and publicly-owned bicycle or pedestrian pathway or trail, and for any traffic calming measure.

HIP: Housing Incentive Program, MTC funds that are intended to be used for transportation capital projects that support Transportation for Livable Communities (TLC) goals.

Home-Based Trip: A trip with one TRIP END at the traveler's residence, in other words, a trip that starts OR ends at the home of the traveler.

Horizon Year: The future year under study

HOV: High Occupancy Vehicle, in other words, buses and carpools. This size of carpools are variously defined. The Federal Highway Administration considers a carpool 3 or more persons. As used in this study, carpools is assumed to be 2 or more persons.

ITIP: Interregional Transportation Improvement Program, a program to improve California's interregional travel and speed the movement of goods throughout the state.

ITS: Intelligent Transportation System.

Link: A section of the highway or transit network, defined by a NODE at each end. A link may be two-way (normally) or one-way.

Logit Model: A mathematical form of a MODE SPLIT MODEL. A key feature of the logit model is that it presumes travelers are most sensitive to a choice between two modes when both are nearly equal in cost and travel time.

MTC: Metropolitan Transportation Commission, Oakland.

Mode Split Model: A mathematical formulation express used to predict what mode of travel people will use (bus, auto, etc.), based on various factors which are assumed to influence that choice: relative travel time and cost being the two most important.

Non-Home Based Trip: A trip for which neither trip end is at the travelers place of residence. In other words, trips which have neither end at the home of the traveler.

OD: Origin-destination. OD tables differ from P/A tables because they do not indicate which end of the trip is the home end. An example illustrates this best: consider trips between London and Boston. An O-D table might indicate 525 trips from London to Boston in the month of June, and 650 from Boston to London. We do not know from this how many were made by U.S. citizens visiting England, and how many were made by British subjects visiting the U.S. We simply know how many trips were made, regardless of the home end. The flows do not match during the month of June, although we presume

that if we measured the travel for a long enough period of time (say a year or more), that the flows would balance, with everyone who left home also eventually returning. The same is true of OD tables—no indication is given as the home end, and over a period (24) we assume the flows are symmetric—that is, all the flows from zone I to J should equal the flows from zone J to I.

Person Trip: A trip made by one person, and having two trip ends. One person driving to work (one way) is one person trip; two people driving to work together in one car is two person trips.

RTIP: Regional Transportation Improvement Program, a 5-year program list of transportation projects that are to be funded with State Transportation Improvement Program (STIP) funds.

RM2: Regional Measure 2, On March 2, 2004, voters passed Regional Measure 2 (RM2), raising the toll on the seven State-owned toll bridges in the San Francisco Bay Area by $1.00. This extra dollar is to fund various transportation projects within the region that have been determined to reduce congestion or to make improvements to travel in the toll bridge corridors.

STIP: State Highway Improvement Program

STP: Surface Transportation Program

SHOPP: State Highway Operations and Protection Program, a program meant to maintain the integrity of the State Highway System. Funding for this program is provided through gas tax revenues.

TCRP: Traffic Congestion Relief Plan.

TCSP: Transportation and Community Systems Preservation, a program that provides funds for planning and implementation grants, technical assistance and research to investigate and address the relationship between transportation; community and system preservation; and private sector-based initiatives.

TEA: Transportation Enhancement Activities funding source, a program that provides funding for projects that enhance quality of life, in or around transportation facilities.

TFCA: Transportation Fund for Clean Air, used to fund programs, capital investments and operations support for programs that help lessen the reliance on traditional single-occupancy vehicles.

TLC: Transportation for Livable Communities Program.

TOD: Transit-Oriented Development.

Trip: A one-direction movement which begins at the origin at the start time, ends at the destination at the arrival time, and is conducted for a specific purpose.

Vehicle Trip: A trip made by a vehicle or truck from an origin to a destination. A vehicle trip involves at least one, and possibly several person trips.

V/C Ration (Volume/Capacity Ratio): A measure used to indicate the level of congestion on the link. Depending on how capacity is defined, this can be translated into travel delay. V/C ratios greater than 1 are always considered undesirable.

VHT: Vehicle hours of travel.

VMT: Vehicle miles of travel.

Zone: A portion of a study area, declined for land use and travel analysis purposes. A zone has one and only and centroid.

Appendix C
Deficiency and Improvement Plan Guidelines

MARIN CONGESTION MANAGEMENT PROGRAM

Deficiency and Improvement Plan Guidelines

prepared for

Marin County
Congestion Management Agency

by
DKS Associates
May 1993

1. Introduction

This document describes a proposed process for the preparation of deficiency and improvement plans. There is an important distinction between the two:

- Deficiency plans are required by CMP legislation for any roadway segment that falls below the adopted level of service standard when the state-mandated exceptions (discussed below) are applied.

- Improvement plans are recommended by the Marin County CMP for all segments which are already below the adopted level of service standard or segments that fall below the adopted level of service standard but are exempted from a deficiency plan after exceptions are applied.

State Requirements for Deficiency Plans

The Congestion Management Program (CMP) legislation provides for deficiency plans as a way for local jurisdictions to remain in conformance with the CMP when level of service (LOS) deteriorates below the established standard.

California Government Code Section 65089.1 (b)(1)(B) states:

> *In no case shall the LOS standards established be below the level of service E or at the current level, whichever is further from level of service A, except where a segment or intersection has been designated as deficient and a deficiency plan has been adopted pursuant to Section 65089.4.*

The 1991 Marin County CMP adopts LOS E as the standard for freeways and rural expressways (Interstate 580, Highway 101 and Highway 37) and LOS D for other roadways on the designated network. When deterioration of the level of service on a given CMP network segment has not been prevented, the legislation provides two options for local jurisdictions to remain in conformance:

a) implementation of a specific plan to correct the LOS deficiency on that affected network segment; and,

b) implementation of other measures intended to result in measurable improvements in LOS on the CMP network and contribute to significant improvements in air quality.

Language regarding deficiency plans is found in California Government Code Section 65089.3, which states:

(a) The agency shall monitor the implementation of the elements of the congestion management program. The department is responsible for data collection and analysis on state highways, unless the agency designates that responsibility to another entity. The agency may also assign data collection and analysis responsibilities to other owners and operators of facilities or services if the responsibilities are specified in its adopted program. The agency shall consult with the department and other affected owners and operators in developing data collection and analysis procedures and schedules prior to program adoption. At least biennially, the agency shall determine if the county and cities are conforming to the congestion management program, including, but not limited to, all of the following:

(a) Consistency with the levels of service and performance standards, except as provided in Section 65089.4.

(b) Adoption and implementation of a trip reduction and travel demand ordinance.

(c) Adoption and implementation of a program to analyze the impacts of land use decisions, including the estimate of the costs associated with mitigating these impacts.

(d) Adoption and implementation of a deficiency plan pursuant to Section 65089.4 when highway and roadway level of service standards are not maintained oil portions of the designated system.

The California Government Code specifies when deficiency plans are required:

65089.4. (a) A local jurisdiction shall prepare a deficiency plan when highway or roadway level of service standards are not maintained oil segments or intersections of the designated system. The deficiency plan shall be adopted by the city or county at a noticed public hearing.

(b) The agency shall calculate the impacts subject to exclusion pursuant to subdivision (0 *of this section, after consultation with the regional agency, the department, and the local air quality management district. If the calculated traffic level of service following exclusion of these impacts is consistent with the level of service standard, the agency shall make a finding at a publicly noticed meeting that no deficiency plan is required and so notify the affected local jurisdiction.*

Section 65089.4 of the California Government Code also specifies the required context of deficiency plans:

(c) The agency shall be responsible for preparing and adopting procedures for local deficiency plan development and implementation responsibilities, consistent with the requirements of this section. The deficiency plan shall include all of the following:

(1) An analysis of the cause of the deficiency. This analysis shall include the following:

(A) Identification of the cause of the deficiency.

(B) Identification of the impacts of those local jurisdictions within the jurisdiction of the agency that contribute to the deficiency. These impacts shall be identified only if the calculated traffic level of service following exclusion of impacts pursuant to subdivision (f) indicates that the level of service standard has not been maintained, and shall be limited to impacts not subject to exclusion.

(2) A list of improvements necessary for the deficient segment of intersection to maintain the minimum level of service otherwise required and the estimated costs of the improvements.

(3) A list of improvements, programs, or actions, and estimates of costs, that will (A) measurably improve multimodal performance, using measures defined in paragraphs (1) and (2) of subdivision (b) of Section 65089, and (B) contribute to significant improvements in air quality, such as improved public transit service and facilities, improved nonmotorized transportation facilities, high occupancy vehicle facilities, parking cash-out programs, and transportation control measures. Vie air quality management district or the air pollution control district shall establish and periodically revise a list of approved improvements, programs, and actions that meet the scope of this paragraph. If all improvement, program, or action is not on the approved list, it shall not be implemented unless approved by the local air quality management district or air pollution control &strict.

(4) An action plan, consistent with the provisions of Chapter 5 (commencing with Section 66000[1]), that shall be implemented, consisting of improvements identified in paragraph (2), or improvements, programs, or actions identified in paragraph (3), that are found by the agency to be in the interest of the public health, safety, and welfare. The action plan shall include a specific implementation schedule. The action plan shall include implementation strategies for those jurisdictions that have contributed to the cause of the deficiency in accordance with the agency's deficiency plan procedures. The action plan need not mitigate the impacts of any exclusions identified in subdivision (f). Action plan strategies shall identify the most effective implementation strategies for improving current and future system performance.

The procedures required for deficiency plan approval are described in Section 65089.4 (d) to (e):

[1]This chapter describes the procedures allowed or required in order to implement development mitigation fees. It includes adoption requirements, allowable categories for fees including transportation, procedures for property donation, and procedures for assessment and payment of the fees.

(d) A local jurisdiction shall forward its adopted deficiency plan to the agency within 12 months of the identification of a deficiency. The agency shall hold a noticed public hearing within 60 days of receiving the deficiency plan. Following that hearing, the agency shall either accept or reject the deficiency plan in its entirety, but the agency may not modify the deficiency plan. If the agency rejects the plan, it shall notify the local jurisdiction of the reasons for that rejection, and the local jurisdiction shall submit a revised plan within 90 days addressing the agency's concerns. Failure of a local jurisdiction to comply with the schedule and requirements of this section shall be considered to be nonconformance for the purposed of Section 65089.5.

(e) The agency shall incorporate into its deficiency plan procedures, a methodology for determining if deficiency impacts are caused by more than one local jurisdiction within the boundaries of the agency.

(1) If, according to the agency's methodology, it is determined that more than one local jurisdiction is responsible for causing a deficient segment or intersection, all responsible local jurisdictions shall participate in the development of a deficiency plan to be adopted by all participating local jurisdictions.

(2) The local jurisdiction in which the deficiency occurs shall have lead responsibility for developing the deficiency plan and for coordinating with other impacting local jurisdictions. If a local jurisdiction responsible for participating in a multi-jurisdictional deficiency plan does not adopt the deficiency plan in accordance with the schedule and requirements of paragraph (a) of this section, that jurisdiction shall be considered in nonconformance with the program for purposes of Section 65089.5.

(3) The agency shall establish a conflict resolution process for addressing conflicts or disputes between local jurisdictions in meeting the multi-jurisdictional deficiency plan responsibilities of this section.

The provision of excluding some traffic from the deficiency is provided in Section 65089.4(f).

(f) The analysis of the cause of the deficiency prepared pursuant to paragraph (1) of subdivision (c) shall exclude the following:

(1) Interregional travel (also defined as trips which originate outside of Marin County),

(2) Construction, rehabilitation, or maintenance of facilities that impact the system,

(3) Freeway ramp metering,

(4) Traffic signal coordination by the state or multi-jurisdictional agencies,

(5) Traffic generated by the provision of low-income and very low income housing.

(6)(A) Traffic generated by high-density residential development located within one-fourth mile of a fixed rail passenger station, and

(B) Traffic generated by any mixed use development located within one-fourth mile of a fixed rail passenger station, if more than half of the land area, or floor area, of the mixed use development is used for high density residential housing, as determined by the agency.

The procedures for a finding of non-conformance are found in California Government Code Section 65089.5, which states:

(a) If, pursuant to the annual monitoring provided for in Section 65089.3, the agency determines, following a noticed public hearing, that a city or county is not conforming with the requirements of the congestion management program, the agency shall notify the city or county in writing of the specific areas of nonconformance. If, within 90 days of the receipt of the written notice of nonconformance, the city or county has not collie into conformance with the congestion management program, the governing body of the agency shall make a finding of nonconformance and shall submit the finding to the commission and to the Controller.

(b) (1) Upon receiving notice form the agency of nonconformance, the Controller shall withhold apportionments of funds required to be apportioned to that nonconforming city *or county by Section 2105 of the Streets and Highways Code.*

(2) If, *within the 12-month period following the receipt of a notice of nonconformance, the Controller is notified by the agency that the city or county is in conformance, the Controller shall allocate the apportionments withheld pursuant to this section to the city or county.*

(3) If the Controller is not notified by the agency that the city or county is in conformance pursuant to paragraph (2), the Controller shall allocate the apportionments withheld pursuant to this section to the agency.

(c) The agency shall use funds apportioned under this section for projects of regional significance which are included in the capital improvement program required by paragraph (5) of subdivision (b) of Section 65089, or in a deficiency plan which has been adopted by the agency. The agency shall not use these funds for administration or planning purposes.

Improvement Plans

Improvement plans are recommended in the Marin Congestion Management Program. However, the State legislation makes no requirements for improvement plans. It is recommended that the approach for development of improvement plans should be similar to deficiency plans.

2. Recommendations on Key Issues

There are several policy directions needed for deficiency and improvement plans. We have identified the issues below.

Who is responsible for preparation of deficiency and improvement plans? Local jurisdictions are responsible for developing and adopting deficiency plans.

In some cases, several jurisdictions are required to collaborate in the development of a plan. The determination of which jurisdictions should participate is to be made by TAM. The policy to make this determination is as follows:

> A jurisdiction should participate in the preparation of a deficiency plan at a specific location if traffic from that jurisdiction, either as an origin or a destination, represents ten (10%) percent of the assigned level of service capacity of the facility. The determination of the jurisdiction percentage of the traffic would be made using the select link analysis for the base year of the Marin County latest approved travel model for the P.M. peak hour.

No specific sponsorship of improvement plans is required. It is suggested that local jurisdictions sponsor these plans where possible, because they would need to prepare deficiency plans if the improvement plan actions eventually become ineffective.

> *Recommended action: TAM is to designate the jurisdiction(s) required to lead or participate in the preparation of a deficiency plan. Preparation of deficiency plans must be the responsibility of local jurisdiction* (s) *with assistance from TAM. Improvement plan preparation should be the responsibility of local jurisdictions, with assistance from TAM.*

What triggers the deficiency and improvement plan process? The deficiency plan process is triggered when, pursuant to biannual LOS monitoring through traffic counts and subsequent adjustments for all exclusions required by law (California Code Section 65089.4), a CMP network segment is found to be "deficient" because it degrades from the adopted LOS standard.

The determination of the exclusions is the responsibility of TAM staff. The procedures for developing these exclusions are to be developed by TAM once the deficiency is identified.

The improvement plans are intended for the grandfathered segments of the CMP network as mentioned in California Code Section 65089(a) (1) (B). This document recommends expanding them to those deficient segments that do not fall below the level of service standard once the state exclusions are applied.

> *Recommended action: TAM to require deficiency plans when deficiency occurs, in accordance with state guidelines.*

What trips must be excluded from the deficiency determination? Biannually, upon completion of the level of service monitoring, TAM will identify potentially deficient segments. The level of service will then be analyzed for both before and after the exclusion procedures established in the State legislation. These procedures mandate that exclusion be determined following consultation with MTC, Caltrans, and BAAQMD.

A decision was made in the first CMP that trips should not be removed for the exclusions. For local planning purposes, all improvement plans should not have any exempted trips. Also, any long-range planning and impact fee analysis work should be performed using level of service analyses before the exclusion.

As required in California Government Code Section 65089.4, several types of travel must be excluded from the determination of the need for deficiency plans, including interregional travel (including traffic originating outside of Marin County); construction, rehabilitation, or maintenance of facilities that impact the system; freeway ramp metering; traffic signal coordination by the state or a multi-jurisdictional agency; and traffic generated by the provision of low and very low income housing; traffic generated by high density residential development located within one-fourth mile of a fixed rail passenger station; and traffic generated by any mixed use development located within one-fourth mile of a fixed rail passenger station, if more than half of the land area, or floor area, of the mixed use development is used for high density residential housing.

> *Recommended Action: TAM will determine the trips to be excluded from the calculation of LOS for segments which may need to submit deficiency plans, in consultation with MTC, Caltrans, BAAQMD. Improvement plans will not contain exclusions.*

What constitutes a deficient segment? A segment will be considered deficient and recommended for submission of an improvement plan when its level of service falls below the adopted standard. It will be considered deficient for CMP legislative purposes and require adoption of a deficiency plan if it registers below the adopted standard even after all exclusions listed above have been computed.

> *Recommended Action: TAM will make a finding biannually of deficient segments that will be recommended for improvement plans. Using the State guidelines, deficient segments requiring deficiency plans will also be designated as a subset of the first list.*

What is the purpose of the deficiency plan process? In the State legislation, the deficiency plan process requires local jurisdictions to examine two types of improvement options, and choose one of the two for addressing deficient network segments. The two options are:

- To implement improvements directly on the deficient segments designed to eliminate the deficiency; or

- To designate the segment as deficient, and implement a deficiency or improvement plan including actions designed to measurably improve the overall LOS on the CMP network, and contribute to significant air quality improvements. Such actions may not necessarily be implemented or have a measurable impact on the deficient segment itself.

BAAQMD has created a list of system deficiency plan measures that are regarded as beneficial for air quality. Measures not on the BAAQMD list may also be used, but will need to be evaluated by the BAAQMD for air quality impacts prior to including it as a measure in a deficiency plan.

> *Recommended action: TAM should maintain a list of acceptable measures to examine both types of solutions to each level of service problem.*

What is the purpose of the improvement plan process? An improvement plan process is established as a proactive planning process to recommend solutions to traffic congestion problems not addressed in the deficiency plan process. This falls into the areas of existing traffic congestion problems, and anticipated traffic congestion problems that do not appear because of the exclusions discussed above.

When is a deficiency plan required? A deficiency plan is required when TAM designates a CMP network segment as deficient using the State legislative definition.

> *Recommended action: TAM should establish an official calendar to provide a* maximum *time window in deficiency plan preparation.*

When is an improvement plan required? An improvement plan deadline is not mandated by state legislation; the current CMP suggests that the plans be developed by the next CMP submittal.

> *Recommended action: TAM may recommend that any proposed draft improvement plans should be in place by June of 1995 to allow for lead time when preparing the EIR on the next biennial approval. They can also be prepared at a later date.*

How are deficiency plans and improvement plans adopted? Under CMP legislative guidelines, a deficiency plan must be prepared by the affected local jurisdiction(s). All participating jurisdictions in a multi-jurisdictional improvement plan must approve the plan.

Because the intent is similar and the approach logical, a similar method seems to be appropriate for improvement plans.

> *Recommended action: TAM staff and the CMP technical advisory committee should review the draft to advise if the plan will be acceptable. Then, the deficiency and improvement plans should be adopted by the affected jurisdiction(s) at a public hearing and finally approved (with no amendments or conditions) by TAM.*

How do deficiency and improvement plans relate to the countywide transportation planning process? Deficiency and improvement plan actions should be coordinated with the countywide transportation planning process, including forecasts of travel needs and planned capital improvements. Likewise, the occurrence of deficiencies should be a factor influencing future programming decisions associated with continued countywide transportation planning efforts.

> *Recommended action: All capital improvement items listed in deficiency and improvement plans should be mentioned in the capital improvements program for the CMP. Any growth management or transit actions from deficiency or improvement plans should be included in upcoming countywide plans.*

How long does a jurisdiction have to prepare a legislatively-mandated deficiency plan? Jurisdictions will receive a formal notice of a level of service deficiency at the time when LOS monitoring results are approved. This is the start of the 90-day period allowed under Section 65084.5.

> *Recommended action: TAM should provide ample time to jurisdictions to consider legislatively-required documents. LOS monitoring should occur in the spring, with conformance determination in the following spring, providing the maximum amount of time possible for jurisdictions to develop a deficiency plan.*

What are the required components of a deficiency and improvement plan? State law requires a deficiency plan to contain these items:

- an analysis of the deficiency;
- a list of improvements and related costs to mitigate that deficiency on that facility itself;
- a list of possible actions that would result in improvements to the CMP system's LOS and be beneficial to air quality; and,
- an action plan to implement improvements from one of the two above lists.

Because improvement plans are similar in nature, it seems appropriate to recommend the same format.

> *Recommended Action: All deficiency and improvement plans should include the State-legislated format.*

What constitutes acceptable deficiency and improvement plans? An acceptable plan shall contain all components listed above, as well as appropriate local review and comment. Approval procedures are specified for deficiency plans; improvement plans do not need to meet the strict approval guidelines.

Recommended Action: All deficiency plans should be reviewed by TAM and a technical committee prior to action by the TAM Board. The technical committee may make a recommendation related to approval or rejection of ally plan to the commission. The plan will be evaluated oil the following technical criteria:

a) Completeness as explained in California Government Code Section 65089.4
b) The appropriateness of the plan actions in relation to the magnitude of the deficiency
c) The reliability of the funding sources
d) The reasonableness of the implementation plan schedule
e) The ability to implement the proposed actions (including jurisdictional control issues)

TAM staff technical committee and TAM Board review should be sought for improvement plans, although no specific TAM board action is required.

Why prepare a deficiency plan? When a state-defined deficiency occurs, the responsible jurisdiction(s) must respond. The jurisdiction will forego additional gasoline tax subventions (pursuant to Section 2105 of the Streets and Highways Code) unless it prepares a deficiency plan. If no response is forthcoming, the jurisdiction with the deficiency is required to be found in nonconformance with the CMP by the Congestion Management Agency (CMA) board.

Recommended action: TAM should adopt a goal to approve all deficiency and improvement plans. TAM should also utilize this adoption as all endorsement of the projects and/or actions in its planning and programming. In particular, these plans should be used in obtaining additional justification for funding allocations from regional, state and Federal sources in competitive funding environments.

Why prepare an improvement plan? Even though they are not required by State legislation, an improvement plan offers several benefits. The plan becomes a document which can be used to leverage funding from regional, state and Federal sources. The plan also becomes a key component in the preparation of a capital improvements program and related funding programs. The plan offers communities and developers an opportunity to help implement the programs identified to eliminate the deficiency. Finally, adoption of an effective improvement plan may prevent a State-mandated deficiency plan from having to be prepared.

3. Process

TAM should adopt a process by which plans are developed and approved. A typical process that could be used by TAM is listed below.

Agencies Involved in Preparation. All jurisdictions affected by the deficiency should be involved. The leading jurisdiction is the jurisdiction in which the deficiency occurs. Other participating jurisdictions are determined according to this policy:

> A jurisdiction should participate in the preparation of a deficiency plan at a specific location if traffic from that jurisdiction, either as an origin or a destination, represents ten (10%) percent of the volume of the facility at the maximum service flow rate of the LOS Standard set by TAM for that facility. The determination of the jurisdiction percentage of the traffic would be made using the select link analysis for the base year of the Marin County latest approved travel model for the P.M. peak hour.

If it is a multi-jurisdictional plan or if it involves system-wide improvements, TAM staff, transit agencies, the BAAQMD, and Caltrans should also be involved.

Deficiency and Improvement Plan Development and Approval Process. The proposed process for developing and approving deficiency and improvement plans is described on the attached flowcharts.

Figure A describes the overall deficiency plan process. Figure B depicts the deficiency identification step in the process. Figure C illustrates the process to be followed by local jurisdictions for development of deficiency plans. Figure D shows the process to be followed for deficiency plan approval. This differs from Figure C in that Figure D sets TAM's actions and schedule for approval of deficiency plans in relation to TAM's biannual findings of conformance with CMP requirements. Figure E illustrates the deficiency plan monitoring process.

A similar set of figures describes the improvement plan approval process. Figure F depicts the overall process. Figure G describes the identification step in the process. Figure H illustrates the process to be followed for the development of improvement plans. Figure I illustrates the improvement plan monitoring process.

Deficiency Identification. A deficiency is discussed in the annual level of service monitoring process, as described in Chapter 2.

Figure A
GENERAL DEFICIENCY PLAN PROCESS

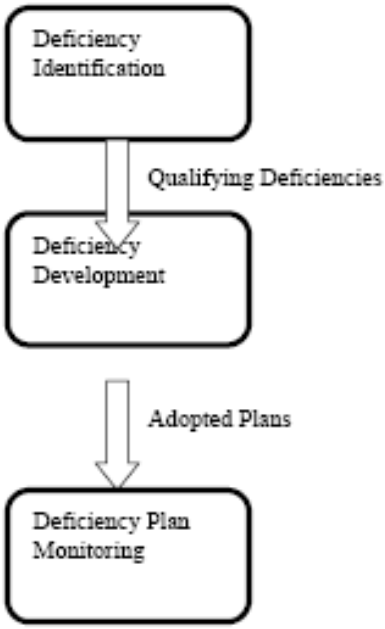


Figure B
IDENTIFICATION FOR DEFICIENCY PLANS

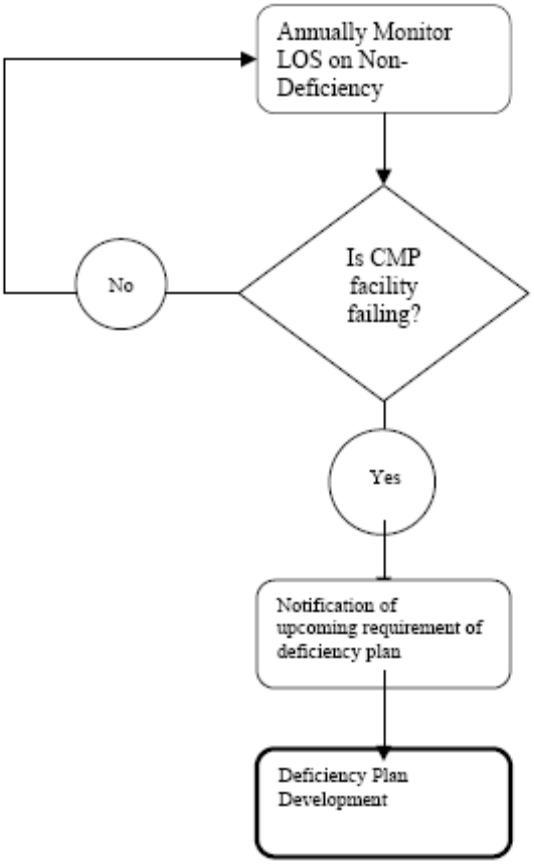


Figure C
DEFICIENCY PLAN DEVELOPMENT

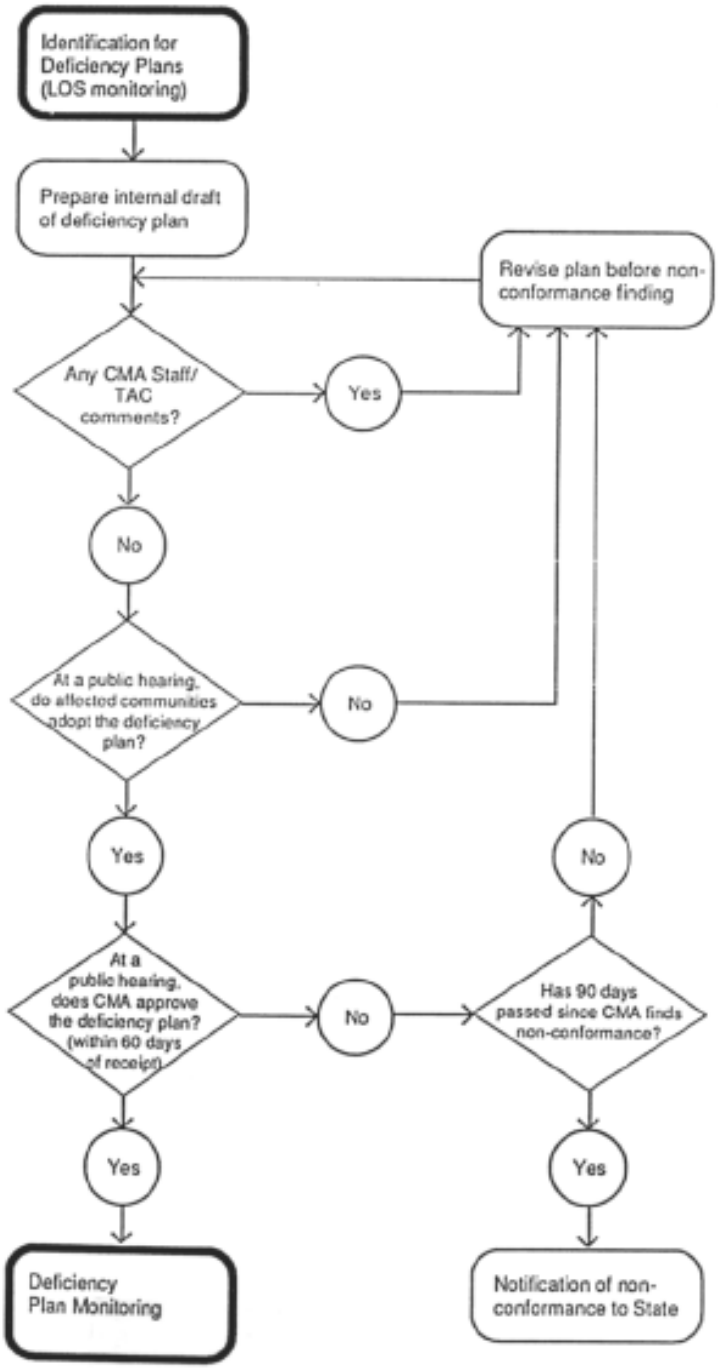
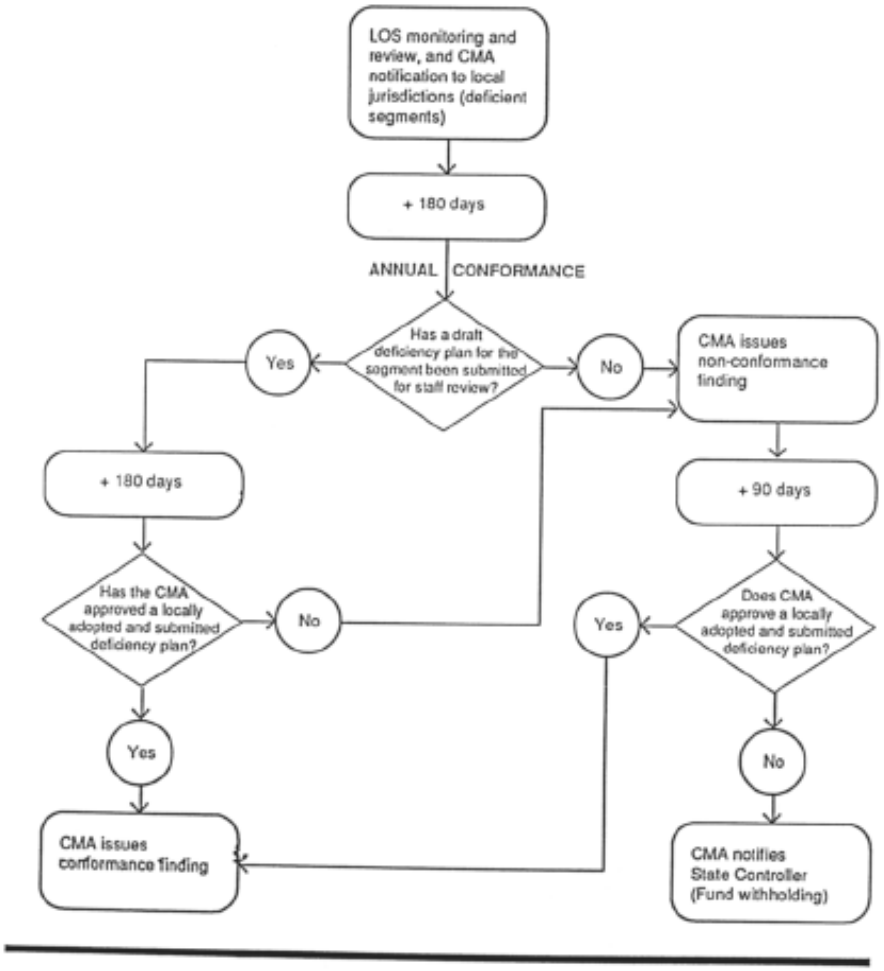


Figure D
APPROVAL PROCESS AND TIME LINES FOR DEFICIENCY PLANS



Time Allowed for Deficiency Plan Preparation (from LOS Notification)

1. If deficiency plan ready at annual monitoring: 180 days
2. If deficiency plan not ready at annual monitoring but approved during 1st cycle: 180 + 180 = 360 days
3. If no plan was prepared: 180 + 90 = 270 days
4. If deficiency plan was not ready at annual conformance monitoring and was rejected once: 180 + 180 + 90 = 450 days

Figure E
DEFICIENCY PLAN MONITORING

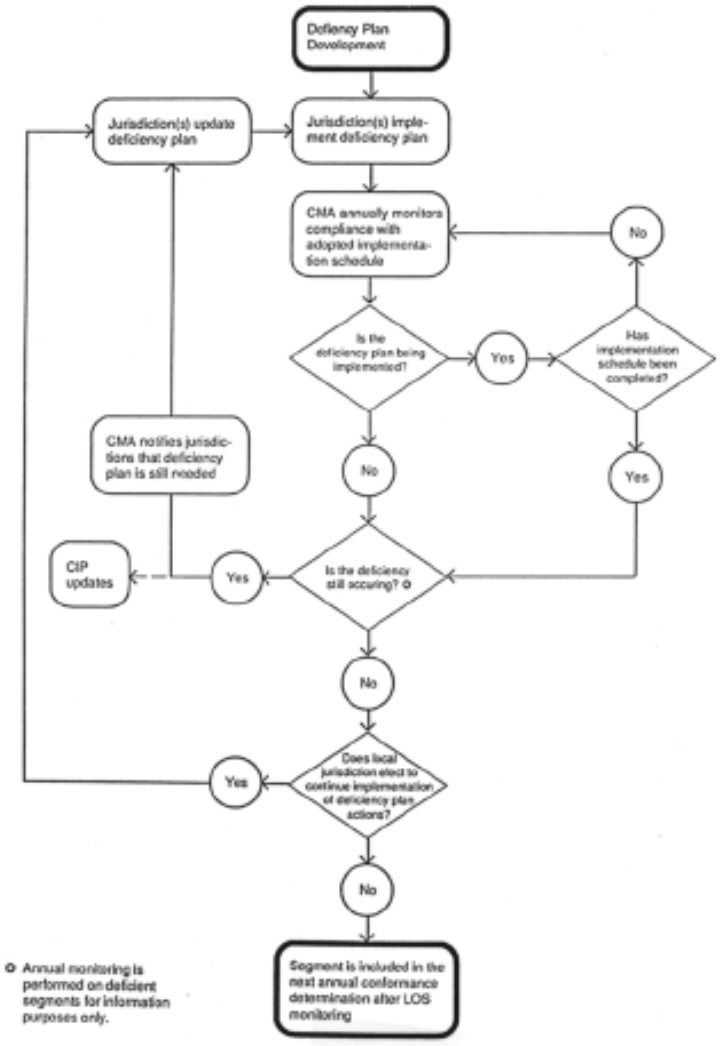


Figure F
GENERAL IMPROVEMENT PLAN PROCESS

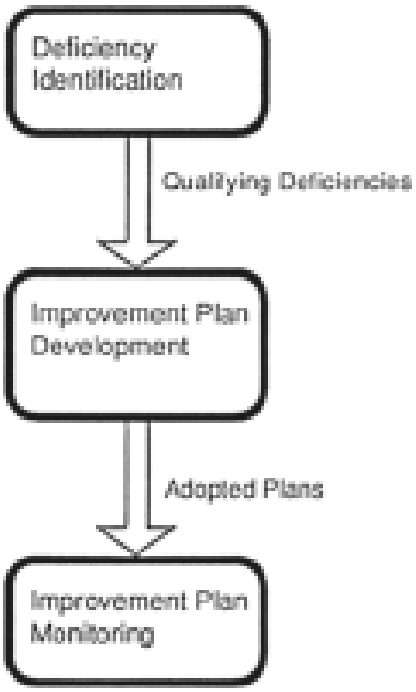


Figure G
IDENTIFICATION FOR IMPROVEMENT PLANS

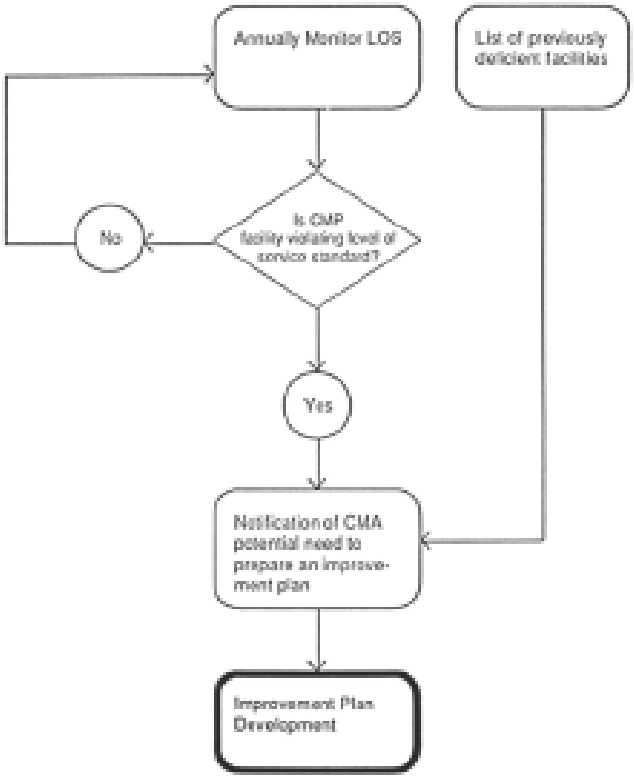
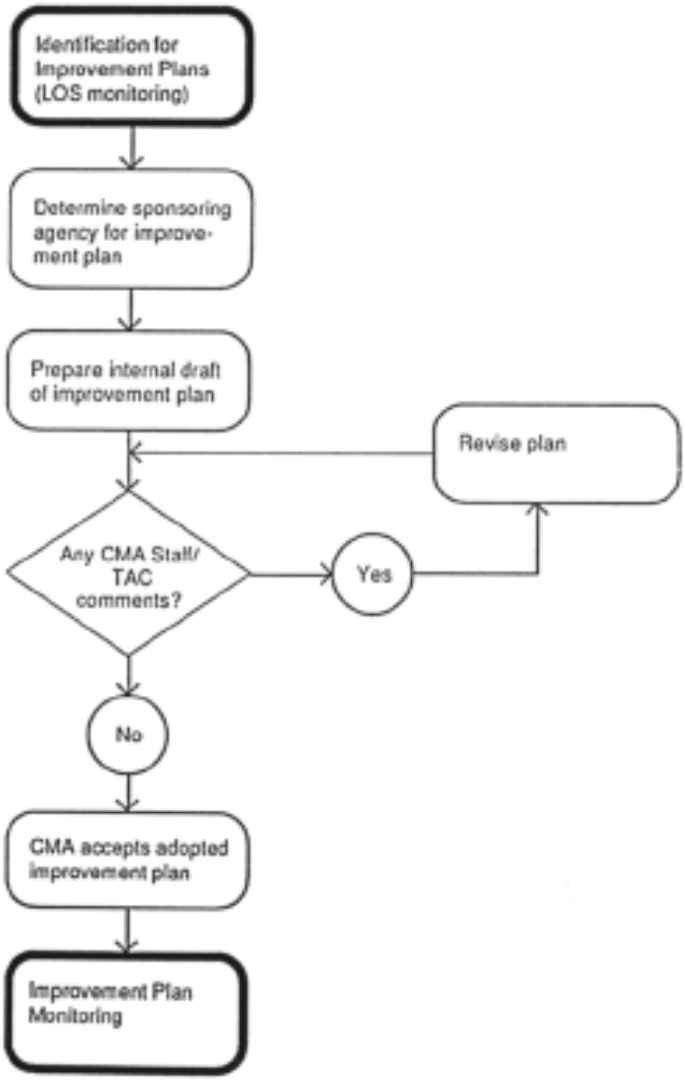


Figure H
IMPROVEMENT PLAN DEVELOPMENT



Development of Deficiency Plans

1. TAM will designate one local jurisdiction to be the lead on preparing and submitting a deficiency plan. That jurisdiction should develop a work strategy by which to develop a draft plan in the adopted time frame. The draft plan should include a plan for other designated jurisdictions to participate and provide feedback. A draft plan should address these points:

   - The deficiency must be described in terms of its cause and magnitude (such as needed reduction in traffic to raise speed to the level of service standard.)

   - Actions considered to remedy the specific deficiency should be considered. If no action can be developed to remedy that specific deficiency, alternative actions to improve level of service on the CMP network shall be considered.

   - If actions are considered which are intended to improve LOS on the CMP network, those actions listed in the BAAQMD guidelines for deficiency plans, and other possible actions identified by affected jurisdictions and approved by the BAAQMD should be given a suitability assessment (See *Appendix* B). Suitable system actions should be evaluated at a sketch-planning level for potential effects on system-wide traffic congestion and air quality (traffic analyses or model forecasts may be required).

   - A detailed action plan should be developed, including description of the selected actions, anticipated costs and related funding sources, and a corresponding implementation schedule.

2. A draft plan should be reviewed by TAM staff and the technical committee. These groups should coordinate with the local jurisdiction where desired to develop a deficiency plan acceptable to that jurisdiction and TAM.

3a. To meet legislative compliance, a final deficiency plan must be adopted by the affected local jurisdictions at a noticed public hearing not later than 90 days following notification of the annual conformance findings of TAM.

Also for plans required to obtain legislative compliance, a final plan must be approved by TAM. TAM will approve or reject a deficiency plan within 60 days of receipt of the deficiency plan from the local jurisdiction.

3b. Because improvement plans do not need legislative compliance, their adoption procedure is simplified. Local jurisdictions may submit their improvement plan, or endorse an improvement plan submitted through the TAM.

Implementation Monitoring. Deficiency and improvement plans should be monitored annually by TAM, prior to annual conformance determination, to establish:

a) whether they are being implemented according to the schedule detailed in their specific action plans; and

b) whether changes have occurred that require modifications of the original deficiency plan or schedule.

The plan should include a schedule for implementation of the proposed actions. Compliance with the stated schedule will be monitored annually at the time of conformance determination. A jurisdiction which is either not implementing the actions stipulated in the approved deficiency plan, or not adhering to the stated schedule may be found in non-conformance if the deficiency still exists. Once the action plan is implemented, ail evaluation to recognize a measurable improvement will determine if the plan should be updated or if the roadway can be returned to level of service monitoring as its conformance determination. Action plans will be incorporated into future CMP documents.

The evaluation may result in recommended changes in other elements of the CMP, such as the capital improvements program (CIP) or trip reduction ordinances (TROs).

Process for Deficiency Plan Update. To facilitate the approval process, minor updates to deficiency and improvement plans should be accepted by TAM Board. The affected jurisdiction(s) may submit a notice to TAM stating the reason and the content of the update to their plan. TAM board would then approve or reject the request for the update. Should TAM reject the request, the existing deficiency plan would remain in place.

Development of Improvement Plans

If an improvement plan need is identified, staff from TAM and the affected local jurisdictions should meet to determine what the contents and objective of the plan should be. At a minimum, an improvement plan should contain:

- An analysis of the causes of the deficiency
- An indication of the potential future need of a deficiency plan if no improvement plan is implemented
- Potential actions to be considered to remedy the deficiency's impact
- Recommendations which are intended to prevent the need for a deficiency plan

Although no adoption is required, review by TAM staff, technical committee, TAM board and affected local jurisdictions governing boards should be provided.

4. Methodology

General Approach to Deficiency and Improvement Plan Analysis. The scope for the deficiency plan actions should be matched to the severity of the problem. Extreme deficiencies will need more significant actions; minor deficiencies need only minor actions.

Calculation of Deficiency. The magnitude of the deficiency should be determined as the amount of traffic on a road segment that is above its level of service capacity.

Available Action Tools. Action tools fall into one of two categories: improvements designed to directly mitigate the specific deficiency, and improvements designed to improve LOS on the CMP network and provide air quality improvements.

The first type of action tools are intended to directly mitigate a deficiency. These include highway, transit and other mode improvements.

The second type of action tools are intended to provide measurable improvements to air quality and LOS on the CMP network in cases where deficiencies on specific segments or at specific intersections cannot be mitigated directly. For these, the BAAQMD has developed a list of available deficiency plan actions, which are considered beneficial for air quality and congestion management. Jurisdictions may include actions other than those on this list, provided that they are reviewed and approved by the BAAQMD prior to adoption of the plan.

When developing a plan, the most current BAAQMD list of actions should be consulted. Actions currently on the BAAQMD list are shown in Appendix A.

Identification of Preferred Implementation Actions. Beginning with the BAAQMD list, a jurisdiction should have a number of preferred implementation actions available to it. To assist jurisdictions with the selection of preferred actions, a suitability screening table has been prepared (Appendix B).

Format. Deficiency and improvement plan reports should be as easy as possible to prepare and reproduce. TAM staff should be available as a technical resource in the preparation of deficiency plans.

Reports should be submitted on copy-ready single-sided 8 and 1/2 by 11 paper, and contain the following sections:

Introduction and Setting. A short description of the facility, including a map showing its location.

Deficiency Analysis. An explanation of what are the likely causes of the deficiency, and a quantitative assessment of the magnitude of the deficiency.

Screening of Actions. A suitability screening table of possible actions and a sketch-planning level evaluation of most suitable actions.

Evaluation of Suitable Actions. A determination of whether to remedy the deficiency on the specific link, or to measurably improve air quality and the LOS on the CMP network.

Implementation Plan. A description of the proposed implementation actions and their costs, and dates for implementation and completion of deficiency plan actions.

Appendix A: Approved Systemwide Deficiency Plan Actions on Bay Area Air Quality Management District List

Actions adopted November 4, 1992 include:

• Bicycle and Pedestrian Measures
- Improved roadway bicycle facilities and bike paths
- Transit and bicycle integration
- Bicycle lockers and racks at park-and-ride lots
- Bicycle facilities and showers at developments
- Improved pedestrian facilities
- Pedestrian signals Lighting for pedestrian safety

• Transit
- Improvement of bus, rail and ferry transit services
- Expansion of rail transit services
- Expansion of ferry services
- Preferential treatment for buses and in-street light rail vehicles
- Transit information and promotion
- Transit pricing strategies to encourage ridership and, where applicable, reduce transit vehicle crowding
- Transit fare subsidy programs
- Transit centers
- Improved and expanded timed transfer programs
- Improved and expanded fare coordination
- Signal preemption by transit vehicles
- Bus stop bulbs
- School bus transit service

• Carpooling, Buspooling, Vanpooling, Taxipooling, Jitneys, Casual Carpooling and Other Shared Rides (Ridesharing)
- Preferential treatment for shared ride vehicles
- Increased use of commuter/employer services

• High-Occupancy Vehicles (HOV) Facilities
- Preferential treatment for HOVs
- Bus and carpool/buspool/vanpool/taxipooI priority lanes on local arterials Accelerated implementation of the 2005 HOV Master Plan
- HOV to HOV facilities
- Direct HOV lane entrance/exit ramps to arterials and special generators

• Other TCMs, Related Measures

- Stricter travel demand management/trip reduction ordinance
- Expanded public education programs
- Child care facilities at or close to employment sites, transit centers and park-and-ride lots
- Retail services at or close to employment sites, transit centers and park-and-ride lots
- Telecommuting centers and work-at-home programs
- Parking management
- Parking "cash-out" program/travel allowance
- Land use measures

•Traffic Flow Improvements

- Preferential treatment of HOVs
- Ramp metering
- Auxiliary lanes of up to one mile in length where HOV lanes are provided
- Signalization improvements
- Computerized traffic and transit control/management on arterials
- Turn lanes at intersections
- Turn restrictions at intersections
- Reversible lanes
- One-way streets
- Targeted traffic enforcement programs
- Restrictions oil curb side deliveries and on-street parking

Appendix B
Suitability Screening for Available Actions
(Deficiency Plan Actions Approved by BAAQMD)

Available Actions	Consistency with Local General Plan	Effect on Local Economy	Relationship to Causes of Deficiency	Anticipated Effect on Travel Behavior	Anticipated Effect on Existing Residents/ Property Owners	Anticipated Implementation Costs	Overall Suitability
Bicycle and Pedestrian Measures							
- Improved roadway bicycle facilities and bike paths							
- Transit and bicycle integration							
- Bicycle lockers and racks at park-and-ride lots							
- Bicycle facilities and showers at developments							
- Improved pedestrian facilities							
- Pedestrian signals							
- Lighting for pedestrian safety							
Transit							
. Improvement of bus, rail and ferry transit services							
- Expansion of rail transit services							
- Expansion of ferry services							
- Preferential treatment for buses and in-street light rail vehicles							
- Transit information and promotion							
- Transit pricing strategies to encourage ridership and, where applicable, reduce transit vehicle crowding							
- Transit fare subsidy programs							
- Transit centers							
- Improved and expanded timed transfer programs							
- Improved and expanded fare coordination							
- Signal preemption by transit vehicles							
- Bus stop bulbs							
- School bus transit service							

CC113 ranked from I to 4, where I - not suitable and 4 = clearly suitable.

Appendix B (continued)
Suitability Screening for Available Actions
(Deficiency Plan Actions Approved by BAAQMD)

Available Actions	Consistency with Local General Plan	Effect on Local Economy	Relationship to Causes of Deficiency	Anticipated Effect on Travel Behavior	Anticipated Effect on Existing Residents/ Property Owners	Anticipated Implementation Costs	Overall Suitability
Carpooling, Buspooling, Vanpooling, Taxipooling, Jitneys, Casual Carpooling, and Other Shared Rider (Ridesharing)							
- Preferential treatment for shared ride vehicles							
- Increased use of commuter/employer services							
High-Occupancy Vehicles (HOV) Facilities							
- Preferential treatment for HOVs							
- Bus and carpool/buspool/vanpool/taxipool priority lanes on local arterials							
- Accelerated implementation of the 2005 HOV Master Plan							
- HOV to HOV facilities							
- Direct HOV lane entrance/exit ramps to arterials and special generators							
Other TCMs, Related Mama=							
- Stricter travel demand management/trip reduction ordinance							
- Expanded public education programs							
- Child care facilities at or close to employment sites, transit centers and park-and-ride lots							
- Retail services at or close to employment sites, transit centers and park-and-ride lots							
- Telecommuting centers and work-at-home programs							
- Parking management							
- Parking "cash-out" program/travel allowance							
- Land use measures							

1 Cells ranked from I to 4, where I = not suitable and 4 = clearly suitable.

Appendix B (continued)
Suitability Screening for Available Actions1
(Deficiency Plan Actions Approved by BAAQMD)

Available Actions	Consistency with Local General Plan	Effect on Local Economy	Relationship to Causes of Deficiency	Anticipated Effect on Travel Behavior	Anticipated Effect on Existing Residents/ Property Owners	Anticipated Implementation Costs	Overall Suitability
Traffic Flow Improvements							
- Preferential treatment of HOVs							
- Ramp metering							
- Auxiliary lanes of up to one mile in length where HOV lanes arc provided							
- Signalization improvements							
- Computerized traffic and transit control/management on arterials							
- Turn lanes at intersection&							
- Turn restrictions at intersections							
- Reversible lanes							
- One-way streets							
- Targeted traffic enforcement programs							
- Restrictions on curb side deliveries and on-street parking							

Cells ranked from I to 4, where I - not suitable and 4 = clearly suitable.

Appendix C: Glossary

AVR (Average Vehicle Ridership). The number of employees reporting to a worksite during the peak period, divided by the number of vehicles those employees use to arrive at the worksite.

Baseline LOS. The level of service included in the initial CMP.

CIP (Capital Improvement Program). A list of physical improvements to the transportation system (including roads, transit facilities, pedestrian and bicycle facilities).

CMA. Marin County's Congestion Management Agency. The CMA is a countywide organization responsible for preparing and implementing the county's CMP. CMAs came into existence as a result of state legislation and voters' approval of Proposition III in 1990.

CMA Model. The Marin County travel model. It is currently monitored by the Marin County Department of Public Services.

CMP. Marin County's Congestion Management Program. Updated biennially, a CMP sets performance standards for roadways and public transit, and shows how local jurisdictions will attempt to meet those standards through TDM strategies (including a TRO), land use strategies, and a seven-year capital improvements program. A CMP is necessary in order to qualify for certain funds made available through the state gas tax increase authorized in **1990.** CMPs must be consistent with the RTP.

ETC (Employee Transportation Coordinator). A person designated to develop and manage an employer's TDM program.

Funded Transportation Projects. Those projects funded for construction. This includes all projects in the State Transportation Improvement Program (STIP).

HCM. The Transportation Research Board's Special Report Number 209, entitled 1985

Highway Capacity Manual.

HOV Lane (High Occupancy Vehicle Lane). The technical term for a carpool lane, commuter lane or diamond lane.

Internal Trips. Those trips expected to have both their origin and destination within specific development projects. For example, if a project consists of office space and residential space, internal trips shall consist of trips by residents of the development project to offices within the development project. The purpose of estimating internal trips is to prevent double counting of trips in trip generation. In the example above, if one trip was assumed to come from the

housing and one trip was assumed to come to the office, when if fact it was the same trip, the estimated trip generation from the project would be too high.

ITE. Institute of Transportation Engineers

IVHS (Intelligent Vehicle Highway Systems). Refers to a wide range of advanced electronics and communications technology applied to roads and vehicles. Designed to improve safety and productivity, IVHS also can have a positive impact on air quality by cutting congestion.

Lead Agency. The local jurisdiction that has responsibility for certifying a lane use development project's CEQA environmental analysis.

LOS (Level of Service). This is tile measure used by transportation professionals to grade performance of transportation facilities. LOS is graded on a scale of A (the best performance) to F (the worse performance).

Member Agency. A local jurisdiction that is a signatory of CMA's Joint Powers Agreement.

Network. The representation of transportation facilities for use in the model.

Passer-By Trips. Those trips estimated to be generated by a development project that will come from traffic already on the transportation system and will merely stop on its way. Passerby trips are important for shopping and commercial development where it is likely that people on their way home from work will stop without generating a new trip.

Peak Hour. The peak hour of traffic volumes in the area surrounding a development project.

Peak Periods. Between the hours of 6:00 A.M. and 9:00 A.M. and between 3:30 P.M. and 6:30 P.M. on non-holiday weekdays.

PMS (Pavement Management System). A computer-assisted program for diagnosing the need for roadway improvements in a timely, cost-effective manner. The Metropolitan Transportation Commission has developed a standard PMS system.

Responsible Jurisdiction. The local jurisdiction is responsible for preparing a deficiency plan (the city or county in which the deficient facility is located).

TCM (Transportation Control Measures). Strategy to reduce driving or smooth traffic flows in order to cut auto emissions.

TDM (Transportation Demand Management). Methods to reduce the number of automobiles on the transportation system; examples include programs to promote telecommuting, flextime and ridesharing.

TMA (Transportation Management Association). A voluntary group set up by employers to develop strategies for reducing vehicle trips within a certain area.

TOS (Traffic Operations System). In the Bay Area, California Department of Transportation and the CHP will monitor traffic flows by means of detectors embedded in pavement and closed-circuit television cameras, quickly dispatching two trucks and other assistance. Signs and radio messages will alert drivers to trouble ahead, while ramp metering will control traffic flows. By the year 2000, all 500 miles of the Bay Area's freeways should be TOS-equipped.

Transportation Facility. Any part of the designated CMP system, including roadways, intersections, freeways, bicycle facilities, pedestrian facilities and transit facilities.

TRO (Trip Reduction Ordinance). A TRO is an ordinance that requires employers to meet certain trip-reduction goals and objectives. A TRO is required under the CMP and CCAA legislation. The Bay Area Air Quality Management District has prepared a regional TRO for the Bay Area.

TSM (Transportation Systems Management). Low-cost improvements to make the transportation system work more efficiently, such as traffic signal coordination.

VER (Vehicle Employee Ratio). The number of vehicles used by employees who start work at a worksite during the peak period, divided by the number of those employees. VER is the reciprocal of AVR.

Appendix D
Adopted Marin Pedestrian and Bicycle Plans

List of Adopted Marin Pedestrian and Bicycle Master Plans

Corte Madera
Town of Corte Madera Bicycle Transportation Plan, Adopted July 10, 2001

County of Marin
Marin County Unincorporated Area Bicycle and Pedestrian Master Plan, Adopted May 22, 2001

Fairfax
Town of Fairfax Pedestrian and Bicycle Master Plan, Adopted July 3, 2001

Larkspur
Larkspur Bicycle and Pedestrian Master Plan, Adopted September 5, 2001

Mill Valley
Mill Valley Bicycle & Pedestrian Transportation Plan Update, Adopted January 21, 2003

Novato
City of Novato Bicycle Plan, adopted December 12, 1995

San Anselmo
San Anselmo Bicycle Master Plan, Adopted June 2001

San Rafael
City of San Rafael Bicycle/Pedestrian Plan, Adopted February 4, 2002

Sausalito
Sausalito Bicycle Master Plan, Adopted October 1999

Tiburon
Town of Tiburon Bicycle and Pedestrian Master Plan, Adopted July 18, 2001

Appendix E
MTC CHECKLIST FOR 2005 CMP

Date June 1, 2005

TO: Transportation Authority of Marin (TAM)

FROM: Tho X. Do, Associate Engineer

Ref: **1. MTC Checklist for Modeling Consistency for 2005 CMP**
2. 2005 Congestion Management Program for TAM

A. General Approach to Travel Demand Modeling by the TAM

The Transportation of Marin (TAM) has operated and updated its own countywide travel demand model based on the information and logic from the MTC model. For the Congestion Management Program, the Marin Travel Model (MTM) contains 117 traffic analysis zones (TAZs) within the county, 83 TAZs for San Francisco, 69 TAZs for Sonoma, and 24 TAZs corresponding with the MTC super-district level for other Bay area counties. This model is prepared using EMME/2 for the P.M. peak hour, A.M. peak hour, ADT and currently stored and updated at the County Public Works Department.

This model is a "focused" model, meaning that the network contains different structures inside and outside of the focus area. The inside or focused counties for the MTM are San Francisco, Marin and Sonoma Counties. Other Bay area counties are outside of the focused area. The primary difference is that the more detailed MTC network structure is included in focused areas, while a skeleton roadway network is structured outside of the focused areas. Because the network outside of the focused areas is reduced, the speeds on the skeleton roadway network are fixed (not variable depending on capacity) and are not expected to represent actual traffic volumes on those roadway links.

To ensure regional consistency, the MTM utilizes a technique referred to as "balancing". The balancing is done to guarantee that the trip end estimates and forecasts are roughly equal between the MTC and Marin Model, and guarantees that the trip flows between counties are also equal between the two models.

The MTM mode choice procedure occurs after the person-trip generation and trip distribution steps. It includes a detailed mode choice analysis that divides trips into transit-person trips, 2 person vehicle-person trips, 3+ person vehicle-person trips, or drive alone vehicle-person trips for home-based-work trips. Simpler formulas for vehicle-person trips are used for all other trip purposes, which are home-based shop/other trips, home-based social-recreational trips, home-based school trips, and non-home-based trips based on San Francisco Bay Area Travel Survey 2000 - Regional Travel Characteristics Report (August 2004).

B. Demographic/Economic/Land Use Forecasts

MTM is based on ABAG P*rojections* 2003 land use data. The MTM structure requires that land uses be allocated at a finer detail for Marin, Sonoma and San Francisco County than ABAG *Projections* 2003 provides. In the disaggregating process, Marin County has recognized some inconsistencies in Marin land uses by census tract and has made corresponding adjustments. Still, the overall land use attributes for Marin County as a whole are consistent with ABAG. Land use data outside of Marin was obtained from ABAG *Projections* '03. The land use comparisons are shown in Tables B-1 to B-3.

Future year allocations by census tract provided by ABAG have been similarly refined. For this reason, individual census tracts do not contain land use attributes identical to ABAG *Projections 2003*, but the overall county total for 2015 and 2030 are consistent with ABAG.

C. Pricing Assumptions

The MTM has made adjustments for these regional pricing assumptions:

- **Bridge Tolls**. The model assumes the current $5.00 Golden Gate Bridge and $3.00 Richmond-San Rafael Bridge tolls, adjusted to 1980 dollars.

- **Auto Parking Costs.** Auto parking costs have been kept at the 1980 fixed costs obtained from the *101 Corridor Study*. The Corridor Study set parking costs for San Francisco ranging from 50 cent per day to $2.60 per day in 1979 dollars. No other auto parking costs were assumed in the focused area.

- **Auto Operating Costs.** An auto operating cost of 13.12 cents per mile in 1980 dollars is assumed to confirm with the MTC model.

- **Transit Fare**: Deflated transit fare from $1987 to at $1980.

D. Network Assumptions

The MTM was originally developed in 1987 and is revalidated for 2000. The MTM uses the MTC model structure facility types and numbers of lanes for Marin County. Some additional detail in the roadway network has been added where appropriate within Marin County.

The MTM includes representations of these major roadway gateways in Marin County:

- Highway 101 - (Golden Gate Bridge) San Francisco
- Interstate 580 - (Richmond/San Rafael Bridge) Contra Costa County
- Highway 37 - Sonoma County
- Highway 101 - Sonoma County
- Highway 1 - Sonoma County

In addition, the ferry connections from Larkspur, Tiburon, and Sausalito to San Francisco are also provided as gateways.

Because of this model is a focused model, the East Bay and South Bay highway network are much less detailed than in the MTC model. A skeleton network in these locations significantly reduces run time for the model, as well as enables the model to be of a size small enough to be operated on Marin County computers. The impact of this network reduction is considered negligible to congestion in Marin County.

E. Auto Ownership Assumptions

The Marin Travel Model utilizes MTC and ABAG's Projection 2003 information on auto ownership for mode split.

F. Trip Generation

The Marin Travel Model uses Household size and income quartile cross class and has been revised using adjustment factors designed to replicate actual MTC trip generation patterns between counties into the model. In this way, aggregate trip generation by county is also consistent with the MTC model. Trip Generation comparisons are shown in Tables F-1-1 through F-5-2.

G. Trip Distribution

The Marin Travel Model uses the MTC trip distribution patterns between counties into the model. In this way, aggregate trip distribution by county is completely consistent with the MTC model.

By utilizing this technique, Marin County has achieved a closer trip distribution match with the MTC model than is normally expected with this focused model structure. Tables G-1-1 through G-5-2 describe the trip distribution comparisons for daily person trips.

H. Mode Choice

The Marin Travel Model mode choice analysis is consistent with MTC methodology, the Home Based Work Mode Choice Model "TOT_TW". It contains a multinomial logit model structure for work trips, using drive alone, 2 person, 3+ person and transit (transit person trips are included walk and bike trips). Non-work trips are assigned to auto and transit with auto occupancies inputted at this stage.

I. Traffic Assignment

The Marin Travel Model provides A.M. peak, P.M. peak, non-peak, ADT, traffic and transit assignments similar to the MTC methodology, with the same A.M. and P.M. peak hour factors assumptions (Table I).

Transportation Authority of Marin (TAM)
Marin Travel Model (MTM)
Land Use Input for the Bay Area Counties

Table B-1

	San Francisco			Marin			Sonoma		
	ABAG P-03	MTM (1)	% Diff.	ABAG P-03	MTM (2)	% Diff.	ABAG P-03	MTM (1)	% Diff.
Households									
2000	329,699	329,699	0.0%	100,653	99,654	1.0%	172,406	172,406	0.0%
2015	352,797	352,797	0.0%	109,783	108,682	1.0%	202,358	202,358	0.0%
2030	402,597	402,597	0.0%	115,379	114,226	1.0%	213,158	213,158	0.0%
% Increase									
2000-2015	7.01%	7.01%		9.07%	9.06%		17.37%	17.37%	
2015-2030	14.12%	14.12%		5.10%	5.10%		5.34%	5.34%	
Population									
2000	776,734	776,734	0.0%	247,290	244,819	1.0%	458,616	458,616	0.0%
2015	827,178	827,178	0.0%	271,166	268,457	1.0%	539,511	539,511	0.0%
2030	935,068	935,068	0.0%	283,090	280,260	1.0%	565,707	565,707	0.0%
% Increase									
2000-2015	6.49%	6.49%		9.66%	9.66%		17.64%	17.64%	
2015-2030	13.04%	13.04%		4.40%	4.40%		4.86%	4.86%	
Jobs									
2000	634,449	634,449	0.0%	122,970	121,748	1.0%	205,223	205,223	0.0%
2015	728,236	728,236	0.0%	144,584	143,139	1.0%	263,717	263,717	0.0%
2030	818,684	818,684	0.0%	163,966	162,324	1.0%	321,016	321,016	0.0%
% Increase									
2000-2015	14.78%	14.78%		17.58%	17.57%		28.50%	28.50%	
2015-2030	12.42%	12.42%		13.41%	13.40%		21.73%	21.73%	
Emp Resid									
2000	444,851	444,851	0.0%	140,955	142,367	-1.0%	229,308	229,308	0.0%
2015	479,794	479,794	0.0%	158,698	160,285	-1.0%	289,402	289,402	0.0%
2030	547,502	547,502	0.0%	166,100	167,762	-1.0%	309,096	309,096	0.0%
% Increase									
2000-2015	7.85%	7.85%		12.59%	12.59%		26.21%	26.21%	
2015-2030	14.11%	14.11%		4.66%	4.66%		6.81%	6.81%	

Notes: (1) All data based on MTC/ABAG Projections 2003 series
(2) Marin Travel Model (MTM)

Transportation Authority of Marin (TAM)
Marin Travel Model (MTM)
Land Use Input for the Bay Area Counties

Table B-2

	San Mateo			Santa Clara			Alameda		
	ABAG P-03	MTM (1)	% Diff.	ABAG P-03	MTM (2)	% Diff.	ABAG P-03	MTM (1)	% Diff.
Households									
2000	254,110	254,110	0.0%	565,878	565,878	0.0%	523,375	523,375	0.0%
2015	277,992	277,992	0.0%	662,088	662,088	0.0%	587,693	587,693	0.0%
2030	301,016	301,016	0.0%	768,065	768,065	0.0%	675,933	675,933	0.0%
% Increase									
2000-2015	9.40%	9.40%		17.00%	17.00%		12.29%	12.29%	
2015-2030	8.28%	8.28%		16.01%	16.01%		15.01%	15.01%	
Population									
2000	707,165	707,165	0.0%	1,682,588	1,682,588	0.0%	1,443,745	1,443,745	0.0%
2015	785,212	785,212	0.0%	1,977,692	1,977,692	0.0%	1,652,676	1,652,676	0.0%
2030	845,945	845,945	0.0%	2,274,167	2,274,167	0.0%	1,888,275	1,888,275	0.0%
% Increase									
2000-2015	11.04%	11.04%		17.54%	17.54%		14.47%	14.47%	
2015-2030	7.73%	7.73%		14.99%	14.99%		14.26%	14.26%	
Jobs									
2000	395,914	395,914	0.0%	1,092,372	1,092,372	0.0%	751,688	751,688	0.0%
2015	461,675	461,675	0.0%	1,299,217	1,299,217	0.0%	921,377	921,377	0.0%
2030	526,569	526,569	0.0%	1,481,683	1,481,683	0.0%	1,087,379	1,087,379	0.0%
% Increase									
2000-2015	16.61%	16.61%		18.94%	18.94%		22.57%		
2015-2030	14.06%	14.06%		14.04%	14.04%		18.02%		
Emp Resid									
2000	403,086	403,086	0.0%	959,074	959,074	0.0%	697,885	697,885	0.0%
2015	450,299	450,299	0.0%	1,125,595	1,125,595	0.0%	846,406	846,406	0.0%
2030	490,702	490,702	0.0%	1,313,394	1,313,394	0.0%	1,063,204	1,063,204	0.0%
% Increase									
2000-2015	11.71%	11.71%		17.36%	17.36%		21.28%	21.28%	
2015-2030	8.97%	8.97%		16.68%	16.68%		25.61%	25.61%	

Notes: (1) All data based on MTC/ABAG Projections 2003 series
(2) Marin Travel Model (MTM)

Transportation Authority of Marin (TAM)
Marin Travel Model (MTM)
Land Use Input for the Bay Area Counties

Table B-3

	Contra Costa			Solano			Napa		
	ABAG P-03	MTM (1)	% Diff.	ABAG P-03	MTM (2)	% Diff.	ABAG P-03	MTM (1)	% Diff.
Households									
2000	344,142	344,142	0.0%	130,404	130,404	0.0%	45,402	45,402	0.0%
2015	408,554	408,554	0.0%	169,232	169,232	0.0%	53,562	53,562	0.0%
2030	459,900	459,900	0.0%	193,371	193,371	0.0%	57,232	57,232	0.0%
% Increase									
2000-2015	18.72%	18.72%		29.78%	29.78%		17.97%	17.97%	
2015-2030	12.57%	12.57%		14.26%	14.26%		6.85%	6.85%	
Population									
2000	948,818	948,818	0.0%	394,542	394,542	0.0%	124,279	124,279	0.0%
2015	1,129,303	1,129,303	0.0%	512,086	512,086	0.0%	145,400	145,400	0.0%
2030	1,257,290	1,257,290	0.0%	577,288	577,288	0.0%	153,503	153,503	0.0%
% Increase									
2000-2015	19.02%	19.02%		29.79%	29.79%		16.99%	16.99%	
2015-2030	11.33%	11.33%		12.73%	12.73%		5.57%	5.57%	
Jobs									
2000	361,133	361,133	0.0%	123,215	123,215	0.0%	66,834	66,834	0.0%
2015	448,165	448,165	0.0%	160,640	160,640	0.0%	82,323	82,323	0.0%
2030	536,440	536,440	0.0%	204,676	204,676	0.0%	88,998	88,998	0.0%
% Increase									
2000-2015	24.10%	24.10%		30.37%	30.37%		23.18%	23.18%	
2015-2030	19.70%	19.70%		27.41%	27.41%		8.11%	8.11%	
Emp Resid									
2000	483,901	483,901	0.0%	179,517	179,517	0.0%	67,111	67,111	0.0%
2015	613,256	613,256	0.0%	253,801	253,801	0.0%	77,697	77,697	0.0%
2030	704,748	704,748	0.0%	305,500	305,500	0.0%	82,997	82,997	0.0%
% Increase									
2000-2015	26.73%	26.73%		41.38%	41.38%		15.77%	15.77%	
2015-2030	14.92%	14.92%		20.37%	20.37%		6.82%	6.82%	

Notes: (1) All data based on MTC/ABAG Projections 2003 series
(2) Marin Travel Model (MTM)

Transportation Authority of Marin (TAM)

Marin Travel Model (MTM)-Trip Generation Comparison-ABAG's Proj. 2003

Table F-1-1 Trip Production Home-Based Work Person Trips (HBW)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	660,683	660,692	-9	0.0%	695,518	691,932	3,586	0.5%	822,935	822,925	10	0.0%
San Mateo	595,081	595,068	13	0.0%	615,914	616,319	-405	-0.1%	718,677	718,677	0	0.0%
Santa Clara	1,325,355	1,325,336	19	0.0%	1,584,098	1,585,156	-1,058	-0.1%	1,946,560	1,946,549	11	0.0%
Alameda	1,070,256	1,070,270	-14	0.0%	1,305,708	1,306,556	-848	-0.1%	1,685,883	1,685,914	-31	0.0%
Contra Costa	700,745	700,755	-10	0.0%	907,097	907,666	-569	-0.1%	1,082,426	1,082,452	-26	0.0%
Solano	263,357	263,360	-3	0.0%	377,368	377,613	-245	-0.1%	460,181	460,191	-10	0.0%
Napa	88,877	88,875	2	0.0%	104,263	104,325	-62	-0.1%	115,315	115,314	1	0.0%
Sonoma	347,075	347,079	-4	0.0%	442,312	442,614	-302	-0.1%	480,564	480,550	14	0.0%
Marin	196,852	196,844	8	0.0%	219,721	219,865	-144	-0.1%	243,003	242,994	9	0.0%
TOTAL	5,248,281	5,248,279	2	0.0%	6,251,999	6,252,046	-47	0.0%	7,555,544	7,555,566	-22	0.0%

Table F-1-2 Trip Attraction Home-Based Work Person Trips (HBW)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	971,054	971,021	33	0.0%	1,123,414	1,123,374	40	0.0%	1,324,117	1,324,099	18	0.0%
San Mateo	545,626	545,609	17	0.0%	640,300	640,298	2	0.0%	771,580	771,582	-2	0.0%
Santa Clara	1,467,353	1,467,383	-30	0.0%	1,784,548	1,784,604	-56	0.0%	2,163,985	2,163,999	-14	0.0%
Alameda	1,018,281	1,018,313	-32	0.0%	1,207,423	1,207,464	-41	0.0%	1,472,421	1,472,419	2	0.0%
Contra Costa	508,358	508,367	-9	0.0%	618,650	618,648	2	0.0%	764,948	764,964	-16	0.0%
Solano	171,288	171,293	-5	0.0%	211,552	211,547	5	0.0%	268,139	268,146	-7	0.0%
Napa	91,961	91,957	4	0.0%	106,660	106,658	2	0.0%	116,039	116,035	4	0.0%
Sonoma	295,892	295,889	3	0.0%	356,018	356,016	2	0.0%	432,080	432,090	-10	0.0%
Marin	178,467	178,469	-2	0.0%	203,434	203,428	6	0.0%	242,236	242,232	4	0.0%
TOTAL	5,248,280	5,248,301	-21	0.0%	6,251,999	6,252,037	-38	0.0%	7,555,545	7,555,566	-21	0.0%

Notes:
(1) MTC County-County Person Trip Forecasts HBW Trips, 1990-2030 Data Summary, Table 8 - Jnuary 2005
(2) Marin Travel Model (MTM) Forecasts for Years 2000, 2015 & 2030 - Based on ABAG' Projections 2003

Transportation Authority of Marin (TAM)

Marin Travel Model (MTM)-Trip Generation Comparison-ABAG's Proj. 2003

Table F-2-1 Trip Production Home-Based Shop/Other Person Trips (HBSH)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	524,742.	524,735	7	0.0%	587,354	587,352	2	0.0%	666,997	667,009	-12	0.0%
San Mateo	588,603.	588,595	8	0.0%	720,830	720,833	-3	0.0%	768,426	768,433	-7	0.0%
Santa Clara	1,465,349.	1,465,341	8	0.0%	1,786,036	1,786,049	-13	0.0%	2,057,721	2,057,722	-1	0.0%
Alameda	1,025,245.	1,025,240	5	0.0%	1,209,401	1,209,413	-12	0.0%	1,405,785	1,405,806	-21	0.0%
Contra Costa	711,980.	711,996	-16	0.0%	877,336	877,329	7	0.0%	994,940	994,947	-7	0.0%
Solano	277,663.	277,669	-6	0.0%	375,269	375,272	-3	0.0%	432,136	432,145	-9	0.0%
Napa	92,564.	92,566	-2	0.0%	114,326	114,328	-2	0.0%	122,272	122,270	2	0.0%
Sonoma	336,406.	336,415	-9	0.0%	415,960	415,979	-19	0.0%	450,317	450,299	18	0.0%
Marin	178,535.	178,531	4	0.0%	207,527	207,539	-12	0.0%	225,518	225,531	-13	0.0%
TOTAL	5,201,087.	5,201,088	-1	0.0%	6,294,039	6,294,094	-55	0.0%	7,124,112	7,124,162	-50	0.0%

Table F-2-2 Trip Attraction Home-Based Shop/Other Person Trips (HBSH)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	591,782.	591,484	298	0.1%	696,240	704,469	-8,229	-1.2%	769,017	766,731	2,286	0.3%
San Mateo	575,781.	575,758	23	0.0%	695,279	693,154	2,125	0.3%	767,370	769,331	-1,961	-0.3%
Santa Clara	1,446,596.	1,446,543	53	0.0%	1,719,788	1,714,615	5,173	0.3%	1,967,318	1,972,345	-5,027	-0.3%
Alameda	1,009,643.	1,009,607	36	0.0%	1,197,931	1,194,309	3,622	0.3%	1,383,455	1,386,998	-3,543	-0.3%
Contra Costa	701,633.	701,614	19	0.0%	883,483	880,809	2,674	0.3%	1,007,477	1,010,030	-2,553	-0.3%
Solano	274,834.	274,822	12	0.0%	377,607	376,465	1,142	0.3%	439,586	440,708	-1,122	-0.3%
Napa	93,559.	93,556	3	0.0%	112,784	112,443	341	0.3%	115,215	115,511	-296	-0.3%
Sonoma	332,056.	331,839	217	0.1%	412,812	417,053	-4,241	-1.0%	463,705	453,238	10,467	2.3%
Marin	175,203.	175,868	-665	-0.4%	198,116	200,759	-2,643	-1.3%	210,970	209,271	1,699	0.8%
TOTAL	5,201,087	5,201,091	-4	0.0%	6,294,040	6,294,076	-36	0.0%	7,124,113	7,124,163	-50	0.0%

Notes:
(1) MTC County-County Person Trip Forecasts HBW Trips, 1990-2030 Data Summary, Table 8 - Jnuary 2005
(2) Marin Travel Model (MTM) Forecasts for Years 2000, 2015 & 2030 - Based on ABAG' Projections 2003

Transportation Authority of Marin (TAM)

Marin Travel Model (MTM)-Trip Generation Comparison-ABAG's Proj. 2003

Table F-3-1 Trip Production Home-Based Social/Recreation Person Trips (HBSR)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francis	244,086	244,077	9	0.0%	272,505	272,497	8	0.0%	317,260	317,279	-19	0.0%
San Mateo	326,829	326,836	-7	0.0%	386,433	386,436	-3	0.0%	426,082	426,088	-6	0.0%
Santa Clara	730,992	731,002	-10	0.0%	891,457	891,436	21	0.0%	1,051,089	1,051,098	-9	0.0%
Alameda	421,910	421,893	17	0.0%	490,647	490,664	-17	0.0%	570,538	570,555	-17	0.0%
Contra Cost	331,182	331,168	14	0.0%	403,657	403,651	6	0.0%	463,962	463,948	14	0.0%
Solano	122,892	122,893	-1	0.0%	164,440	164,443	-3	0.0%	190,018	190,026	-8	0.0%
Napa	41,733	41,733	0	0.0%	52,429	52,426	3	0.0%	57,749	57,747	2	0.0%
Sonoma	156,710	156,704	6	0.0%	194,105	194,101	4	0.0%	210,804	210,800	4	0.0%
Marin	92,855	92,856	-1	0.0%	104,944	104,938	6	0.0%	115,197	115,198	-1	0.0%
TOTAL	2,469,189	2,469,162	27	0.0%	2,960,617	2,960,592	25	0.0%	3,402,699	3,402,739	-40	0.0%

Table F-3-2 Trip Attraction Home-Based Social/Recreation Person Trips (HBSR)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francis	258,759	258,757	2	0.0%	296,632	296,641	-9	0.0%	338,605	338,596	9	0.0%
San Mateo	323,829	323,820	9	0.0%	377,445	377,436	9	0.0%	422,497	422,490	7	0.0%
Santa Clara	729,104	729,067	37	0.0%	868,601	868,577	24	0.0%	1,008,086	1,008,108	-22	0.0%
Alameda	415,869	415,889	-20	0.0%	492,947	492,935	12	0.0%	576,855	576,854	1	0.0%
Contra Cost	330,141	330,153	-12	0.0%	411,511	411,516	-5	0.0%	476,969	476,984	-15	0.0%
Solano	121,634	121,637	-3	0.0%	163,438	163,440	-2	0.0%	195,022	195,027	-5	0.0%
Napa	41,503	41,500	3	0.0%	51,389	51,387	2	0.0%	54,773	54,772	1	0.0%
Sonoma	155,048	155,042	6	0.0%	192,456	192,468	-12	0.0%	215,107	215,117	-10	0.0%
Marin	93,302	93,305	-3	0.0%	106,198	106,196	2	0.0%	114,785	114,791	-6	0.0%
TOTAL	2,469,189	2,469,170	19	0.0%	2,960,617	2,960,596	21	0.0%	3,402,699	3,402,739	-40	0.0%

Notes:
(1) MTC County-County Person Trip Forecasts HBW Trips, 1990-2030 Data Summary, Table 8 - Jnuary 2005
(2) Marin Travel Model (MTM) Forecasts for Years 2000, 2015 & 2030 - Based on ABAG' Projections 2003

Transportation Authority of Marin (TAM)

Marin Travel Model (MTM)-Trip Generation Comparison-ABAG's Proj. 2003

Table F-4-1 Trip Production Home-Based School Person Trips (HBSch)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisc	201,937	201,936	1	0.0%	293,777	293,778	-1	0.0%	244,446	244,446	0	0.0%
San Mateo	227,249	227,251	-2	0.0%	232,754	232,762	-8	0.0%	222,519	222,512	7	0.0%
Santa Clara	592,561	592,588	-27	0.0%	678,847	678,839	8	0.0%	681,819	681,811	8	0.0%
Alameda	513,343	513,327	16	0.0%	534,247	534,272	-25	0.0%	560,770	560,753	17	0.0%
Contra Costa	340,518	340,528	-10	0.0%	335,110	335,097	13	0.0%	351,347	351,363	-16	0.0%
Solano	150,337	150,330	7	0.0%	165,538	165,543	-5	0.0%	176,664	176,664	0	0.0%
Napa	41,441	41,438	3	0.0%	40,481	40,483	-2	0.0%	42,032	42,031	1	0.0%
Sonoma	158,454	158,450	4	0.0%	151,904	151,897	7	0.0%	148,984	148,989	-5	0.0%
Marin	68,758	68,761	-3	0.0%	69,518	69,505	13	0.0%	62,793	62,798	-5	0.0%
TOTAL	2,294,598.	2,294,609	-11	0.0%	2,502,176	2,502,176	0	0.0%	2,491,374	2,491,367	7	0.0%

Table F-4-2 Trip Attraction Home-Based School Person Trips (HBSch)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisc	219,383	219,420	-37	0.0%	310,119	310,094	25	0.0%	261,521	261,515	6	0.0%
San Mateo	210,657	210,687	-30	0.0%	217,519	217,514	5	0.0%	206,946	206,933	13	0.0%
Santa Clara	607,441	607,558	-117	0.0%	693,788	693,781	7	0.0%	697,019	697,004	15	0.0%
Alameda	516,928	517,015	-87	0.0%	537,977	538,023	-46	0.0%	564,609	564,643	-34	0.0%
Contra Costa	325,348	325,412	-64	0.0%	320,146	320,147	-1	0.0%	335,287	335,290	-3	0.0%
Solano	143,648	143,292	356	0.2%	157,891	157,894	-3	0.0%	169,658	169,658	0	0.0%
Napa	41,567	41,576	-9	0.0%	40,633	40,637	-4	0.0%	42,171	42,173	-2	0.0%
Sonoma	162,403	162,412	-9	0.0%	156,034	156,025	9	0.0%	152,840	152,826	14	0.0%
Marin	67,223	67,236	-13	0.0%	68,070	68,059	11	0.0%	61,324	61,327	-3	0.0%
TOTAL	2,294,598	2,294,608	-10	0.0%	2,502,177	2,502,174	3	0.0%	2,491,375	2,491,369	6	0.0%

Notes:
(1) MTC County-County Person Trip Forecasts HBW Trips, 1990-2030 Data Summary, Table 8 - Jnuary 2005
(2) Marin Travel Model (MTM) Forecasts for Years 2000, 2015 & 2030 - Based on ABAG' Projections 2003

Transportation Authority of Marin (TAM)

Marin Travel Model (MTM)-Trip Generation Comparison-ABAG's Proj. 2003

Table F-5-1 Trip Production Non Home-Based Person Trips (NHB)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	920,563.	920,584	-21	0.0%	1,054,299	1,054,307	-8	0.0%	1,185,720	1,185,700	20	0.0%
San Mateo	699,051.	699,056	-5	0.0%	808,314	808,318	-4	0.0%	914,803	914,817	-14	0.0%
Santa Clara	1,602,743.	1,602,737	6	0.0%	1,870,147	1,870,134	13	0.0%	2,147,334	2,147,356	-22	0.0%
Alameda	1,103,449.	1,103,432	17	0.0%	1,308,358	1,308,380	-22	0.0%	1,536,327	1,536,328	-1	0.0%
Contra Costa	637,221.	637,214	7	0.0%	781,916	781,931	-15	0.0%	919,749	919,754	-5	0.0%
Solano	231,686.	231,688	-2	0.0%	301,822	301,825	-3	0.0%	369,573	369,571	2	0.0%
Napa	97,313.	97,314	-1	0.0%	118,692	118,693	-1	0.0%	125,585	125,584	1	0.0%
Sonoma	312,211.	312,226	-15	0.0%	387,394	387,397	-3	0.0%	451,233	451,240	-7	0.0%
Marin	216,423.	216,426	-3	0.0%	244,756	244,754	2	0.0%	268,797	268,793	4	0.0%
TOTAL	5,820,660.	5,820,677	-17	0.0%	6,875,698.	6,875,739.	-41	0.0%	7,919,121	7,919,143	-22	0.0%

Table F-5-2 Trip Attraction Non Home-Based Person Trips (NHB)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	919,901.	919,882	19	0.0%	1,056,747	1,056,770	-23	0.0%	1,191,218	1,191,239	-21	0.0%
San Mateo	700,635.	700,625	10	0.0%	812,117	812,140	-23	0.0%	918,760	918,764	-4	0.0%
Santa Clara	1,604,739.	1,604,770	-31	0.0%	1,873,524	1,873,531	-7	0.0%	2,157,597	2,157,625	-28	0.0%
Alameda	1,104,127.	1,104,148	-21	0.0%	1,304,107	1,304,096	11	0.0%	1,530,495	1,530,476	19	0.0%
Contra Costa	634,667.	634,679	-12	0.0%	778,264	778,276	-12	0.0%	913,300	913,313	-13	0.0%
Solano	231,931.	231,927	4	0.0%	302,871	302,866	5	0.0%	369,273	369,271	2	0.0%
Napa	97,466.	97,464	2	0.0%	118,865	118,866	-1	0.0%	125,792	125,793	-1	0.0%
Sonoma	312,504.	312,504	0	0.0%	386,849	386,831	18	0.0%	447,339	447,331	8	0.0%
Marin	214,690.	214,679	11	0.0%	242,355	242,359	-4	0.0%	265,347	265,342	5	0.0%
TOTAL	5,820,660	5,820,678	-18	0.0%	6,875,699	6,875,735	-36	0.0%	7,919,121	7,919,154	-33	0.0%

Notes:
(1) MTC County-County Person Trip Forecasts HBW Trips, 1990-2030 Data Summary, Table 8 - Jnuary 2005
(2) Marin Travel Model (MTM) Forecasts for Years 2000, 2015 & 2030 - Based on ABAG' Projections 2003

Transportation Authority of Marin (TAM)

Marin Travel Model (MTM)-Trip Distribution Comparison-ABAG's Proj. 2003

Table G-1-1 Trip Production Home-Based Work Person Trips (HBW)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	660,683	660,577	106	0.0%	695,518	692,174	3,344	0.5%	822,935	822,774	161	0.0%
San Mateo	595,081	595,090	-9	0.0%	615,914	617,278	-1,364	-0.2%	718,677	719,721	-1,044	-0.1%
Santa Clara	1,325,355	1,325,386	-31	0.0%	1,584,098	1,587,623	-3,525	-0.2%	1,946,560	1,949,376	-2,816	-0.1%
Alameda	1,070,256	1,070,310	-54	0.0%	1,305,708	1,308,590	-2,882	-0.2%	1,685,883	1,688,363	-2,480	-0.1%
Contra Costa	700,745	700,781	-36	0.0%	907,097	909,079	-1,982	-0.2%	1,082,426	1,084,024	-1,598	-0.1%
Solano	263,357	263,370	-13	0.0%	377,368	378,201	-833	-0.2%	460,181	460,859	-678	-0.1%
Napa	88,877	88,878	-1	0.0%	104,263	104,487	-224	-0.2%	115,315	115,481	-166	-0.1%
Sonoma	347,075	347,092	-17	0.0%	442,312	440,600	1,712	0.4%	480,564	478,451	2,113	0.4%
Marin	196,852	196,851	1	0.0%	219,721	213,853	5,868	2.7%	243,003	236,279	6,724	2.8%
TOTAL	5,248,281	5,248,335	-54	0.0%	6,251,999	6,251,885	114	0.0%	7,555,544	7,555,328	216	0.0%

Table G-1-2 Trip Attraction Home-Based Work Person Trips (HBW)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	971,054	972,378	-1,324	-0.1%	1,123,414	1,125,622	-2,208	-0.2%	1,324,117	1,327,012	-2,895	-0.2%
San Mateo	545,626	546,372	-746	-0.1%	640,300	641,579	-1,279	-0.2%	771,580	773,280	-1,700	-0.2%
Santa Clara	1,467,353	1,469,434	-2,081	-0.1%	1,784,548	1,788,174	-3,626	-0.2%	2,163,985	2,168,760	-4,775	-0.2%
Alameda	1,018,281	1,019,736	-1,455	-0.1%	1,207,423	1,209,880	-2,457	-0.2%	1,472,421	1,475,658	-3,237	-0.2%
Contra Costa	508,358	509,078	-720	-0.1%	618,650	619,886	-1,236	-0.2%	764,948	766,647	-1,699	-0.2%
Solano	171,288	171,532	-244	-0.1%	211,552	211,970	-418	-0.2%	268,139	268,736	-597	-0.2%
Napa	91,961	92,086	-125	-0.1%	106,660	106,871	-211	-0.2%	116,039	116,290	-251	-0.2%
Sonoma	295,892	289,000	6,892	2.4%	356,018	348,567	7,451	2.1%	432,080	421,536	10,544	2.5%
Marin	178,467	178,718	-251	-0.1%	203,434	199,336	4,098	2.1%	242,236	237,408	4,828	2.0%
TOTAL	5,248,280	5,248,334	-54	0.0%	6,251,999	6,251,885	114	0.0%	7,555,545	7,555,327	218	0.0%

Notes:

(1) MTC County-County Person Trip Forecasts HBW Trips, 1990-2030 Data Summary, Table 8 - Jnuary 2005

(2) Marin Travel Model (MTM) Forecasts for Years 2000, 2015 & 2030 - Based on ABAG' Projections 2003

Transportation Authority of Marin (TAM)

Marin Travel Model (MTM)-Trip Distribution Comparison-ABAG's Proj. 2003

Table G-2-1 Trip Production Home-Based Shop/Other Person Trips (HBSH)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	524,742.	524,341	401	0.1%	587,354	585,824	1,530	0.3%	666,997	665,244	1,753	0.3%
San Mateo	588,603.	588,217	386	0.1%	720,830	719,526	1,304	0.2%	768,426	767,233	1,193	0.2%
Santa Clara	1,465,349.	1,464,269	1,080	0.1%	1,786,036	1,782,442	3,594	0.2%	2,057,721	2,053,871	3,850	0.2%
Alameda	1,025,245.	1,025,053	192	0.0%	1,209,401	1,208,766	635	0.1%	1,405,785	1,405,218	567	0.0%
Contra Costa	711,980.	712,361	-381	-0.1%	877,336	878,567	-1,231	-0.1%	994,940	996,622	-1,682	-0.2%
Solano	277,663.	278,046	-383	-0.1%	375,269	376,509	-1,240	-0.3%	432,136	433,649	-1,513	-0.3%
Napa	92,564.	92,780	-216	-0.2%	114,326	114,979	-653	-0.6%	122,272	122,874	-602	-0.5%
Sonoma	336,406.	337,438	-1,032	-0.3%	415,960	419,355	-3,395	-0.8%	450,317	453,539	-3,222	-0.7%
Marin	178,535.	178,559	-24	0.0%	207,527	207,785	-258	-0.1%	225,518	225,833	-315	-0.1%
TOTAL	5,201,087.	5,201,064	23	0.0%	6,294,039	6,293,753	286	0.0%	7,124,112	7,124,083	29	0.0%

Table G-2-2 Trip Attraction Home-Based Shop/Other Person Trips (HBSH)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	591,782.	542,523	49,259	9.1%	696,240	607,311	88,929	14.6%	769,017	640,957	128,060	20.0%
San Mateo	575,781.	582,915	-7,134	-1.2%	695,279	706,325	-11,046	-1.6%	767,370	785,718	-18,348	-2.3%
Santa Clara	1,446,596.	1,464,523	-17,927	-1.2%	1,719,788	1,747,195	-27,407	-1.6%	1,967,318	2,014,356	-47,038	-2.3%
Alameda	1,009,643.	1,022,156	-12,513	-1.2%	1,197,931	1,217,003	-19,072	-1.6%	1,383,455	1,416,541	-33,086	-2.3%
Contra Costa	701,633.	710,335	-8,702	-1.2%	883,483	897,546	-14,063	-1.6%	1,007,477	1,031,544	-24,067	-2.3%
Solano	274,834.	278,238	-3,404	-1.2%	377,607	383,618	-6,011	-1.6%	439,586	450,095	-10,509	-2.3%
Napa	93,559.	94,719	-1,160	-1.2%	112,784	114,580	-1,796	-1.6%	115,215	117,971	-2,756	-2.3%
Sonoma	332,056.	335,964	-3,908	-1.2%	412,812	424,574	-11,762	-2.8%	463,705	462,260	1,445	0.3%
Marin	175,203.	169,692	5,511	3.2%	198,116	195,601	2,515	1.3%	210,970	204,641	6,329	3.1%
TOTAL	5,201,087	5,201,065	22	0.0%	6,294,040	6,293,753	287	0.0%	7,124,113	7,124,083	30	0.0%

Notes:

(1) MTC County-County Person Trip Forecasts HBW Trips, 1990-2030 Data Summary, Table 8 - Jnuary 2005

(2) Marin Travel Model (MTM) Forecasts for Years 2000, 2015 & 2030 - Based on ABAG' Projections 2003

Transportation Authority of Marin (TAM)

Marin Travel Model (MTM)-Trip Distribution Comparison-ABAG's Proj. 2003

Table G-3-1 Trip Production Home-Based Social/Recreation Person Trips (HBSR)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	244,086	244,042	44	0.0%	272,505	272,237	268	0.1%	317,260	316,817	443	0.1%
San Mateo	326,829	326,851	-22	0.0%	386,433	386,474	-41	0.0%	426,082	426,066	16	0.0%
Santa Clara	730,992	731,030	-38	0.0%	891,457	891,507	-50	0.0%	1,051,089	1,050,992	97	0.0%
Alameda	421,910	421,914	-4	0.0%	490,647	490,722	-75	0.0%	570,538	570,551	-13	0.0%
Contra Costa	331,182	331,188	-6	0.0%	403,657	403,717	-60	0.0%	463,962	463,996	-34	0.0%
Solano	122,892	122,903	-11	0.0%	164,440	164,481	-41	0.0%	190,018	190,076	-58	0.0%
Napa	41,733	41,741	-8	0.0%	52,429	52,452	-23	0.0%	57,749	57,808	-59	-0.1%
Sonoma	156,710	156,744	-34	0.0%	194,105	194,235	-130	-0.1%	210,804	211,131	-327	-0.2%
Marin	92,855	92,864	-9	0.0%	104,944	104,898	46	0.0%	115,197	115,156	41	0.0%
TOTAL	2,469,189	2,469,277	-88	0.0%	2,960,617	2,960,723	-106	0.0%	3,402,699	3,402,593	106	0.0%

Table G-3-2 Trip Attraction Home-Based Social/Recreation Person Trips (HBSR)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	258,759	258,783	-24	0.0%	296,632	296,730	-98	0.0%	338,605	338,664	-59	0.0%
San Mateo	323,829	323,852	-23	0.0%	377,445	377,549	-104	0.0%	422,497	422,575	-78	0.0%
Santa Clara	729,104	729,139	-35	0.0%	868,601	868,837	-236	0.0%	1,008,086	1,008,310	-224	0.0%
Alameda	415,869	415,930	-61	0.0%	492,947	493,083	-136	0.0%	576,855	576,969	-114	0.0%
Contra Costa	330,141	330,186	-45	0.0%	411,511	411,639	-128	0.0%	476,969	477,079	-110	0.0%
Solano	121,634	121,649	-15	0.0%	163,438	163,489	-51	0.0%	195,022	195,066	-44	0.0%
Napa	41,503	41,504	-1	0.0%	51,389	51,402	-13	0.0%	54,773	54,783	-10	0.0%
Sonoma	155,048	155,057	-9	0.0%	192,456	192,526	-70	0.0%	215,107	215,160	-53	0.0%
Marin	93,302	93,178	124	0.1%	106,198	105,469	729	0.7%	114,785	113,988	797	0.7%
TOTAL	2,469,189	2,469,278	-89	0.0%	2,960,617	2,960,724	-107	0.0%	3,402,699	3,402,594	105	0.0%

Notes:
(1) MTC County-County Person Trip Forecasts HBW Trips, 1990-2030 Data Summary, Table 8 - Jnuary 2005
(2) Marin Travel Model (MTM) Forecasts for Years 2000, 2015 & 2030 - Based on ABAG' Projections 2003

Transportation Authority of Marin (TAM)

Marin Travel Model (MTM)-Trip Distribution Comparison-ABAG's Proj. 2003

Table G-4-1 Trip Production Home-Based School Person Trips (HBSch)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	201,937	201,931	6	0.0%	293,777	293,837	-60	0.0%	244,446	244,413	33	0.0%
San Mateo	227,249	227,291	-42	0.0%	232,754	232,895	-141	-0.1%	222,519	222,561	-42	0.0%
Santa Clara	592,561	592,793	-232	0.0%	678,847	679,340	-493	-0.1%	681,819	681,955	-136	0.0%
Alameda	513,343	513,246	97	0.0%	534,247	534,462	-215	0.0%	560,770	560,737	33	0.0%
Contra Costa	340,518	340,330	188	0.1%	335,110	335,087	23	0.0%	351,347	351,288	59	0.0%
Solano	150,337	150,244	93	0.1%	165,538	165,552	-14	0.0%	176,664	176,945	-281	-0.2%
Napa	41,441	41,319	122	0.3%	40,481	40,410	71	0.2%	42,032	42,065	-33	-0.1%
Sonoma	158,454	158,883	-429	-0.3%	151,904	152,340	-436	-0.3%	148,984	149,759	-775	-0.5%
Marin	68,758	68,583	175	0.3%	69,518	68,229	1,289	1.9%	62,793	61,739	1,054	1.7%
TOTAL	2,294,598.	2,294,620	-22	0.0%	2,502,176	2,502,152	24	0.0%	2,491,374	2,491,462	-88	0.0%

Table G-4-2 Trip Attraction Home-Based School Person Trips (HBSch)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	219,383	219,401	-18	0.0%	310,119	310,052	67	0.0%	261,521	261,393	128	0.0%
San Mateo	210,657	210,708	-51	0.0%	217,519	217,688	-169	-0.1%	206,946	207,098	-152	-0.1%
Santa Clara	607,441	607,619	-178	0.0%	693,788	694,336	-548	-0.1%	697,019	697,561	-542	-0.1%
Alameda	516,928	517,067	-139	0.0%	537,977	538,454	-477	-0.1%	564,609	565,095	-486	-0.1%
Contra Costa	325,348	325,445	-97	0.0%	320,146	320,403	-257	-0.1%	335,287	335,558	-271	-0.1%
Solano	143,648	143,306	342	0.2%	157,891	158,020	-129	-0.1%	169,658	169,794	-136	-0.1%
Napa	41,567	41,580	-13	0.0%	40,633	40,670	-37	-0.1%	42,171	42,207	-36	-0.1%
Sonoma	162,403	162,428	-25	0.0%	156,034	156,150	-116	-0.1%	152,840	152,948	-108	-0.1%
Marin	67,223	67,066	157	0.2%	68,070	66,379	1,691	2.5%	61,324	59,808	1,516	2.5%
TOTAL	2,294,598	2,294,620	-22	0.0%	2,502,177	2,502,152	25	0.0%	2,491,375	2,491,462	-87	0.0%

Notes:
(1) MTC County-County Person Trip Forecasts HBW Trips, 1990-2030 Data Summary, Table 8 - Jnuary 2005
(2) Marin Travel Model (MTM) Forecasts for Years 2000, 2015 & 2030 - Based on ABAG' Projections 2003

Transportation Authority of Marin (TAM)

Marin Travel Model (MTM)-Trip Distribution Comparison-ABAG's Proj. 2003

Table G-5-1 Trip Production Non Home-Based Person Trips (NHB)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	920,563.	920,433	130	0.0%	1,054,299	1,053,186	1,113	0.1%	1,185,720	1,184,018	1,702	0.1%
San Mateo	699,051.	699,097	-46	0.0%	808,314	808,477	-163	0.0%	914,803	915,070	-267	0.0%
Santa Clara	1,602,743.	1,602,828	-85	0.0%	1,870,147	1,870,497	-350	0.0%	2,147,334	2,147,945	-611	0.0%
Alameda	1,103,449.	1,103,499	-50	0.0%	1,308,358	1,308,642	-284	0.0%	1,536,327	1,536,757	-430	0.0%
Contra Costa	637,221.	637,258	-37	0.0%	781,916	782,099	-183	0.0%	919,749	920,023	-274	0.0%
Solano	231,686.	231,707	-21	0.0%	301,822	301,900	-78	0.0%	369,573	369,693	-120	0.0%
Napa	97,313.	97,326	-13	0.0%	118,692	118,723	-31	0.0%	125,585	125,622	-37	0.0%
Sonoma	312,211.	312,277	-66	0.0%	387,394	387,508	-114	0.0%	451,233	451,382	-149	0.0%
Marin	216,423.	216,441	-18	0.0%	244,756	244,648	108	0.0%	268,797	268,695	102	0.0%
TOTAL	5,820,660.	5,820,866	-206	0.0%	6,875,698.	6,875,680.	18	0.0%	7,919,121	7,919,205	-84	0.0%

Table G-5-2 Trip Attraction Non Home-Based Person Trips (NHB)

County	2000				2015				2030			
	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.	MTC (1)	MTM (2)	Diff.	% Diff.
San Francisco	919,901.	919,974	-73	0.0%	1,056,747	1,057,087	-340	0.0%	1,191,218	1,191,595	-377	0.0%
San Mateo	700,635.	700,695	-60	0.0%	812,117	812,384	-267	0.0%	918,760	919,039	-279	0.0%
Santa Clara	1,604,739.	1,604,931	-192	0.0%	1,873,524	1,874,094	-570	0.0%	2,157,597	2,158,271	-674	0.0%
Alameda	1,104,127.	1,104,258	-131	0.0%	1,304,107	1,304,488	-381	0.0%	1,530,495	1,530,934	-439	0.0%
Contra Costa	634,667.	634,742	-75	0.0%	778,264	778,510	-246	0.0%	913,300	913,586	-286	0.0%
Solano	231,931.	231,950	-19	0.0%	302,871	302,957	-86	0.0%	369,273	369,382	-109	0.0%
Napa	97,466.	97,474	-8	0.0%	118,865	118,902	-37	0.0%	125,792	125,831	-39	0.0%
Sonoma	312,504.	312,535	-31	0.0%	386,849	386,947	-98	0.0%	447,339	447,465	-126	0.0%
Marin	214,690.	214,305	385	0.2%	242,355	240,312	2,043	0.9%	265,347	263,102	2,245	0.9%
TOTAL	5,820,660	5,820,864	-204	0.0%	6,875,699	6,875,681	18	0.0%	7,919,121	7,919,205	-84	0.0%

Notes:
(1) MTC County-County Person Trip Forecasts HBW Trips, 1990-2030 Data Summary, Table 8 - Jnuary 2005
(2) Marin Travel Model (MTM) Forecasts for Years 2000, 2015 & 2030 - Based on ABAG' Projections 2003

Marin Travel Model - Marin CMP

Regional Highway Peaking Factors for A.M. and P.M. peak Hours

Table I

AM/PM Peak Hour - Trip Purpose	Trip Direction	Factors
A.M. Peak Hour Factors		
Home-Based Work	H -> W	0.15436
Weighted Average	W -> H	0.00329
Home-Based Non-Work	H -> N W	0.04476
	NW -> H	0.01576
Non-Home-Based	NW -> NW	0.02404
HBW Drive Alone	H -> W	0.14597
	W -> H	0.00514
HBW Shared Ride 2+	H -> W	0.17763
	W -> H	0.00172
P.M. Peak Hour Factors		
Home-Based Work	H -> W	0.00788
Weighted Average	W -> H	0.12533
Home-Based Non-Work	H -> N W	0.03626
	NW -> H	0.06325
Non-Home-Based	NW -> NW	0.08388
HBW Drive Alone	H -> W	0.0079
	W -> H	0.12661
HBW Shared Ride 2+	H -> W	0.00857
	W -> H	0.13595

Source: Regional Highway Peaking Factors for AM and PM Peak Hour - MTCFCAST Model-
Travel Forecasting Assumptions for Transportation Plan and 2005 Transportation Improvement Program

Appendix F
Performance Measures Monitoring Report

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1 INTRODUCTION

This report provides the results of the 2005 performance measures monitoring program undertaken as part of the Marin County Congestion Management Program.

2 PURPOSE OF MONITORING PROGRAM

According to California Government Code section 65089(b)(2), the Congestion Management Program (CMP) shall contain a performance element that includes performance measures to evaluate current and future multimodal system performance for the movement of people and goods. The CMP identifies eight performance measures. These measures and their evaluation are presented in this performance measures monitoring report.

According to California Government Code section 65089.5(a), the Congestion Management Agency (CMA), based on information obtained by a monitoring program, determines whether or not the County and its cities and towns are conforming to the requirements of the CMP. If an agency believes that a local government is not conforming to CMP requirements, it must then hold a noticed public hearing to determine areas of nonconformance. If after the public hearing the CMA still believes that the local government is not conforming to CMP requirements, it must provide written notice to the local government citing the specific instances of nonconformance. If after ninety days the local government has not remedied the nonconformance instances, the CMA makes a finding of nonconformance and notifies the State Controller to withhold the subventions from the *additional* gas tax made available from Proposition 111, and this could affect Discretionary Funding.

3 2005 CMP PERFORMANCE MEASURES MONITORING RESULTS

3.1. Highway Level of Service Description

The CMP monitoring program documented here consisted of several tasks. They included:

- Identification of monitoring locations
- Data collection results
- Evaluation of level of service
- Additional level of service analysis based on travel time
- Comparisons to highway level-of-service standards in the CMP

All major facilities on the CMP designated network have been counted. A total of 24 locations were counted in May 2005, and evaluated for the monitoring program. All monitoring locations were counted during the P.M. peak period (4:00 - 6:00 P.M.). For those facilities that are multi-directional, only the primary commute distance was counted and evaluated. This was deemed sufficient to record the lower range LOS for each facility. Figure 1 shows the count locations. The numerical references on the figure refer to the count locations that can be found in Table 1. The appendix includes the data collection sheets.

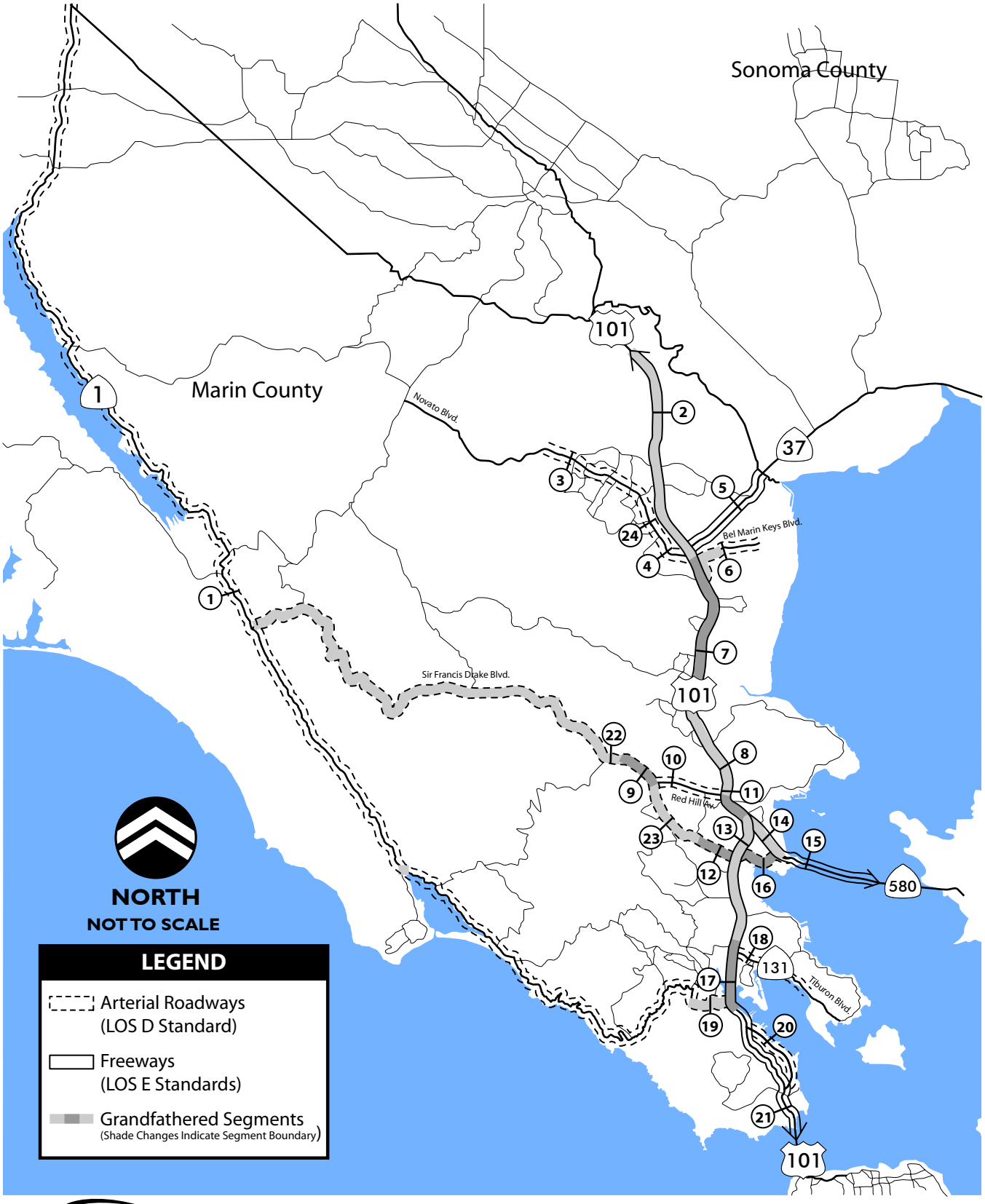
Since the first CMP, there has been considerable research done on highway level of service, and new methodologies have been developed that better reflect the operation of highways. In particular, the *Highway Capacity Manual, 2000* no longer uses volume-to-capacity ratio to analyze

arterial segments. Instead, it bases the level of service on travel time and/or time spent following. The Transportation Authority of Marin (TAM) has determined that the 2007 year cycle should be a transitional year, where the level of service for roadway segments is still determined based on volume-to-capacity, but that some segments would be analyzed based on travel time. This will help give some perspective to the information that will be collected during the next CMP update when the CMA completely transitions to analyzing the roadway LOS through the use of travel time data.

One capacity has been assumed for the freeway segments in all the previous CMPs and earlier versions of the *Highway Capacity Manual*. This enables a consistent analysis based on the adopted CMP standards. However, research included in the recent *Highway Capacity Manual* indicates that the capacity of basic freeway segments has increased from an estimated 2000 vehicles per hour per lane to 2,200 or 2,400 vehicles per hour per lane. This increase is largely attributed to the improved handling of vehicles that has led to more aggressive drivers. This higher capacity could substantially improve the reporting of level of service of some roadways.

Table 1: Count Locations

Segment #	Segment
1	Shoreline Highway (State Route 1), from Sir Francis Drake Blvd to Pt. Reyes Station
2	U.S. 101, from Atherton Ave. to Sonoma County Line
3	Novato Blvd. from San Marin Dr./Sutro Ave to Wilson Ave.
4	South Novato Blvd. from U.S. 101 to Novato Blvd.
5	State Route 37, from U.S. 101 to Atherton Ave
6	Bel Marin Keys, from U.S.101 to Commercial Blvd
7	U.S. 101, from N. San Pedro Rd. to State Route 37
8	U.S. 101, from Mission Ave. to N. San Pedro Rd.
9	Sir Francis Drake Blvd., from San Anselmo Ave. to Red Hill Ave.
10	Red Hill Ave. from Sir Francis Drake Blvd.to Hilldale Dr.
11	U.S. 101, from Interstate 580 to Mission Ave.
12	Sir Francis Drake Blvd., from College Ave. to Wolfe Grade
13	U.S. 101 from Tiburon Blvd. (SR 131) to Interstate 580
14	Interstate 580, from Sir Francis Drake Blvd. to Bellam Blvd.
15	Interstate 580, from Sir Francis Drake Blvd. to Richmond/San Rafael Bridge
16	E. Sir Francis Drake Blvd., from U.S. 101 to Larkspur Landing Cir
17	U.S. 101, from Shoreline Highway (SR 1) to Tiburon Blvd. (SR 131)
18	Tiburon Blvd. (State Route 131) from U.S. 101 to Strawberry Drive
19	Shoreline Highway (State Route 1), from Northern Ave. to Almonte Blvd.
20	Bridgeway Blvd.,from U.S. 101 to U.S. 101
21	U.S. 101 from San Francisco County Line to Shoreline Highway (SR1)
22	Sir Francis Drake Blvd.from Butterfield Rd. to State Route 1
23	Sir Francis Drake Blvd. from College Ave. to Toussin Ave.
24	Novato Blvd., from Wilson Ave. to Diablo Ave.



ENGINEERS
PLANNERS
ECONOMISTS
Wilbur Smith Associates

Figure 1
MARIN COUNTY 2005 CONGESTION MANAGEMENT PROGRAM MONITORED ROADWAY LOCATIONS

531950/BASE - 06/24/05

3.1.1 2003 CMP Monitoring Results

The level-of-service methodology, which applies for both freeway segments and arterial segments, is based on a level that was adopted for the *1991 Congestion Management Plan*. Under this methodology, the levels of service are based on the volume-to-capacity (V/C) ratios for each roadway segment. The maximum V/C ratio for each roadway type is listed in Table 2.

The established roadway level-of-service standards are as follows:

- Freeways and Rural Expressways (such as Highway 101, Interstate 580, State Route 37) - LOS E
- Urban and Suburban Arterials - LOS D

The only exception to these standards is for "grandfathered" monitoring segments; those segments that were operating at LOS F when the first CMP was first completed. TAM has recommended that an improvement plan be developed for each grandfathered segment that still operates worse than the level-of-service standard for that type of segment.

The results of the 2003 monitoring survey are found in Table 3. Many of the freeway segments in the peak direction are operating at levels higher than capacity, which results in a failure in the level of service. However, as discussed earlier, there is considerable research to suggest that the 2000 vehicles per hour per lane that was assumed in the initial CMP is too low and that a capacity of 2,200 to 2,400 would be more appropriate. An assessment of the volumes per lane in Table 3 indicates that most of the segments that are considered to be failing today, would not be if a higher capacity was assumed. Because the volume-to-capacity ratio does not necessarily capture the performance of the roadway segment, especially when they are severely congested, the CMA is transitioning to measuring the roadway level of service based on the travel time of the segment.

The CMP monitoring program has been conducted for each segment at two year intervals. Table 4 summarizes the monitoring results since 1995.

Table 2: Maximum Volume-to-Capacity Ratio by Roadway Type

LOS	Type I Basic Freeway	Type II Major Arterial
A	0.35	0.60
B	0.54	0.70
C	0.77	0.80
D	0.93	0.90
E	1.00	1.00

Table 3: Segment Level of Service

Segment #	Segment	Direction	Peak Hour Volume	No. of Lanes	Volume Per Lane	Type	Capacity	V/C	Peak Direction LOS	# of Vehicles above Standard
Non-Grandfathered, Satisfactory										
1	Shoreline Highway (State Route 1), from Sir Francis Drake Blvd to Pt. Reyes Station	NB	124	1	124	II	800	0.16	A	
3	Novato Blvd. from San Marin Dr./Sutro Ave to Wilson Ave.	NB	346	1	346	II	800	0.43	A	
4	South Novato Blvd. from U.S. 101 to Novato Blvd.	NB	475	1	475	II	800	0.59	A	
5	State Route 37, from Sonoma County Line to U.S. 101	EB	2302	2	1151	I	2000	0.58	C	
10	Red Hill Ave. from Sir Francis Drake Blvd.to Hilldale Dr.	WB	1804	2	902	II	1200	0.75	C	
15	Interstate 580, from west of Sir Francis Drake Blvd. to Contra Costa Co. Line	WB	2634	2	1317	I	2000	0.66	C	
		EB	3271	2	1636	I	2000	0.82	D	
18	Tiburon Blvd. (State Route 131) from U.S. 101 to Strawberry Drive	EB	1449	2	725	II	960	0.75	C	
20	Bridgeway Blvd.,from U.S. 101 to U.S. 101	NB	1258	2	629	II	960	0.66	B	
21	U.S. 101 from San Francisco County Line to Shoreline Highway (SR1)	NB	5486	4	1372	I	2000	0.69	C	
		SB	3575	4	894	I	2000	0.45	B	
24	Novato Blvd., from Wilson Ave. to Diablo Ave.	NB	912	1	912	II	960	0.95	E[1]	
Grandfathered, Satisfactory										
2	U.S. 101, from Atherton Ave. to Sonoma County Line	NB	3664	2	1832	I	2000	0.92	D	
6	Bel Marin Keys, from U.S.101 to Commercial Blvd	WB	1253	2	627	II	800	0.78	C	
7	U.S. 101, from N. San Pedro Rd. to State Route 37	NB	7748	4	1937	I	2000	0.97	E	
12	Sir Francis Drake Blvd., from College Ave. to Wolfe Grade	WB	1547	2	774	II	1200	0.64	B	
16	E. Sir Francis Drake Blvd., from U.S. 101 to Larkspur Landing Cir	EB	1446	2	723	II	960	0.75	C	
Grandfathered, Improvement Plan Recommended										
8	U.S. 101, from Mission Ave. to N. San Pedro Rd.	NB	8602	4	2151	I	2000	1.08	F	-151
9	Sir Francis Drake Blvd., from San Anselmo Ave. to Red Hill Ave.	WB	1880	2	940	II	960	0.98	E	
11	U.S. 101, from Interstate 580 to Mission Ave.	NB	6530	3	2177	I	2000	1.09	F	-177
13	U.S. 101 from Tiburon Blvd. (SR 131) to Interstate 580	NB	6214	3	2071	I	2000	1.04	F	-71
14	Interstate 580, from Sir Francis Drake Blvd. to Bellam Blvd.	EB	1941	1	1941	I	1400	1.39	F	-541
17	U.S. 101, from Shoreline Highway (SR 1) to Tiburon Blvd. (SR 131)	NB	7078	3	2359	I	2000	1.18	F	-359
19	Shoreline Highway (State Route 1), from Northern Ave. to Almonte Blvd.	NB	842	1	842	II	800	1.05	F	-42
22	Sir Francis Drake Blvd.from Butterfield Rd. to State Route 1	WB	910	1	910	II	960	0.95	E	
23	Sir Francis Drake Blvd. from College Ave. to Toussin Ave.	WB	1120	1	1120	II	960	1.17	F	-160

[1] More detailed intersection level analysis indicates Level of Service D (acceptable)

Table 4: Segment LOS Timeline

				1995		1997		1999		2001		2003		2005	
#	Segment	Direction	Type	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
Non-Grandfathered, Satisfactory															
1	Shoreline Highway (State Route 1), from Sir Francis Drake Blvd to Pt. Reyes Station	NB	II	0.16	A	0.13	A	0.09	A	0.05	A	0.07	A	0.09	A
3	Novato Blvd. from San Marin Dr./Sutro Ave to Wilson Ave.	NB	II	0.67	B	0.59	A	0.54	A	0.45	A	0.4	A	0.43	A
4	South Novato Blvd. from U.S. 101 to Novato Blvd.	NB	II	0.42	A	0.58	A	0.55	A	0.51	A	0.48	A	0.59	A
5	State Route 37, from U.S. 101 to Atherton Ave	EB	I	0.57	C	0.59	C	0.63	C	0.62	C	0.59	C	0.58	C
10	Red Hill Ave. from Sir Francis Drake Blvd.to Hilldale Dr.	WB	II	0.8	D	0.91	D	0.82	D	0.89	D	0.82	D	0.75	C
18	Tiburon Blvd. (State Route 131) from U.S. 101 to Strawberry Drive	EB	II	0.78	C	0.76	C	0.7	C	0.71	C	0.66	C	0.75	C
20	Bridgeway Blvd.,from U.S. 101 to U.S. 101	NB	II	0.71	C	0.69	B	0.74	C	0.62	B	0.73	C	0.66	B
21	U.S. 101 from San Francisco County Line to Shoreline Highway (SR1)	NB	I	0.86	D	0.87	D	0.87	D	0.77	D	0.69	C	0.69	C
		SB	I	0.51	B	0.49	B	0.48	B	0.54	C	0.48	B	0.45	B
15	Interstate 580, from Sir Francis Drake Blvd. to Richmond/San Rafael Bridge	EB	I	0.63	C	0.64	C	0.64	C	1.01	F	0.95	E	0.66	C
		WB	I	0.63	C	0.63	C	0.83	D	0.62	C	0.59	C	0.82	D
24	Novato Blvd., from Wilson Ave. to Diablo Ave.	NB	II	1.10	F	0.93	E	1.02	F	0.88	D	0.70	C	0.95	E[1]
Grandfathered, Satisfactory															
6	Bel Marin Keys, from U.S.101 to Commercial Blvd	WB	II	0.92	E	0.96	E	1.24	F	0.94	E	0.78	C	0.78	C
7	U.S. 101, from N. San Pedro Rd. to State Route 37	NB	I	0.79	D	0.8	D	0.82	D	0.91	D	0.62	C	0.97	E
12	Sir Francis Drake Blvd., from College Ave. to Wolfe Grade	WB	II	0.69	B	0.69	B	0.72	C	0.76	C	0.8	C	0.64	B
2	U.S. 101, from Atherton Ave. to Sonoma County Line	NB	II	1.01	F	1.02	F	1.08	F	0.94	E	1	F	0.92	D
16	E. Sir Francis Drake Blvd., from U.S. 101 to Larkspur Landing Cir	EB	II	1.11	F	0.99	E	1	F	1.1	F	1.03	F	0.75	C
Grandfathered, Improvement Plan Recommended															
17	U.S. 101, from Shoreline Highway (SR 1) to Tiburon Blvd. (SR 131)	NB	I	0.78	D	0.77	C	0.8	D	0.89	D	0.77	C	1.18	F
8	U.S. 101, from Mission Ave. to N. San Pedro Rd.	NB	I	1.04	F	1.01	F	1.11	F	0.91	D	1.05	F	1.08	F
9	Sir Francis Drake Blvd., from San Anselmo Ave. to Red Hill Ave.	WB	II	0.88	D	1.06	F	0.99	E	1.2	F	0.99	E	0.98	E
11	U.S. 101, from Interstate 580 to Mission Ave.	NB	I	1.06	F	1.21	F	1.1	F	0.91	D	1.09	F	1.09	F
13	U.S. 101 from Tiburon Blvd. (SR 131) to Interstate 580	NB	I	0.98	E	0.87	D	0.87	D	1.11	F	1.1	F	1.04	F
19	Shoreline Highway (State Route 1), from Northern Ave. to Almonte Blvd.	NB	II	0.9	E	0.82	D	0.86	D	0.81	D	0.77	C	1.05	F
14	Interstate 580, from Sir Francis Drake Blvd. to Bellam Blvd.	EB	I	0.35	B	0.4	B	0.31	A	0.46	B	0.52	B	1.39	F
22	Sir Francis Drake Blvd.from Butterfield Rd. to State Route 1	WB	II	1.16	F	1.05	F	1.11	F	1.33	F	1.05	F	0.95	E
23	Sir Francis Drake Blvd. from College Ave. to Toussin Ave.	WB	II	1.24	F	1.32	F	1.26	F	0.95	E	1.16	F	1.17	F

[1] More detailed intersection level analysis indicates Level of Service D (acceptable)

3.1.2 Actions

The results of the survey suggest different actions in monitoring for four different categories of roadways. Table 5 illustrates the actions that should be taken on each segment.

Table 5: Actions Recommended by Segment

Segment #	Segment	Peak Direction	Peak Direction LOS	Action Needed
Non-Grandfathered, Satisfactory				
1	Shoreline Highway (State Route 1), from Sir Francis Drake Blvd to Pt. Reyes Station	NB	A	Within LOS Standard; No Action
3	Novato Blvd. from San Marin Dr./Sutro Ave to Wilson Ave.	NB	A	Within LOS Standard; No Action
4	South Novato Blvd. from U.S. 101 to Novato Blvd.	NB	A	Within LOS Standard; No Action
5	State Route 37, from U.S. 101 to Atherton Ave	EB	C	Within LOS Standard; No Action
10	Red Hill Ave. from Sir Francis Drake Blvd.to Hilldale Dr.	WB	C	Within LOS Standard; No Action
15	Interstate 580, from Sir Francis Drake Blvd. to Richmond/San Rafael Bridge	WB	C	Within LOS Standard; No Action
		EB	D	Within LOS Standard; No Action
18	Tiburon Blvd. (State Route 131) from U.S. 101 to Strawberry Drive	EB	C	Within LOS Standard; No Action
20	Bridgeway Blvd.,from U.S. 101 to U.S. 101	NB	B	Within LOS Standard; No Action
21	U.S. 101 from San Francisco County Line to Shoreline Highway (SR1)	NB	C	Within LOS Standard; No Action
		SB	B	Within LOS Standard; No Action
24	Novato Blvd., from Wilson Ave. to Diablo Ave.	NB	E[1]	Improvement plan or deficiency plan recommended
Grandfathered, Satisfactory				
2	U.S. 101, from Atherton Ave. to Sonoma County Line	NB	D	Grandfathered; No Action
6	Bel Marin Keys, from U.S.101 to Commercial Blvd	WB	C	Grandfathered; No Action
7	U.S. 101, from N. San Pedro Rd. to State Route 37	NB	E	Grandfathered; No Action
12	Sir Francis Drake Blvd., from College Ave. to Wolfe Grade	WB	B	Grandfathered; No Action
16	E. Sir Francis Drake Blvd., from U.S. 101 to Larkspur Landing Cir	EB	C	Grandfathered; No Action
Grandfathered, Improvement Plan Recommended				
8	U.S. 101, from Mission Ave. to N. San Pedro Rd.	NB	F	Grandfathered; Improvement Plan Recommended
9	Sir Francis Drake Blvd., from San Anselmo Ave. to Red Hill Ave.	WB	E	Grandfathered; Improvement Plan Recommended
11	U.S. 101, from Interstate 580 to Mission Ave.	NB	F	Grandfathered; Improvement Plan Recommended
13	U.S. 101 from Tiburon Blvd. (SR 131) to Interstate 580	NB	F	Grandfathered; Improvement Plan Recommended
14	Interstate 580, from Sir Francis Drake Blvd. to Bellam Blvd.	EB	F	Grandfathered; Improvement Plan Recommended
17	U.S. 101, from Shoreline Highway (SR 1) to Tiburon Blvd. (SR 131)	NB	F	Grandfathered; Improvement Plan Recommended
19	Shoreline Highway (State Route 1), from Northern Ave. to Almonte Blvd.	NB	F	Grandfathered; Improvement Plan Recommended
22	Sir Francis Drake Blvd.from Butterfield Rd. to State Route 1	WB	E	Grandfathered; Improvement Plan Recommended
23	Sir Francis Drake Blvd. from College Ave. to Toussin Ave.	WB	F	Grandfathered; Improvement Plan Recommended

[1] More detailed intersection level analysis indicates Level of Service D (acceptable)

3.2. Aggregate Peak Hour Travel Time

This performance measure will determine the amount of time required to travel through selected corridors on a variety of modes. In order to capture the system performance, travel time for the various modes, single-occupant, high-occupant, and transit vehicles, is calculated. To determine peak hour travel times by single-occupant vehicles, travel time runs were conducted over several days at peak hour in the peak direction. Transit schedules were used to determine travel times via buses.

Table 7 lists the 2003 aggregate travel times in four segments for Marin County:

- U.S. 101 between the Sonoma County line and San Rafael Transit Center
- U.S. 101 between San Rafael Transit Center and the Golden Gate Bridge
- Sir Francis Drake between Butterfield Road and U.S. 101
- Red Hill Avenue, Second and Third streets between Sir Francis Drake and San Rafael Transit Center

Table 6: Representative Travel Times by Mode

		Highway	HOV	Transit
US 101 - San Rafael Transit Center to Sonoma County Line (11.1 miles)				
AM Peak				
	SB	28	22	48
	NB	11	N/A	33
PM Peak				
	SB	11	N/A	38
	NB	15	12	38
US 101 - Golden Gate Bridge to San Rafael Transit Center (10.3 miles)				
AM Peak				
	SB	13	12	30
	NB	10	N/A	34
PM Peak				
	SB	11	N/A	30
	NB	33	15	50
Sir Francis Drake - Butterfield to US 101 (4.8 miles)				
AM Peak				
	SB	8	N/A	-
	NB	5	N/A	23
PM Peak				
	SB	8	N/A	23
	NB	16	N/A	-
Red Hill Avenue-Sir Francis Drake to San Rafael Transit Center (2.1 miles)				
AM Peak				
	EB (SB)	17	N/A	13
	WB (NB)	10	N/A	13
PM Peak				
	EB (SB)	14	N/A	13
	WB (SB)	6	N/A	13

* All travel times are by minutes

Source: Wilbur Smith Associates, 2005

These numbers clearly indicate the extent of peak direction congestion. For example, the HOV lanes on U.S.101. North of central San Rafael are moving almost 18 minutes faster than the general purpose lanes, indicating the slow speed of travel in the general purpose lanes. In addition, the Southbound lanes have a 28 minute travel time in the AM peak hour, vs. only 11 minutes in the uncongested PM peak hour. Sir Francis Drake –Butterfield Road shows similar peak hour congestion, the NB lanes can be traveled over in 5 minutes in the uncongested AM peak, but take 11 minutes longer (16 minute travel time) during PM peak congestion conditions.

3.3. Person Throughput

The performance measure "person throughput" identifies the number of people, not vehicles, who are able to move over a given facility in the peak period. As a combination of vehicle occupancy and level of service, this measure allows for recognition that transit service and HOV lanes can benefit corridor capacity.

This performance measure can be estimated by analyzing traffic volumes and transit usage. Average auto occupancy information for mixed-flow and HOV lanes are used to derive auto riders in the analysis. Monitoring of this measure was conducted at the following locations:

- U.S. 101 between Interstate 580 and Central San Rafael
- U.S. 101 between Paradise Drive and Tiburon Boulevard
- U.S. 101 north of Atherton Avenue
- Sir Francis Drake Boulevard east of Wolfe Grade
- Sir Francis Drake Boulevard north of Red Hill Avenue
- Red Hill Avenue east of Sir Francis Drake Boulevard

Table 7 summarizes the number of persons traveling through each checkpoint by transit and automobile in each direction during the evening peak hour. The table further identifies the person throughput in terms of persons per roadway lane.

The maximum person throughput occurs on U.S. 101 between Tiburon Boulevard and Paradise Drive with over 16,400 persons per hour northbound in the evening. This checkpoint also has the greatest number of transit riders: almost 4,700 riders (nearly 30 percent of person throughput).

The throughput per roadway lane is highest for the two most congested sections of U.S. 101 (Corte Madera and northern Novato). The single highest lane volume occurs on U.S. 101 between Interstate 580 and Central San Rafael. This four lane facility has roughly 3,333 persons traveling in each lane during the evening peak hour.

Table 7: Person Throughput in the PM Peak Hour

	Transit Persons	Auto Persons	Vanpool Persons	Total Persons	Number of Lanes	Persons Per Lane
US 101 between Interstate 580 and Central San Rafael						
NB	2,205	11,127	0	13,332	4	3,333
US 101 between Tiburon Boulevard and Paradise Drive						
NB	4,680	11,631	110	16,421	5	3,284
US 101 North of Atherton						
NB	1,080	4,026	11	5,117	2	2,559
Sir Francis Drake Boulevard east of Wolfe Grade						
NB	0	3,497	0	3,497	2	1,749
Sir Francis Drake Boulevard north of Red Hill Avenue						
NB	1,620	3,986	0	5,606	2	2,803
Red Hill Avenue east of Sir Francis Drake Boulevard						
NB	315	3,460	0	3,775	2	1,888
Source: Wilbur Smith Associates, 2005						

3.4. Vehicle Miles Traveled on Congested Highway

This performance measure, derived from the Marin Travel Model, measures vehicle miles traveled on congested segments of the freeway system in Marin County. Congested segments are highway segments at LOS E or worse. This measure, when viewed over time, provides an understanding of the relative extent of congestion on the freeway portion of the CMP roadway system.

Table 9 summarizes the vehicle miles traveled on the State Highway System for 1990, 1998 and two future periods, 2010 and 2020. The travel model shows a significant increase in vehicle miles traveled in the future. Vehicle miles on congested highway will almost double between 1990 and 2010 with some improvement due to roadway projects by the year 2020.

Table 8: Vehicle Miles Traveled on Congested Roadways (PM Peak Hour)

	1990	1998	2010	2020
Total PM Peak Hour Vehicle Miles Traveled	510,881	572,227	752,720	785,717
Total PM Peak Hour Vehicle Miles Traveled in Congested Conditions	78,296	87,928	341,299	364,936
Percent of Vehicle Miles Traveled in Congested Conditions	15%	15%	45%	46%
Source: Marin County Travel Model, 2003				

3.5. Jobs/Housing Balance

This performance measure considers the balance between projected employed residents and projected jobs within different planning areas of the county. Achieving a balance between jobs and housing within a community or area can help the regional transportation system by reducing the length of trips and traffic congestion.

Through a variety of land-use analyses conducted in the county, it has been found that the least long-distance commuting occurs when the number of employed residents equals the number of jobs in the county or subareas of the county. The primary reasons for long distance commuting are economic, job specialization and community ties. If there is an imbalance, then some of the workers must commute to jobs in other subareas or counties. Table 9 summarizes the number of employed residents and jobs for the San Francisco Bay Area. Table 10 summarizes the number of employed residents and jobs for subareas in Marin County.

Based on ABAG 2003 projections, the Marin Community Development Agency has projected the number of employed residents and jobs in Sonoma, Marin and San Francisco. In the year 2010 Sonoma County is expected to have 242,857 jobs and 274,795 employed residents, so Sonoma County will have to export at least 31,938 workers to jobs outside the County. In Marin County, there are expected to be 134,096 jobs and 154,597 employed residents. Marin County will have to export at least 20,501 workers to jobs outside the county. San Francisco is expected to have 686,505 jobs and 453,300employed residents. San Francisco will have to import at least 233,205 workers to fill their jobs.

Table 9: Bay Area Jobs/Housing Balance

Employed Residents							
	2000	2005	2010	2015	2020	2025	2030
Alameda	697,882	730,706	795,498	846,402	923,299	1,007,404	1,063,201
Contra Costa	483,898	518,693	572,688	613,253	650,392	681,723	704,742
Marin	**140,955**	**145,301**	**154,597**	**158,698**	**161,398**	**163,897**	**166,100**
Napa	67,111	70,301	73,799	77,697	80,000	81,800	82,997
San Francisco	444,850	434,612	453,300	479,794	494,297	519,301	547,501
San Mateo	403,083	400,797	420,990	450,296	469,696	483,305	490,701
Santa Clara	959,071	961,104	984,923	1,125,590	1,193,998	1,254,000	1,313,391
Solano	179,517	205,201	233,102	253,801	272,604	294,599	305,499
Sonoma	229,307	254,401	274,795	289,402	297,903	304,501	309,097
Total Jobs							
	2000	2005	2010	2015	2020	2025	2030
Alameda	751,674	790,403	865,076	921,358	975,417	1,028,612	1,087,366
Contra Costa	361,105	385,061	418,908	448,145	476,541	505,449	536,412
Marin	122,964	125,290	134,096	144,578	151,916	158,232	163,964
Napa	66,834	72,259	77,236	82,323	85,147	87,076	88,998
San Francisco	634,447	635,507	686,505	728,233	755,877	786,047	815,680
San Mateo	395,905	396,659	429,104	461,666	489,008	506,455	526,561
Santa Clara	1,092,348	1,085,891	1,199,186	1,299,194	1,362,834	1,418,804	1,481,652
Solano	123,211	133,630	146,767	160,640	172,383	188,435	204,673
Sonoma	205,221	224,261	242,857	263,713	283,418	303,703	321,013
Jobs/Residents Ratio							
	2000	2005	2010	2015	2020	2025	2030
Alameda	1.08	1.08	1.09	1.09	1.06	1.02	1.02
Contra Costa	0.75	0.74	0.73	0.73	0.73	0.74	0.76
Marin	**0.87**	**0.86**	**0.87**	**0.91**	**0.94**	**0.97**	**0.99**
Napa	1.00	1.03	1.05	1.06	1.06	1.06	1.07
San Francisco	1.43	1.46	1.51	1.52	1.53	1.51	1.49
San Mateo	0.98	0.99	1.02	1.03	1.04	1.05	1.07
Santa Clara	1.14	1.13	1.22	1.15	1.14	1.13	1.13
Solano	0.69	0.65	0.63	0.63	0.63	0.64	0.67
Sonoma	0.89	0.88	0.88	0.91	0.95	1.00	1.04
Import (Export) Workers							
	2000	2005	2010	2015	2020	2025	2030
Alameda	53,792	59,697	69,578	74,956	52,118	21,208	24,165
Contra Costa	(122,793)	(133,632)	(153,780)	(165,108)	(173,851)	(176,274)	(168,330)
Marin	**(17,991)**	**(20,011)**	**(20,501)**	**(14,120)**	**(9,482)**	**(5,665)**	**(2,136)**
Napa	(277)	1,958	3,437	4,626	5,147	5,276	6,001
San Francisco	189,597	200,895	233,205	248,439	261,580	266,746	268,179
San Mateo	(7,178)	(4,138)	8,114	11,370	19,312	23,150	35,860
Santa Clara	133,277	124,787	214,263	173,604	168,836	164,804	168,261
Solano	(56,306)	(71,571)	(86,335)	(93,161)	(100,221)	(106,164)	(100,826)
Sonoma	(24,086)	(30,140)	(31,938)	(25,689)	(14,485)	(798)	11,916

Source: ABAG Projections 2003

Table 10: Marin Jobs/Housing Balance

Employed Residents							
	2000	2005	2010	2015	2020	2025	2030
Mill Valley/Saulsalito*	50,348	51,628	54,207	55,310	56,198	57,199	58,119
Novato*	32,043	33,415	36,595	38,652	39,905	40,773	41,503
San Rafael*	58,564	60,258	63,795	64,736	65,295	65,925	66,478
Marin County	140,955	145,301	154,597	158,698	161,398	163,897	166,100
Total Jobs							
	2000	2005	2010	2015	2020	2025	2030
Mill Valley/Saulsalito*	42,175	42,666	44,639	46,965	49,388	51,911	54,815
Novato*	27,878	28,582	32,455	38,201	41,499	43,864	45,295
San Rafael*	52,911	54,042	57,002	59,412	61,029	62,457	63,854
Marin County	122,964	125,290	134,096	144,578	151,916	158,232	163,964
Jobs/Residents Ratio							
	2000	2005	2010	2015	2020	2025	2030
Mill Valley/Saulsalito*	0.84	0.83	0.82	0.85	0.88	0.91	0.94
Novato*	0.87	0.86	0.89	0.99	1.04	1.08	1.09
San Rafael*	0.90	0.90	0.89	0.92	0.93	0.95	0.96
Marin County	0.87	0.86	0.87	0.91	0.94	0.97	0.99
Import (Export) Workers							
	2000	2005	2010	2015	2020	2025	2030
Mill Valley/Saulsalito*	(8,173)	(8,962)	(9,568)	(8,345)	(6,810)	(5,288)	(3,304)
Novato*	(4,165)	(4,833)	(4,140)	(451)	1,594	3,091	3,792
San Rafael*	(5,653)	(6,216)	(6,793)	(5,324)	(4,266)	(3,468)	(2,624)
Marin County	(17,991)	(20,011)	(20,501)	(14,120)	(9,482)	(5,665)	(2,136)

Note: * City Sphere of Influence
Source: ABAG Projections 2003

Based on the ABAG 2003 projections, the jobs/housing balance should be substantially better in 2030 with significantly reduced need for long-distance commuting in Sonoma and Marin Counties. In 2030, Sonoma County is expected to have 321,013 jobs and 309,097 employed residents. Sonoma County will have to import at least 11,916 workers to jobs inside the County. Marin County is expected to have 164,964 jobs and 166,100 employed residents. Marin County will have to export only 2,136 workers to jobs outside the county. In San Francisco, there are projected to be 815,680 jobs and 547,501 employed residents. San Francisco will have to import at least 268,179 workers to fill their jobs.

3.6. Transit Headway

The performance measure "transit headway" presents the time intervals, or headways, between transit vehicles. Proper headways ensure that individual routes operate at frequencies that are appropriate to the type of service they provide and adequately address both existing and potential ridership demand.

The following transit routes are considered a portion of the congestion management transportation

system. Their effective headways are shown below.

Golden Gate Transit Basic Service

- Route 10, Tiburon to Sausalito (30 min)
- Route 26, San Francisco to San Anselmo via San Rafael (30 min)
- Route 40, San Rafael to Richmond (20 min)
- Route 70, Novato to SF (included in Route 80)
- Route 80, Santa Rosa to SF (30 min)

Golden Gate Transit Commute Service to San Francisco (unless otherwise noted)

- Route 2, Marin City/Sausalito (15 min)
- Route 4, Mill Valley (10 min)
- Route 8, Tiburon/Belvedere (25 min)
- Route 18, Kentfield (College of Marin) (15 min)
- Route 24, Inverness/Fairfax (10 min)
- Route 26, Sleepy Hollow/San Anselmo (25 min)
- Route 38, Terra Linda (15 min)
- Route 44, Lucas Valley (25 min)
- Route 54, San Marin/Novato to San Francisco (10 min)
- Route 56, San Marin/Novato (30 min)
- Route 71, Santa Rosa to San Rafael (30 min)
- Route 75, Santa Rosa to San Rafael (30 min)
- Route 97, San Rafael to SF via Larkspur Ferry Terminal (1 per day)

Golden Gate Transit Local Service

- Route 21, Kentfield to Mill Valley (30 min)
- Route 22, San Rafael to Sausilito (60 min)
- Route 23, Fairfax to Marin Civic Center (30 min)
- Route 29, San Rafael to San Anselmo (30 Min)
- Route 35, San Rafael to Canal Area (30 min)

3.7. Transit Coordination

This performance measure considers the extent to which transit service is integrated between service types and modes and with other transit services within the county or in adjacent counties. The coordination of regional transit services enhances seamless regional transit travel. Transit schedule coordination can be measured at key transfer facilities between local and regional services.

The measures and targets for improving transit coordination in Marin County are listed below:

- Convenient transfers within Marin County. Target: Continued operation of existing transfer locations, and effort to establish additional transfer locations and facilities.
- Convenience of regional transit connections. Target: Continued coordination of regional services and fares with those of other local transit operators in Marin, San Francisco and

Sonoma counties, and work toward joint fare agreements and service coordination with other public transit operators in the Bay Area.

- Level of coordination with other modes. Target: Continue to work with ridesharing agencies to increase the number of vanpools and carpools to jobs in Marin and San Francisco, as well as to facilitate bicycle and pedestrian access to transit routes.
- Discount fares for seniors and youth. Target: Continue to provide transit fare discounts for seniors age 65 or older and students age 6-18.
- Deficiency plan participation. Target: Work with local operators, local jurisdictions and the Bay Area Air Quality Management District to implement transit improvements as potential deficiency plan actions.

Local jurisdictions must consider whether or not the services noted above will result in transit accommodating the necessary share of trips during peak periods of congestion (e.g., the P.M. peak hour) so that the chosen Highway Level of Service (LOS) Standards can be met. It will be necessary for local jurisdictions to work closely with all transit operators (e.g., Golden Gate, Marin Transit District, Blue and Gold Fleet, Whistlestop Wheels, Marin Airporter, etc.) to ensure that transit services remain effective, as well as identify the costs (and anticipated sources of any needed funding subsidies) of needed improvements in transit service.

TAM continues to work with local governments and transit agencies to ensure that any transit improvements identified are reasonable, and can be funded and implemented in the time frame they are proposed. All participating agencies must consider transit service performance measures as potential actions when developing a deficiency plan. A requirement to meet the CMP performance measure targets may be enacted for particular transit services recommended as a deficiency plan action.

3.8. Pedestrian and Bicycle Investment

The purpose of this measure is to ensure that pedestrian and bicycle travel is being accommodated in new transportation improvement projects. Because the capital improvement program is a component of the CMP and pedestrian and bicycle improvements contribute to improved transportation system options, a separate measurement of pedestrian and bicycle improvement should be provided. This measure will reflect the extent to which pedestrian and bicycle facilities are included in the design of all transportation projects, as appropriate, in the CMP's Capital Improvement Program.

Marin County routinely applies for and spends the TDA funds available for bicycle and pedestrian projects each year. Additionally, the County includes bicycle and pedestrian components in capital projects whenever appropriate. Recognizing the importance of bicycle and pedestrian projects in the community, the County has undertaken a Countywide Pedestrian Bicycle Master Plan effort as a basis for prioritizing and implementing improvements for both near-term and long-range development.

Appendix F1
Traffic Count Data

Location #	Location Description	Direction	PM Peak Hour Count [1][3]	Peak Hour Factor [2]	Count Date	Count Day of Week	Lanes	Capacity	Volume / Capacity	Level Of Service [4]
1	SR 1 n/o Sir Francis Drake Blvd (Sir Francis Drake Blvd to Point Reyes Station)	Northwest bound	124	0.98	May 17, 2005	Tuesday	1	2000	0.062	A
2	US 101 north of Sonoma Co Line (Atherton Ave to Sonoma Co line)	Northbound	3664	0.99	May 24, 2005	Tuesday	2	4000	0.83	C [5]
		Southbound	2535	1.00	May 24, 2005	Tuesday	2	4000	0.58	
3	Novato Blvd e/o San Marin Dr (San Marin Dr to Eucalyptus Ave)	Westbound	346	0.96	May 17, 2005	Tuesday	1	800	0.16	A
4	Novato Blvd w/o US 101 (Sunset Parkway to US 101)	Westbound	475	0.97	May 17, 2005	Tuesday	1	800	0.22	A
5	SR 37 e/o US 101 (US 101 to Atherton Ave)	Eastbound	2302	0.98	May 17, 2005	Tuesday	2	2000	0.52	B
6	Bel Marin Keys e/o US 101 (US 101 to Commercial Blvd)	Eastbound	543	1.00	June 28,2005	Tuesday	2	1600	0.12	A
		Westbound	1253	0.99	June 28,2005	Tuesday	2	1600	0.28	A
6	Nave Dr n/o US 101 Northbound off (Us 101 to Commercial Blvd))	Northbound	528	0.93	May 17, 2005	Tuesday	3	2400	0.22	A
7	US 101 s/o Lucas Valley Rd (Freitas Parkway to Lucas Valley Rd)	Northbound	7748	0.98	May 17, 2005	Tuesday	3	6000	1.29	F
	HOV volume		945		2003	Tuesday	1	1650	0.57	B
8	US 101 n/o Mission Ave (Mission Ave to N San Pedro Rd)	Northbound	8602	0.97	May 24, 2005	Tuesday	4	8000	0.98	E
9	Sir Francis Drake Blvd w/o Red Hill Ave (San Anselmo Ave to Red Hill Ave)	Westbound	1880	0.98	May 12, 2005	Thursday	2	1920	0.43	B
10	Redhill Ave e/o Sir Francis Drake Blvd (Sir Francis Drake to Hilldale Dr)	Westbound	1804	1.00	May 12, 2005	Thursday	2	2400	0.41	A
11	US 101 n/o I-580 (I-580 to Mission Ave)	Northbound	6530	1.00	May 10, 2005	Tuesday	3.5	7000	0.85	D
12	Sir Francis Drake Blvd wo Wolfe Grade (College to Wolfe Grade)	Westbound	1547	1.00	May 12, 2005	Thursday	2	2400	0.35	A
13	US 101 s/o I-580 (Sir Francis Drake Blvd to I-580)	Northbound	6214	0.98	May 24, 2005	Tuesday	3.5	7000	0.89	D
14	I - 580 w/o Sir Francis Drake Blvd (Bellam Blvd to Sir Francis Drake Blvd.)	Eastbound	1941	0.98	May 12, 2005	Thursday	2	4000	0.44	B
15	I - 580 e/o Sir Francis Drake Blvd (Sir Francis Drake to Richmond-San Rafael Bridge)	Eastbound	3271	0.99	May 10, 2005	Tuesday	2	4000	0.74	C [7]
		Westbound	3108	0.96	May 10, 2005	Tuesday	2	4000	0.71	C
16	Sir Francis Drake Blvd East e/o US 101 NB (US 101 to Larkspur Landing Circle)	Eastbound	1446	0.93	May 10, 2005	Tuesday	2	4000	0.33	B
17	US 101 n/o SR 131 (Tiburon Blvd) (Tiburon Blvd to Paradise Drive)	Northbound	7078	0.93	May 10, 2005	Tuesday	3.5	7000	1.01	F
	HOV volume		1101		2003	Tuesday	1	1650	0.67	C
17	US 101 n/o SR 131 (Tiburon Blvd) nb on ramp	Northbound	1855	0.88	May 10, 2005	Tuesday	1	2000	0.93	D
17	US 101 n/o SR 131 (Tiburon Blvd) (Tiburon Blvd to Paradise Drive) Total	Northbound	9002	0.93	May 10,2005	Tuesday	See above rows			
18	SR 131 Tiburon Blvd w/o E Strawberry Dr (Redwood Hwy Frontage Rd to East Strawberry Dr)	Eastbound	1449	0.99	May 10, 2005	Tuesday	2	1920	0.75	C
19	SR 1 e/o Almonte Blvd	Northwest bound	1575	0.99	May 3, 2005	Tuesday	1	800	1.97	F
19	SR 1 East of Flamingo Rd	Eastbound	734	0.92	June 28, 2005	Tuesday	2	1600	0.46	A
19	SR 1 East of Flamingo Rd	Westbound	842	0.92	June 28, 2005	Tuesday	2	1600	0.53	A
20	Bridgeway s/o Gate 6 (Gate 5 to Gate 6)	Northbound	1258	0.99	May 3, 2005	Tuesday	2	1920	0.66	C
21	US 101 s/o Spencer Ave (Spencer to Goldengate Bridge northern end)	Northbound	5486	0.99	May 3, 2005	Tuesday	4	8000	0.69	C
		Southbound	3575	0.97	May 3, 2005	Tuesday	4	8000	0.45	B

22	Sir Francis Drake Blvd w/o Butterfield Rd (Butterfield Rd to Willow Ave)	Westbound	910	0.99	May 12, 2005	Thursday	2	1920	0.47	A
23	Sir Francis Drake Blvd w/o College Ave (College Ave to Toussin Ave)	Westbound	1120	1.00	May 12, 2005	Thursday	1	960	1.17	F
24	Novato Blvd at Diablo Ave (Grant Ave to Diablo Ave)	North/South	1543/1859	1.00	July 13, 2005	Wednesday	1	960	1.94	F [8]
		East/West	2016/2652	1.00	July 13, 2005	Wednesday	1	960	2.76	F [8]
24	Novato Blvd w/o Diablo Ave	Westbound	912	1.00	July 13, 2005	Wednesday	1	960	0.95	E

1) The PM peak hour is typically 4:45 to 5:45 PM,or 5 to 6 PM.
2) Peak hour factor is peak hour volume divided by the 4 highest 15 minute volumes.
3) The highest 4 15-minute intervals counted are in the peak hour.
4) Levels of service are estimated for Basic Freeways segments at up to 0.35 A, up to 0.54 B, up to 0.77 C up to 0.93D, up to 1.00 E, and or Major Arterials up to 0.60 A, up to 0.70 B, up to 0.80 C, up to 0.90 D and up to 1.00 E
5) Bottlenecks in adjoining segments above or below the segment may be affecting the V/C and therefore the displayed LOS.
6) The demand at this location is higher than the count due to the metering at the Highway to expressway conversion and lane drop north of Atherton Ave.
7) The evening peak capacity on this segment has been erratic due to the seismic retrofit and resurfacing and the evening demand may also be variable due to Bay Bridge work and congestion on I-80.
8) Intersection turning movement analysis shows the intersection which should be the constraint operates at LOS D or better.

Appendix G
FUTURE TRANSPORTATION DEMAND

Land Development

ABAG 2003 Projections - Generally Includes city spheres

	Exist 2005	Projected 2015	Change 2005 to 2015
Belvedere			
Sum households	970	990	20
Total Jobs	470	470	0
Corte Madera			
Sum households	3,930	4,110	180
Total jobs	9,640	10,820	1,180
Fairfax			
Sum households	3,810	3,960	150
Total jobs	1,490	1,600	110
Larkspur			
Sum households	8,880	9,600	720
Total jobs	10,240	11,470	1,230
Mill Valley			
Sum households	10,900	11,370	470
Total jobs	8,190	8,480	290
Novato			
Sum households	21,200	23,980	2,780
Total jobs	25,900	34,750	8,850
Ross			
Sum households	770	790	20
Total jobs	1,230	1,260	30
San Anselmo			
Sum households	6,160	6,290	130
Total jobs	3,840	3,940	100
San Rafael			
Sum households	27,840	29,600	1,760
Total jobs	43,210	47,810	4,600
Sausalito			
Sum households	5,940	6,210	270
Total jobs	5,440	6,170	730
Tiburon			
Sum households	6,660	6,900	240
Total jobs	3,750	4,120	370
Unincorporated			
Sum households	5,630	5,980	350
Total jobs	11,890	13,700	1,810
Countywide			
Sum households	**102,690**	**109,780**	**7,090**
Total jobs	**125,290**	**144,590**	**19,300**

Assumed Transportation Network Changes

The HOV Gap Closure is complete through central San Rafael, so there is continuous HOV from SR1 to Hwy 37. There are no HOV lanes through the Marin Sonoma Narrows. There is no commuter or light rail between Cloverdale and San Rafael or Larkspur. The transit system is as it existed in summer 2005.

Appendix H
CONGESTION MANAGEMENT PROGRAM
CALIFORNIA GOVERNMENT CODE

{**Caution**}

CALIFORNIA GOVERNMENT CODE

65088. The Legislature finds and declares all of the following:

(a) Although California's economy is critically dependent upon transportation, its current transportation system relies primarily upon a street and highway system designed to accommodate far fewer vehicles than are currently using the system.

(b) California's transportation system is characterized by fragmented planning, both among jurisdictions involved and among the means of available transport.

(c) The lack of an integrated system and the increase in the number of vehicles are causing traffic congestion that each day results in 400,000 hours lost in traffic, 200 tons of pollutants released into the air we breathe, and three million one hundred thousand dollars ($3,100,000) added costs to the motoring public.

(d) To keep California moving, all methods and means of transport between major destinations must be coordinated to connect our vital economic and population centers.

(e) In order to develop the California economy to its full potential, it is intended that federal, state, and local agencies join with transit districts, business, private and environmental interests to develop and implement comprehensive strategies needed to develop appropriate responses to transportation needs.

(f) In addition to solving California's traffic congestion crisis, rebuilding California's cities and suburbs, particularly with affordable housing and more walkable neighborhoods, is an important part of accommodating future increases in the state's population because homeownership is only now available to most Californians who are on the fringes of metropolitan areas and far from employment centers.

(g) The Legislature intends to do everything within its power to remove regulatory barriers around the development of infill housing, transit-oriented development, and mixed use commercial development in order to reduce regional traffic congestion and provide more housing choices for all Californians.

(h) The removal of regulatory barriers to promote infill housing, transit-oriented development, or mixed use commercial development does not preclude a city or county from holding a public hearing nor finding that an individual infill project would be adversely impacted by the surrounding environment or transportation patterns.
65088.

1. As used in this chapter the following terms have the following meanings:

(a) Unless the context requires otherwise, "regional agency" means the agency responsible for preparation of the regional transportation improvement program.

(b) Unless the context requires otherwise, "agency" means the agency responsible for the preparation and adoption of the congestion management program.

(c) "Commission" means the California Transportation Commission.

(d) "Department" means the Department of Transportation.

(e) "Local jurisdiction" means a city, a county, or a city and county.

(f) "Parking cash-out program" means an employer-funded program under which an employer offers to provide a cash allowance to an employee equivalent to the parking subsidy that the employer would otherwise pay to

provide the employee with a parking space. "Parking subsidy" means the difference between the out-of-pocket amount paid by an employer on a regular basis in order to secure the availability of an employee parking space not owned by the employer and the price, if any, charged to an employee for use of that space. A parking cash-out program may include a requirement that employee participants certify that they will comply with guidelines established by the employer designed to avoid neighborhood parking problems, with a provision that employees not complying with the guidelines will no longer be eligible for the parking cash-out program.

(g) "Infill opportunity zone" means a specific area designated by a city or county, pursuant to subdivision (c) of Section 65088.4, zoned for new compact residential or mixed use development within one-third mile of a site with an existing or future rail transit station, a ferry terminal served by either a bus or rail transit service, an intersection of at least two major bus routes, or within 300 feet of a bus rapid transit corridor, in counties with a population over 400,

000. The mixed use development zoning shall consist of three or more land uses that facilitate significant human interaction in close proximity, with residential use as the primary land use supported by other land uses such as office, hotel, health care, hospital, entertainment, restaurant, retail, and service uses. The transit service shall have maximum scheduled headways of 15 minutes for at least 5 hours per day. A qualifying future rail station shall have broken ground on construction of the station and programmed operational funds to provide maximum scheduled headways of 15 minutes for at least 5 hours per day.

(h) "Interregional travel" means any trips that originate outside the boundary of the agency. A "trip" means a one-direction vehicle movement. The origin of any trip is the starting point of that trip. A roundtrip consists of two individual trips.

(i) "Level of service standard" is a threshold that defines a deficiency on the congestion management program highway and roadway system which requires the preparation of a deficiency plan. It is the intent of the Legislature that the agency shall use all elements of the program to implement strategies and actions that avoid the creation of deficiencies and to improve multimodal mobility.

(j) "Multimodal" means the utilization of all available modes of travel that enhance the movement of people and goods, including, but not limited to, highway, transit, nonmotorized, and demand management strategies including, but not limited to, telecommuting. The availability and practicality of specific multimodal systems, projects, and strategies may vary by county and region in accordance with the size and complexity of different urbanized areas.

(k) "Performance measure" is an analytical planning tool that is used to quantitatively evaluate transportation improvements and to assist in determining effective implementation actions, considering all modes and strategies. Use of a performance measure as part of the program does not trigger the requirement for the preparation of deficiency plans.

(l) "Urbanized area" has the same meaning as is defined in the 1990 federal census for urbanized areas of more than 50,000 population.

(m) "Bus rapid transit corridor" means a bus service that includes at least four of the following attributes:

(1) Coordination with land use planning.

(2) Exclusive right-of-way.

(3) Improved passenger boarding facilities.

(4) Limited stops.

(5) Passenger boarding at the same height as the bus.

(6) Prepaid fares.

(7) Real-time passenger information.

(8) Traffic priority at intersections.

(9) Signal priority.

(10) Unique vehicles. 65088.

3. This chapter does not apply in a county in which a majority of local governments, collectively comprised of the city councils and the county board of supervisors, which in total also represent a majority of the population in the county, each adopt resolutions electing to be exempt from the congestion management program. 65088.

4. (a) It is the intent of the Legislature to balance the need for level of service standards for traffic with the need to build infill housing and mixed use commercial developments within walking distance of mass transit facilities, downtowns, and town centers and to provide greater flexibility to local governments to balance these sometimes competing needs.

(b) Notwithstanding any other provision of law, level of service standards described in Section 65089 shall not

apply to the streets and highways within an infill opportunity zone. The city or county shall do either of the following:

(1) Include these streets and highways under an alternative areawide level of service standard or multimodal composite or personal level of service standard that takes into account both of the following:

(A) The broader benefits of regional traffic congestion reduction by siting new residential development within walking distance of, and no more than one-third mile from, mass transit stations, shops, and services, in a manner that reduces the need for long vehicle commutes and improves the jobs-housing balance.

(B) Increased use of alternative transportation modes, such as mass transit, bicycling, and walking.

(2) Approve a list of flexible level of service mitigation options that includes roadway expansion and investments in alternate modes of transportation that may include, but are not limited to, transit infrastructure, pedestrian infrastructure, and ridesharing, vanpool, or shuttle programs.

(c) The city or county may designate an infill opportunity zone by adopting a resolution after determining that the infill opportunity zone is consistent with the general plan and any applicable specific plan. A city or county may not designate an infill opportunity zone after December 31,

2009.

(d) The city or county in which the infill opportunity zone is located shall ensure that a development project shall be completed within the infill opportunity zone not more than four years after the date on which the city or county adopted its resolution pursuant to subdivision (c). If no development project is completed within an infill opportunity zone by the time limit imposed by this subdivision, the infill opportunity zone shall automatically terminate. 65088.

5. Congestion management programs, if prepared by county transportation commissions and transportation authorities created pursuant to Division 12 (commencing with Section 130000) of the Public Utilities Code, shall be used by the regional transportation planning agency to meet federal requirements for a congestion management system, and shall be incorporated into the congestion management system.

65089. (a) A congestion management program shall be developed, adopted, and updated biennially, consistent with the schedule for adopting and updating the regional transportation improvement program, for every county that includes an urbanized area, and shall include every city and the county. The program shall be adopted at a noticed public hearing of the agency. The program shall be developed in consultation with, and with the cooperation of, the transportation planning agency, regional transportation providers, local governments, the department, and the air pollution control district or the air quality management district, either by the county transportation commission, or by another public agency, as designated by resolutions adopted by the county board of supervisors and the city councils of a majority of the cities representing a majority of the population in the incorporated area of the county.

(b) The program shall contain all of the following elements:

(1) (A) Traffic level of service standards established for a system of highways and roadways designated by the agency. The highway and roadway system shall include at a minimum all state highways and principal arterials. No highway or roadway designated as a part of the system shall be removed from the system. All new state highways and principal arterials shall be designated as part of the system, except when it is within an infill opportunity zone. Level of service (LOS) shall be measured by Circular 212, by the most recent version of the Highway Capacity Manual, or by a uniform methodology adopted by the agency that is consistent with the Highway Capacity Manual. The determination as to whether an alternative method is consistent with the Highway Capacity Manual shall be made by the regional agency, except that the department instead shall make this determination if either (i) the regional agency is also the agency, as those terms are defined in Section 65088.1, or (ii) the department is responsible for preparing the regional transportation improvement plan for the county.

(B) In no case shall the LOS standards established be below the level of service E or the current level, whichever is farthest from level of service A except when the area is in an infill opportunity zone. When the level of service on a segment or at an intersection fails to attain the established level of service standard outside an infill opportunity zone, a deficiency plan shall be adopted pursuant to Section 65089.

4.

(2) A performance element that includes performance measures to evaluate current and future multimodal system performance for the movement of people and goods. At a minimum, these performance measures shall incorporate highway and roadway system performance, and measures established for the frequency and routing of public transit, and for the coordination of transit service provided by separate operators. These performance measures shall support mobility, air quality, land use, and economic objectives, and shall be used in the

development of the capital improvement program required pursuant to paragraph (5), deficiency plans required pursuant to Section 65089.4, and the land use analysis program required pursuant to paragraph (4).

(3) A travel demand element that promotes alternative transportation methods, including, but not limited to, carpools, vanpools, transit, bicycles, and park-and-ride lots; improvements in the balance between jobs and housing; and other strategies, including, but not limited to, flexible work hours, telecommuting, and parking management programs. The agency shall consider parking cash-out programs during the development and update of the travel demand element.

(4) A program to analyze the impacts of land use decisions made by local jurisdictions on regional transportation systems, including an estimate of the costs associated with mitigating those impacts. This program shall measure, to the extent possible, the impact to the transportation system using the performance measures described in paragraph (2). In no case shall the program include an estimate of the costs of mitigating the impacts of interregional travel. The program shall provide credit for local public and private contributions to improvements to regional transportation systems. However, in the case of toll road facilities, credit shall only be allowed for local public and private contributions which are unreimbursed from toll revenues or other state or federal sources. The agency shall calculate the amount of the credit to be provided. The program defined under this section may require implementation through the requirements and analysis of the California Environmental Quality Act, in order to avoid duplication.

(5) A seven-year capital improvement program, developed using the performance measures described in paragraph (2) to determine effective projects that maintain or improve the performance of the multimodal system for the movement of people and goods, to mitigate regional transportation impacts identified pursuant to paragraph (4). The program shall conform to transportation-related vehicle emission air quality mitigation measures, and include any project that will increase the capacity of the multimodal system. It is the intent of the Legislature that, when roadway projects are identified in the program, consideration be given for maintaining bicycle access and safety at a level comparable to that which existed prior to the improvement or alteration. The capital improvement program may also include safety, maintenance, and rehabilitation projects that do not enhance the capacity of the system but are necessary to preserve the investment in existing facilities.

(c) The agency, in consultation with the regional agency, cities, and the county, shall develop a uniform data base on traffic impacts for use in a countywide transportation computer model and shall approve transportation computer models of specific areas within the county that will be used by local jurisdictions to determine the quantitative impacts of development on the circulation system that are based on the countywide model and standardized modeling assumptions and conventions. The computer models shall be consistent with the modeling methodology adopted by the regional planning agency. The data bases used in the models shall be consistent with the data bases used by the regional planning agency. Where the regional agency has jurisdiction over two or more counties, the data bases used by the agency shall be consistent with the data bases used by the regional agency.

(d) (1) The city or county in which a commercial development will implement a parking cash-out program that is included in a congestion management program pursuant to subdivision (b), or in a deficiency plan pursuant to Section 65089.4, shall grant to that development an appropriate reduction in the parking requirements otherwise in effect for new commercial development.

(2) At the request of an existing commercial development that has implemented a parking cash-out program, the city or county shall grant an appropriate reduction in the parking requirements otherwise applicable based on the demonstrated reduced need for parking, and the space no longer needed for parking purposes may be used for other appropriate purposes.

(e) Pursuant to the federal Intermodal Surface Transportation Efficiency Act of 1991 and regulations adopted pursuant to the act, the department shall submit a request to the Federal Highway Administration Division Administrator to accept the congestion management program in lieu of development of a new congestion management system otherwise required by the act. 65089.

1. (a) For purposes of this section, "plan" means a trip reduction plan or a related or similar proposal submitted by an employer to a local public agency for adoption or approval that is designed to facilitate employee ridesharing, the use of public transit, and other means of travel that do not employ a single-occupant vehicle.

(b) An agency may require an employer to provide rideshare data bases; an emergency ride program; a preferential parking program; a transportation information program; a parking cash-out program, as defined in subdivision (f) of Section 65088.1; a public transit subsidy in an amount to be determined by the employer;

bicycle parking areas; and other noncash value programs which encourage or facilitate the use of alternatives to driving alone. An employer may offer, but no agency shall require an employer to offer, cash, prizes, or items with cash value to employees to encourage participation in a trip reduction program as a condition of approving a plan.

(c) Employers shall provide employees reasonable notice of the content of a proposed plan and shall provide the employees an opportunity to comment prior to submittal of the plan to the agency for adoption.

(d) Each agency shall modify existing programs to conform to this section not later than June 30,

1995. Any plan adopted by an agency prior to January 1, 1994, shall remain in effect until adoption by the agency of a modified plan pursuant to this section.

(e) Employers may include disincentives in their plans that do not create a widespread and substantial disproportionate impact on ethnic or racial minorities, women, or low-income or disabled employees.

(f) This section shall not be interpreted to relieve any employer of the responsibility to prepare a plan that conforms with trip reduction goals specified in Division 26 (commencing with Section 39000) of the Health and Safety Code, or the Clean Air Act (42 U.S.C. Sec. 7401 et seq.).

(g) This section only applies to agencies and employers within the South Coast Air Quality Management District. 65089.

2. (a) Congestion management programs shall be submitted to the regional agency. The regional agency shall evaluate the consistency between the program and the regional transportation plans required pursuant to Section

65080. In the case of a multicounty regional transportation planning agency, that agency shall evaluate the consistency and compatibility of the programs within the region.

(b) The regional agency, upon finding that the program is consistent, shall incorporate the program into the regional transportation improvement program as provided for in Section

65082. If the regional agency finds the program is inconsistent, it may exclude any project in the congestion management program from inclusion in the regional transportation improvement program.

(c) (1) The regional agency shall not program any surface transportation program funds and congestion mitigation and air quality funds pursuant to Section 182.6 and 182.7 of the Streets and Highways Code in a county unless a congestion management program has been adopted by December 31, 1992, as required pursuant to Section

65089. No surface transportation program funds or congestion mitigation and air quality funds shall be programmed for a project in a local jurisdiction that has been found to be in nonconformance with a congestion management program pursuant to Section 65089.5 unless the agency finds that the project is of regional significance.

(2) Notwithstanding any other provision of law, upon the designation of an urbanized area, pursuant to the 1990 federal census or a subsequent federal census, within a county which previously did not include an urbanized area, a congestion management program as required pursuant to Section 65089 shall be adopted within a period of 18 months after designation by the Governor.

(d) (1) It is the intent of the Legislature that the regional agency, when its boundaries include areas in more than one county, should resolve inconsistencies and mediate disputes which arise between agencies related to congestion management programs adopted for those areas.

(2) It is the further intent of the Legislature that disputes which may arise between regional agencies, or agencies which are not within the boundaries of a multicounty regional transportation planning agency, should be mediated and resolved by the Secretary of Business, Housing and Transportation Agency, or an employee of that agency designated by the secretary, in consultation with the air pollution control district or air quality management district within whose boundaries the regional agency or agencies are located.

(e) At the request of the agency, a local jurisdiction that owns, or is responsible for operation of, a trip-generating facility in another county shall participate in the congestion management program of the county where the facility is located. If a dispute arises involving a local jurisdiction, the agency may request the regional agency to mediate the dispute through procedures pursuant to subdivision (d) of Section 65089.

2. Failure to resolve the dispute does not invalidate the congestion management program. 65089.

3. The agency shall monitor the implementation of all elements of the congestion management program. The department is responsible for data collection and analysis on state highways, unless the agency designates that responsibility to another entity. The agency may also assign data collection and analysis responsibilities to other owners and operators of facilities or services if the responsibilities are specified in its adopted program. The

agency shall consult with the department and other affected owners and operators in developing data collection and analysis procedures and schedules prior to program adoption. At least biennially, the agency shall determine if the county and cities are conforming to the congestion management program, including, but not limited to, all of the following:

(a) Consistency with levels of service standards, except as provided in Section 65089.

4.

(b) Adoption and implementation of a program to analyze the impacts of land use decisions, including the estimate of the costs associated with mitigating these impacts.

(c) Adoption and implementation of a deficiency plan pursuant to Section 65089.4 when highway and roadway level of service standards are not maintained on portions of the designated system. 65089.

4. (a) A local jurisdiction shall prepare a deficiency plan when highway or roadway level of service standards are not maintained on segments or intersections of the designated system. The deficiency plan shall be adopted by the city or county at a noticed public hearing.

(b) The agency shall calculate the impacts subject to exclusion pursuant to subdivision (f) of this section, after consultation with the regional agency, the department, and the local air quality management district or air pollution control district. If the calculated traffic level of service following exclusion of these impacts is consistent with the level of service standard, the agency shall make a finding at a publicly noticed meeting that no deficiency plan is required and so notify the affected local jurisdiction.

(c) The agency shall be responsible for preparing and adopting procedures for local deficiency plan development and implementation responsibilities, consistent with the requirements of this section. The deficiency plan shall include all of the following:

(1) An analysis of the cause of the deficiency. This analysis shall include the following:

(A) Identification of the cause of the deficiency.

(B) Identification of the impacts of those local jurisdictions within the jurisdiction of the agency that contribute to the deficiency. These impacts shall be identified only if the calculated traffic level of service following exclusion of impacts pursuant to subdivision (f) indicates that the level of service standard has not been maintained, and shall be limited to impacts not subject to exclusion.

(2) A list of improvements necessary for the deficient segment or intersection to maintain the minimum level of service otherwise required and the estimated costs of the improvements.

(3) A list of improvements, programs, or actions, and estimates of costs, that will (A) measurably improve multimodal performance, using measures defined in paragraphs (1) and (2) of subdivision (b) of Section 65089, and (B) contribute to significant improvements in air quality, such as improved public transit service and facilities, improved nonmotorized transportation facilities, high occupancy vehicle facilities, parking cash-out programs, and transportation control measures. The air quality management district or the air pollution control district shall establish and periodically revise a list of approved improvements, programs, and actions that meet the scope of this paragraph. If an improvement, program, or action on the approved list has not been fully implemented, it shall be deemed to contribute to significant improvements in air quality. If an improvement, program, or action is not on the approved list, it shall not be implemented unless approved by the local air quality management district or air pollution control district.

(4) An action plan, consistent with the provisions of Chapter 5 (commencing with Section 66000), that shall be implemented, consisting of improvements identified in paragraph (2), or improvements, programs, or actions identified in paragraph (3), that are found by the agency to be in the interest of the public health, safety, and welfare. The action plan shall include a specific implementation schedule. The action plan shall include implementation strategies for those jurisdictions that have contributed to the cause of the deficiency in accordance with the agency's deficiency plan procedures. The action plan need not mitigate the impacts of any exclusions identified in subdivision (f). Action plan strategies shall identify the most effective implementation strategies for improving current and future system performance.

(d) A local jurisdiction shall forward its adopted deficiency plan to the agency within 12 months of the identification of a deficiency. The agency shall hold a noticed public hearing within 60 days of receiving the deficiency plan. Following that hearing, the agency shall either accept or reject the deficiency plan in its entirety, but the agency may not modify the deficiency plan. If the agency rejects the plan, it shall notify the local jurisdiction of the reasons for that rejection, and the local jurisdiction shall submit a revised plan within 90 days addressing the agency's concerns. Failure of a local jurisdiction to comply with the schedule and requirements of this section shall be considered to be nonconformance for the purposes of Section 65089.

5.

(e) The agency shall incorporate into its deficiency plan procedures, a methodology for determining if deficiency impacts are caused by more than one local jurisdiction within the boundaries of the agency.

(1) If, according to the agency's methodology, it is determined that more than one local jurisdiction is responsible for causing a deficient segment or intersection, all responsible local jurisdictions shall participate in the development of a deficiency plan to be adopted by all participating local jurisdictions.

(2) The local jurisdiction in which the deficiency occurs shall have lead responsibility for developing the deficiency plan and for coordinating with other impacting local jurisdictions. If a local jurisdiction responsible for participating in a multi-jurisdictional deficiency plan does not adopt the deficiency plan in accordance with the schedule and requirements of paragraph (a) of this section, that jurisdiction shall be considered in nonconformance with the program for purposes of Section 65089.

5.

(3) The agency shall establish a conflict resolution process for addressing conflicts or disputes between local jurisdictions in meeting the multi-jurisdictional deficiency plan responsibilities of this section.

(f) The analysis of the cause of the deficiency prepared pursuant to paragraph (1) of subdivision (c) shall exclude the following:

(1) Interregional travel.

(2) Construction, rehabilitation, or maintenance of facilities that impact the system.

(3) Freeway ramp metering.

(4) Traffic signal coordination by the state or multi-jurisdictional agencies.

(5) Traffic generated by the provision of low-income and very low income housing.

(6) (A) Traffic generated by high-density residential development located within one-fourth mile of a fixed rail passenger station, and

(B) Traffic generated by any mixed use development located within one-fourth mile of a fixed rail passenger station, if more than half of the land area, or floor area, of the mixed use development is used for high density residential housing, as determined by the agency.

(g) For the purposes of this section, the following terms have the following meanings:

(1) "High density" means residential density development which contains a minimum of 24 dwelling units per acre and a minimum density per acre which is equal to or greater than 120 percent of the maximum residential density allowed under the local general plan and zoning ordinance. A project providing a minimum of 75 dwelling units per acre shall automatically be considered high density.

(2) "Mixed use development" means development which integrates compatible commercial or retail uses, or both, with residential uses, and which, due to the proximity of job locations, shopping opportunities, and residences, will discourage new trip generation. 65089.

5. (a) If, pursuant to the monitoring provided for in Section 65089.3, the agency determines, following a noticed public hearing, that a city or county is not conforming with the requirements of the congestion management program, the agency shall notify the city or county in writing of the specific areas of nonconformance. If, within 90 days of the receipt of the written notice of nonconformance, the city or county has not come into conformance with the congestion management program, the governing body of the agency shall make a finding of nonconformance and shall submit the finding to the commission and to the Controller.

(b) (1) Upon receiving notice from the agency of nonconformance, the Controller shall withhold apportionments of funds required to be apportioned to that nonconforming city or county by Section 2105 of the Streets and Highways Code.

(2) If, within the 12-month period following the receipt of a notice of nonconformance, the Controller is notified by the agency that the city or county is in conformance, the Controller shall allocate the apportionments withheld pursuant to this section to the city or county.

(3) If the Controller is not notified by the agency that the city or county is in conformance pursuant to paragraph (2), the Controller shall allocate the apportionments withheld pursuant to this section to the agency.

(c) The agency shall use funds apportioned under this section for projects of regional significance which are included in the capital improvement program required by paragraph (5) of subdivision (b) of Section 65089, or in a deficiency plan which has been adopted by the agency. The agency shall not use these funds for administration or planning purposes. 65089.

6. Failure to complete or implement a congestion management program shall not give rise to a cause of action against a city or county for failing to conform with its general plan, unless the city or county incorporates

the congestion management program into the circulation element of its general plan. 65089.

7. A proposed development specified in a development agreement entered into prior to July 10, 1989, shall not be subject to any action taken to comply with this chapter, except actions required to be taken with respect to the trip reduction and travel demand element of a congestion management program pursuant to paragraph (3) of subdivision (b) of Section

65089. 65089.

9. The study steering committee established pursuant to Section 6 of Chapter 444 of the Statutes of 1992 may designate at least two congestion management agencies to participate in a demonstration study comparing multimodal performance standards to highway level of service standards. The department shall make available, from existing resources, fifty thousand dollars ($50,000) from the Transportation Planning and Development Account in the State Transportation Fund to fund each of the demonstration projects. The designated agencies shall submit a report to the Legislature not later than June 30, 1997, regarding the findings of each demonstration project. 65089.

10. Any congestion management agency that is located in the Bay Area Air Quality Management District and receives funds pursuant to Section 44241 of the Health and Safety Code for the purpose of implementing paragraph (3) of subdivision (b) of Section 65089 shall ensure that those funds are expended as part of an overall program for improving air quality and for the purposes of this chapter.

Appendix I
Self-Certification on Monitoring (Draft)

Transportation Authority of Marin

P.O. Box 4186
San Rafael
California 94913-4186

Phone: 415/499-6570
Fax: 415/499-3799

www.tam.ca.gov

LOCAL AGENCY - ROADWAY SEGMENT COMPLIANCE SELF-CERTIFICATION

Street Name: _____

Segment Limits: _____

Requirement: Level of Service D or better is required for local arterial segments in the Congestion Management network that are not grandfathered due to operation at a lower level when the network was created per pages 7, 8 & 9 of the 2005 Marin Congestion Management Plan. If a segment does not meet this standard the Agency has 90 days to prepare a deficiency plan detailing how the agency will arrange for operations to meet the standard on the identified segment. Traffic to & from outside the county and low income households may be exempt from the LOS calculation.

The identified roadway segment operates at Level of Service D or better without considering trips from outside the County and trips to/from low income housing as detailed in the following:

Traffic Volumes	**Count Dates:**

Level of Service Evaluation: TRB 212, HCM 2000 or Transit 7f:

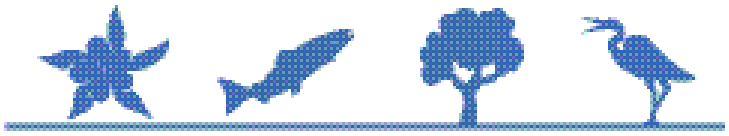
Certification: I _____ am responsible for evaluating traffic operating conditions in _____ and certify that the above level of service calculations correctly and accurately describes the traffic operations in conformance with the Marin Congestion Management agency requirements, as described above.

F:\traffic\brook\cma\05\aug\selfcert.doc

APPENDIX 1-B

AIR QUALITY BACKGROUND REPORT, APRIL 2002, UPDATED DECEMBER 2005

MARIN COUNTYWIDE PLAN



Air Quality Technical Background Report

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April 2002
Updated December 2005

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I. PURPOSE

Air quality in Marin County is very good due to favorable climate conditions and the lack of air pollutant sources. However, emissions from human activities within Marin County, i.e., mostly traffic, contribute to air quality problems experienced elsewhere in the Bay Area. The Bay Area Air Quality Management District (BAAQMD) along with other regional planning agencies relies on local jurisdictions to assist with plans to improve air quality. Many land use and transportation strategies to reduce air quality rely on cities and counties as implementing agencies. Under the California Government Code, air quality is mentioned only as an optional issue in the "Conservations" element. The BAAQMD encourages local jurisdictions to include General Plan policy ideas or elements that, when implemented, will improve air quality. Although air quality elements are not mandated, general plans are required to be consistent with any air quality policies and programs that exist within that jurisdiction. Local plans should also be consistent with regional air quality plans, i.e., the Bay Area Clean Air Plan. This background report provides a discussion of current air quality conditions and future planning efforts. Climate and meteorological conditions that affect air quality in the project area are also described.

II. PHYSICAL ENVIRONMENT

The ambient air quality in a given area depends on the quantities of pollutants emitted within the area, transport of pollutants to and from surrounding areas, local and regional meteorological conditions, as well as the surrounding topography of the air basin. Air quality is described by the concentration of various pollutants in the atmosphere. Units of concentration are generally expressed in parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The significance of a pollutant concentration is determined by comparing the concentration to an appropriate ambient air quality standard. The standards represent the allowable pollutant concentrations designed to ensure that the public health and welfare are protected, while including a reasonable margin of safety to protect the more sensitive individuals in the population.

Marin County is located in the northern portion of the San Francisco Bay Area Air Basin. The basin includes the counties of San Francisco, Santa Clara, San Mateo, Marin, Napa, Contra Costa, and Alameda, along with the southeast portion of Sonoma County and the southwest portion of Solano County. The local air quality regulatory agency responsible for this basin is the Bay Area Air Quality Management District (BAAQMD).

A. CLIMATE AND METEOROLOGICAL CONDITIONS

The climate varies throughout Marin County, depending on proximity to the Pacific Ocean and San Francisco Bay. It is mainly characterized by warm dry summers and cool moist winters. The proximity of the San Francisco Bay and Pacific Ocean has a moderating influence on the climate, especially near the coast.

The major large-scale weather feature controlling the area's climate is a large high pressure system located in the eastern Pacific Ocean, known as the Pacific High. The strength and position of the

Pacific High varies seasonally. It is strongest and located off the west coast of the United States during summer. Large-scale atmospheric subsidence associated with the Pacific High, produces an elevated temperature inversion along the West Coast. The base of this inversion is usually located from 1,000 to 3,000 feet above mean sea level, depending on the intensity of subsidence and the prevailing weather condition. Vertical mixing is often limited to the base of the inversion, trapping air pollutants in the lower atmosphere. Marine air trapped below the base of the inversion is often condensed into fog or stratus clouds by the cool Pacific Ocean. This condition is typical of the warmer months of the year from roughly May through October. Stratus clouds usually form offshore and move into the Bay Area during the evening hours. As the land warms the following morning, the clouds often dissipate, except along the immediate coast. The stratus then redevelops and moves inland late in the day. Otherwise, clear skies and dry conditions prevail during summer.

As winter approaches, the Pacific High becomes weaker and shifts south, allowing pressure systems associated with the polar jet stream to affect the region. Low pressure systems produce periods of cloudiness, strong shifting winds, and precipitation. The number of days with precipitation can vary greatly from year to year, resulting in a wide range of annual precipitation totals. Precipitation is generally lowest along the Bay, with highest amounts occurring along south and west facing slopes. Annual average precipitation totals for Marin County vary from about 30 to 50 inches. Topography results in the large variation of precipitation, with portions of southwest Marin County receiving nearly twice as much rainfall as eastern portions of the county. About 90 percent of rainfall occurs from November through April. High pressure systems are also common in winter and can produce cool stagnant conditions. Radiation fog and haze are common during extended winter periods where high pressure systems influence the weather

Topographical features of Marin County include series of mountains (mostly 1,000 feet or lower in elevation) and valleys. The valleys, where most of the population resides, act as a series of miniature air basins. Marine air penetrates much of the county; however, it is moderated by bayside conditions as it reaches the eastern portions of the county furthest from the ocean.

The proximity of the eastern Pacific High and relatively lower pressure inland produces a prevailing west to northwest sea breeze along the central and northern California coast for most of the year. As this wind is channeled through the Golden Gate and other topographical gaps, it branches off to the northeast and southeast, following the general orientation of the San Francisco Bay system. Although wind conditions vary across much of Marin, the prevailing wind is primarily from the northwest. Nocturnal winds and land breezes during the colder months of the year prevail with variable drainage out of the mountainous areas. Wind speeds are highest along coastal parts, averaging about 8 to 10 miles per year. The complex terrain throughout the County creates sufficient friction to slow airflow. At Hamilton Air Force Base, the average annual wind speeds are only 5 miles per hour.

Temperatures along the Coast and Bay tend to be less extreme compared to inland locations, due to the moderating effect of the Pacific Ocean. Coast side temperatures vary little between summer and wintertime months. In summer, high temperatures are generally in the high 50's to about 70, and in the 50's during winter. Summer high temperatures at inland portions are considerably warmer in summer ranging from the 70's to 80's. Winter high temperatures inland are also in the 50's. Low temperatures throughout the county range from the 50's in summer to the 30's in winter.

During the fall and winter months, the Pacific High can combine with high pressure over the interior regions of the western United States (known as the Great Basin High) to produce extended periods of light winds and low-level temperature inversions. Fair weather and very warm temperatures are common throughout the County with this weather pattern. This condition frequently produces poor atmospheric mixing that results in degraded regional air quality. Ozone standards traditionally are exceeded when this condition occurs during the warmer months of the year.

III. REGULATORY FRAMEWORK

A. AIR QUALITY STANDARDS

The Federal and California Clean Air Acts have established ambient air quality standards for different pollutants. National ambient air quality standards (NAAQS) were established by the federal Clean Air Act of 1970 (amended in 1977 and 1990) for six "criteria" pollutants. These criteria pollutants now include carbon monoxide (CO), ozone (0_3), nitrogen dioxide ($N0_2$), particulate matter with a diameter less than 10 microns ($PM\text{-}_{10}$), sulfur dioxide ($S0_2$), and lead (Pb). Recently, EPA added fine particulate matter or PM-2.5 as a criteria pollutant. The air pollutants that standards have been established are considered the most prevalent air pollutants that are known to be hazardous to human health.

California established ambient air quality standards as early as 1969 through the MulfordCarrol Act. Pollutants regulated under the California Clean Air Act are similar to those regulated under the Federal Clean Air Act. In many cases, California standards are more stringent than the national ambient air quality standards. Federal and State air quality standards are shown in Table 1. Both the national and California ambient air quality standards have been adopted by the BAAQMD. A brief description of the six criteria air pollutants is as follows:

TABLE 1 -- CALIFORNIA AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standards	NATIONAL STANDARDS [a]	
			Primary [b,c]	Secondary [b,d]
Ozone	8-hour	0.07 ppm (154 µg/m^3)	0.08 ppm (176µg/m^3)	–
	1-hour	0.09 ppm (180 µg/m^3)	--(e)	Same as primary
Carbon monoxide	8-hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	–
	1-hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	–
Nitrogen dioxide	Annual	–	0.053 ppm (100 µg/m^3)	Same as primary
	1-hour	0.25 ppm (470 µg/m^3)	–	–
Sulfur dioxide	Annual	–	0.03 ppm (80 µg/m^3)	–
	24-hour	0.04 ppm (105 µg/m^3)	0.14 ppm (365 µg/m^3)	–
	3-hour	–	–	0.5 ppm (1,300 µg/m^3)
	1-hour	0.25 ppm (655 µg/m^3)	–	–
PM_{10}	Annual	20 µg/m^3	50 µg/m^3	Same as primary
	24-hour	50 µg/m^3	150 µg/m^3	Same as primary
$PM_{2.5}$	Annual	12 µg/m^3	15 µg/m^3	–
	24-hour	–	65 µg/m^3	–
Lead	Calendar quarter	–	1.5 µg/m^3	Same as primary
	30-day average	1.5 µg/m^3	–	–

Notes: (a) Standards, other than for ozone and those based on annual averages, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.

(b) Concentrations are expressed first in units in which they were promulgated. Equivalent units given in parenthesis.

(c) Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health. Each state must attain the primary standards no later than 3 years after that state's implementation plan is approved by the EPA.

(d) Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

(e) The national 1-hour ozone standard was revoked by U.S. EPA on June 15, 2005.

Ozone. Ground-level ozone is the principal component of smog. It is not directly emitted into the atmosphere, but is formed by the photochemical reaction of reactive organic gases and nitrogen oxides (known as ozone precursors) in the presence of sunlight. Ozone levels are highest during late spring through early summer when precursor emissions are high and meteorological conditions are favorable for the complex photochemical reactions to occur. Approximately half of the reactive organic gas and nitrogen oxide emissions in the Bay Area are from motor vehicles. Adverse health effects of ground-level ozone include respiratory impairment and eye irritation. High ozone concentrations are also a potential problem to sensitive crops such as wine grapes.

Carbon Monoxide. Carbon monoxide is a non-reactive pollutant that is highly toxic, invisible, and odorless. It is formed by the incomplete combustion of fuels. The largest source of carbon monoxide emissions is motor vehicles. Wood stoves and fireplaces also contribute to high levels of carbon monoxide. Unlike ozone, carbon monoxide is directly emitted to the atmosphere. The highest carbon monoxide concentrations occur during the nighttime and early mornings in late fall and winter. Carbon monoxide levels are strongly influenced by meteorological factors such as wind speed and atmospheric stability. Adverse health effects of carbon monoxide include the impairment of oxygen transport in the bloodstream, increase of carboxyhemoglobin, aggravation of cardiovascular disease, impairment of central nervous system function, and fatigue, headache, confusion, dizziness. Exposure to carbon monoxide can be fatal in the case of very high concentrations in enclosed places.

Nitrogen Dioxide. Nitrogen dioxide is a reddish-brown gas that is a by-product of combustion processes. Automobiles and industrial operations are the primary sources of nitrogen dioxides. Nitrogen dioxide contributes to ozone formation. Adverse health effects associated with exposure to high levels of nitrogen dioxide include the risk of acute and chronic respiratory illness.

Sulfur Dioxide. Sulfur dioxide is a colorless gas with a strong odor and potential to damage materials. It is produced by the combustion of sulfur containing fuels such as oil and coal. Refineries and chemical plants are the primary sources of sulfur dioxide emissions in the Bay Area. Sulfur dioxide concentrations in the North Bay Area are well below the ambient standards. Adverse health effects associated with exposure to high levels of sulfur dioxide include aggravation of chronic obstruction lung disease and increased risk of acute and chronic respiratory illness.

Inhalable Particulate Matter. Inhalable particulate matter or PM-l0 (particulate matter 10 microns or less in diameter) and PM-2.5 (particulate matter 2.5 microns or less in diameter) refer to a wide variety of solid or liquid particles in the atmosphere. These include smoke, dust, aerosols, and metallic oxides. Some of these particulates are considered toxic. Although particulates are found naturally in the air, most particulate matter found in the Bay Area is emitted either directly or indirectly by motor vehicles, industry, construction, agricultural activities, and wind erosion of disturbed areas. Most PM-2.5 is comprised of combustion products (i.e., soot). Small particulate matter may be inhaled, and possibly lodge in and/or irritate the lungs. Exposure to small particulate matter can also increase the risk of chronic respiratory illness with long-term exposure and altered lung function in children.

Lead. Lead occurs in the atmosphere as particulate matter. It is primarily emitted by gasoline-powered motor vehicles, although the use of lead in fuel has been virtually eliminated. Because of lead being eliminated from fuels, levels in the Bay Area have dropped dramatically. Lead concentrations in the Bay Area are well below the ambient standards.

Besides the "criteria" air pollutants, there is another group of substances found in ambient air referred to as Toxic Air Contaminants. These contaminants tend to be localized and are found in relatively low concentrations in ambient air. However, they can result in adverse chronic health effects if exposure to low concentrations occurs for long periods. They are regulated at the local, state, and federal level.

B. FEDERAL AIR QUALITY REGULATIONS

If an area does not meet the NAAQS over a set period (three years), the EPA designates it as a "nonattainment" area for that particular pollutant. The EPA requires states that have areas that do not comply with the national standards to prepare and submit air quality plans showing how the standards would be met. If the states cannot show how the standards would be met, then they must show progress toward meeting the standards. These plans are referred to as the State Implementation Plan (SIP). Under severe cases, the EPA may impose a federal plan to make progress in meeting the federal standards.

Prior to 1998, the Bay Area was a "moderate nonattainment" area for carbon monoxide due to localized exceedances of the national carbon monoxide standards in downtown San Jose and Vallejo. The carbon monoxide standards have not been exceeded since 1991. Since the region had not experienced exceedances of the carbon monoxide standards, the San Francisco Bay Area Redesignation Request and Maintenance Plan for the National Carbon Monoxide Standard was submitted to EPA in 1994. In 1998, EPA approved the plan and reclassified the area as a carbon monoxide "maintenance" area.

Prior to 1995, the San Francisco Bay Area air basin was classified by the EPA as a "moderate nonattainment" area for ozone, since some air pollutant monitors in the area routinely measure concentrations exceeding the national one-hour ozone standard. In 1993, after three years of monitoring compliance with the one-hour ozone standard, the Bay Area Air Quality Management District (BAAQMD) submitted the 1993 Ozone Maintenance Plan to the EPA to request the redesignation of the region to an ozone maintenance area. The plan included measures to maintain the attainment of the ozone NAAQS. In 1995, the EPA formally recognized that the area attained the ozone standard and approved the 1993 Ozone Maintenance Plan. The Bay Area was classified by EPA as a "maintenance" area, since the region had not violated the ozone standard for 5 years (1990-1994). However, violations of the national one-hour ozone standards occurred during the summers of 1995 and 1996. As a result, in 1997 EPA revoked the region's clean air status and designated the area as an "unclassified nonattainment" area for ozone. In April 2004, EPA designated the Bay Area as a "marginal nonattainment" area under the 8-hour ozone NAAQS. At the same time, EPA announced it would revoke the NAAQS for I-hour ozone in June 2005.

In response to the redesignation of the area back to a ozone nonattainment area, the Bay Area co-lead agencies (BAAQMD, Metropolitan Transportation Commission, and Association of Bay Area Governments) prepared and submitted the San Francisco Bay Area Ozone Attainment Plan or ozone SIP to the California Air Resources Board (CARB). This plan, which was a revision to the 1993 Ozone Maintenance Plan, was submitted to EPA in 1999. The plan includes a compilation of existing and proposed plans and regulations that govern how the region complies with the federal Clean Air Act requirements. This plan was designed to show how the region would attain the federal ozone standard by the end of the 2000 ozone season (summer) and thereafter. EPA defines attainment of the national one-hour ozone standard as when the Bay Area does record an exceedance of the ozone standard more

than 3 times in a year for three consecutive years. The Bay Area continued to violate the ozone NAAQS in 1998; therefore, attainment of the standard was not possible prior to 2000. In March 2001, EPA formerly announced that the region had not attained the one-hour ozone standard and it would only partially approve the plan. As a result, the Bay Area 2001 Ozone Attainment Plan was prepared and submitted to EPA after approval by the CARB. This is the most current plan for reducing ozone levels to meet the NAAQS in the Bay Area.

For all pollutants other than ozone, the San Francisco Bay Area air basin is in attainment of the NAAQS. The Bay Area counties, including Marin County, have not measured ambient air pollutant concentrations in excess of those allowed by the NAAQS for all other criteria air pollutants.

Under Section 176(c) of the 1990 Clean Air Act Amendments, the "conformity" provisions for federal projects are outlined. Federal actions are required to conform to the requirements of a SIP and must not jeopardize efforts for a region to achieve the NAAQS. Section 176(c) also assigns primary oversight responsibility for conformity assurance to the federal agency undertaking the project, not the EPA, state, or local agency. For there to be conformity, federally supported or funded activities must not (1) cause or contribute to any new air quality standard violation, (2) increase the frequency or severity of any existing standard violation, or (3) delay the timely attainment of any standard, interim emission reduction, or other SIP milestone aimed at bringing the region into attainment.

In 1993, the U.S. EPA issued conformity regulations that addressed transportation projects (Transportation Conformity) and conformity of all other non-transportation federal actions (General Conformity). The primary requirements of the transportation conformity rule are that implementation of transportation plans or programs cannot produce more emissions of pollutants than budgeted in the latest SIP.

The EPA also has programs for identifying and regulating toxic air contaminants. The Clean Air Act requires EP A to set standards for air toxics and sharply reduce emissions of controlled chemicals. Industries were classified as major sources if they emitted certain amounts of toxic air contaminants.

C. CALIFORNIA AIR QUALITY REGULATIONS

The California Clean Air Act of 1988, amended in 1992, outlines a program for areas in the state to attain the CAAQS by the earliest practical date. The California Air Resources Board (CARB) is the state air pollution control agency. The California Clean Air Act set more stringent air quality standards for all of the pollutants covered under national standards, and additionally regulates levels of vinyl chloride, hydrogen sulfide, sulfates, and visibility-reducing particulates. If an area does not meet the CAAQS, the CARB designates the area as a nonattainment area. Based on the California standards, the Bay Area is a serious nonattainment area for ozone (since the area cannot forecast attainment of the state ozone standard in the foreseeable future). It is also a state nonattainment area for PM-10. The Bay Area has met the CAAQS for all other air pollutants. The CARB requires regions that do not meet the CAAQS for ozone to submit clean air plans that describe plans to attain the standard.

The CARB regulates the amount of air pollutants that can be emitted by new motor vehicles sold in California. Motor vehicle emissions standards have always been more stringent than federal standards since they were first imposed in 1961. The CARB has also developed 1/M and "Smog Check"

programs with the California Bureau of Automotive Repair. Inspection programs for trucks and buses have also been implemented. The CARB also has authority to set standards for fuel sold in California.

The Air Toxic "Hot Spots" Information and Assessment Act was enacted by the California Legislature. This act, known also as AB2588, is intended to identify toxic air contaminant hot spots where emissions from specific sources may expose individuals to elevated risk of adverse health effects. Businesses or establishments (including dry cleaning facilities) identified as a significant source or toxic air emissions are required to notify the affected population and provide them with information about the associated health risk. The implementation and enforcement provisions of this Act are the responsibility of the BAAQMD in Marin County.

D. REGIONAL AIR QUALITY REGULATIONS AND PLANNING

Regional air quality is regulated by the BAAQMD. The BAAQMD regulates stationary sources (with respect to federal, State, and local regulations), monitors regional air pollutant levels (including measurement of toxic air contaminants), develops air quality control strategies and conducts public awareness programs. The BAAQMD has also developed CEQA guidelines that establish significance thresholds for evaluating new projects and plans and provide guidance to lead agencies for evaluating air quality impacts of projects and plans.

As discussed above, the BAAQMD along with the other regional agencies (i.e., Association of Bay Area Governments and the Metropolitan Transportation Commission) has prepared the Ozone Attainment Plan to address the federal standard for ozone. A Carbon Monoxide Maintenance Plan was also prepared in 1994 to demonstrate how the federal carbon monoxide standard will be maintained. The Bay Area Clean Air Plan was prepared to address the more stringent requirements of the California Clean Air Act with respect to ozone. This plan includes a comprehensive strategy to reduce emissions from stationary, area, and mobile sources. The plan objective is to indicate how the region would attain the stricter state air quality standards, as mandated by the California Clean Air Act. The plan is designed to achieve a region-wide reduction of ozone precursor pollutants through the expeditious implementation of all feasible measures. Air quality plans addressing the California Clean Air Act are developed on a triennial basis, with the latest approved plan developed in 2000 (i.e., Bay Area 2000 Clean Air Plan). The new Bay Area Ozone Strategy was recently released as a draft and is expected to be approved in late 2005. This plan proposes implementation of transportation control measures (TCMs) and programs such as *Spare the Air.* Some of these measures or programs rely on local governments for implementation.

A key element in air quality planning is to make reasonably accurate projections of future human activities that are related to air pollutant emissions. Most important is vehicle activity. The BAAQMD uses population projections made by the Association of Bay Area Governments and vehicle use trends made by the Metropolitan Transportation Commission to formulate future air pollutant emission inventories. The basis for these projections comes from cities and counties. In order to provide the best plan to reduce air pollution in the Bay Area, accurate projections from local governments are necessary. When individual projects are not consistent with these projections, they cumulatively reduce the effectiveness of air quality planning in the region.

The BAAQMD administers the Toxic Air Contaminant Control Program. The main objective of this program is to reduce public exposure to toxic air contaminants. The BAAQMD has regulated air toxics

since the 1980's. To date, a risk-based approach, meaning that decisions over what sources and pollutants to control and the degree of control have been based on results of health risk assessments.

After the level of risk from a new project has been determined, a decision must be made as to the significance of this risk level. If a new source has a cancer risk of one in a million or less over a 70-year-lifetime exposure period, and will not result in non-cancer health effects, it is considered a non-significant risk and no further review of all health impacts is required. If a project has a risk greater than one in a million, it must be further evaluated in order to determine acceptability. Factors that affect acceptability include the presence of controls on the rate of emissions, the location of the site in relation to residential areas and schools, and contaminants reductions in other media such as water. In general, projects with risks greater than one in a million, but less than ten in a million, are approved if other determining factors are acceptable. In general, projects with risks greater than ten in a million are not approved. Non-approved projects may be reevaluated if emissions are reduced thus reducing their risks.

E. BAAQMD CEQA GUIDELINES

The BAAQMD has prepared CEQA Guidelines to assist lead agencies, analysts, project proponents, and other interested parties in evaluating potential air quality impacts of projects and plans proposed in the Bay Area. The guidelines recommend procedures for evaluating projects or plans and thresholds to determine whether the impacts are significant. The guidelines also provide direction for identifying measures to mitigate impacts.

The BAAQMD CEQA Guidelines recommend significance thresholds as follows:

Construction Impacts. The BAAQMD normally considers construction-related emissions as short-term in duration. PM-I0, caused by dust generation is the pollutant of greatest concern, since other emissions from construction equipment are included in emission inventories that are the basis for regional air quality planning. The BAAQMD CEQA Guidelines identify feasible control measures for emissions of PM-I0 that would greatly reduce the impacts from construction activities. Under the guidelines, proper incorporation of these measures would result in less than significant construction-related impacts to air quality.

Local Carbon Monoxide Concentrations. A project would have a significant adverse impact if it causes a violation of any air quality standard or contributes substantially to an existing or projected air quality violation.

A significant impact to local air quality is defined under the guidelines as increased carbon monoxide concentrations at the closest sensitive receptors that cause a violation of the most stringent ambient standard for carbon monoxide (20 ppm for the one-hour averaging period, 9.0 ppm for the eight-hour averaging period).

Total Emissions A significant impact on air quality is defined under the guidelines as an increase in emissions of any ozone precursor pollutant (i.e., reactive organic gases or nitrogen oxides) or PM-l0 exceeding 80 pounds per day (or 15 tons/year). Total emissions include direct and indirect emissions.

Toxic Air Contaminants. Exposing sensitive receptors or the public to substantial levels of toxic air contaminants would be considered significant. A significant impact is defined as follows: 1) the probability of contracting cancer for the Maximally Exposed Individual (MEI) exceeds ten in one million; or 2) ground-level concentrations of non-carcinogenic toxic air contaminants would result in a hazard Index greater than one for the MEI.

Odors. Any project with the potential to expose members of the public frequently to objectionable odors would be considered significant. Analysis of potential odor impacts should be analyzed for both of the following situations: 1) sources of odorous emissions locating near existing receptors, and 2) receptors locating near existing odor sources. The BAAQMD CEQA Guidelines identify screening distances between potential odor sources and receptors that should be considered when evaluating odor impacts.

Acute Hazardous Air Emissions or Accidental Releases. A determination of significance for potential impacts from accidental releases of acutely hazardous materials should be made in consultation with the local administering agency of the Risk Management Prevention Program (RMPP). This determination should be made for both projects using or storing acutely hazardous materials proposed near existing receptors as well as proposed projects locating near existing facilities that use or store these materials.

Cumulative Impacts. Any project that would individually have a significant air quality impact is also considered to have a significant cumulative air quality impact. For other projects, the determination of a significant cumulative air quality impact should be based on the consistency of the project with the Bay Area's most recently adopted Clean Air Plan. In order to show consistency with the Clean Air Plan, the project must be consistent with the Countywide Plan (i.e., not requiring a General Plan Amendment) and the Countywide Plan must be found to be consistent with population and travel assumptions used to develop the Clean Air Plan. In addition, the project and Countywide Plan must incorporate the control measures contained in the Clean Air Plan. The Clean Air Plan uses the latest population and travel estimates developed by the Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG). Projects located in a jurisdiction where the general plan is not consistent with the Clean Air Plan would be required to compare impacts of it along with recent past, present and reasonably foreseeable future projects to the thresholds described above.

Note: Although the effects of a pre-existing contaminated environment upon a proposed project may be beyond the scope of CEQA, the BAAQMD recommends that impacts of existing sources of air pollution on proposed project occupants be analyzed. Such impacts include those from toxic air contaminants, odors, and dust.

F. CARB AIR QUALITY AND LAND USE HANDBOOK

In April 2005, the CARB released the final version of the Air Quality and Land Use Handbook, which is intended to encourage local land use agencies to consider the risks from air pollution prior to making decisions that approve the siting of new sensitive receptors (e.g., homes or daycare centers) near sources of air pollution. Unlike industrial or stationary sources of air pollution, siting of new sensitive receptors does not require air quality permits, but could create air quality problems. The primary purpose of the

document is to highlight the potential health impacts associated with proximity to common air pollution sources, so that those issues are considered in the planning process. CARB makes recommendations regarding the siting of new sensitive land uses near freeways, truck distribution centers, dry cleaners, gasoline dispensing stations, and other air pollution sources. These "advisory" recommendations, summarized in Table 2, are based primarily on modeling information and may not be entirely reflective of conditions in Marin County. Siting of new sensitive land uses within these recommendation distances may be possible, but only after site-specific studies are conducted to identify the actual health risks. CARB acknowledges that land use agencies have to balance other siting considerations such as housing and transportation needs, economic development priorities and other quality of life issues.

TABLE 2 -- CARB RECOMMENDED SETBACK DISTANCES FOR COMMON SOURCES OF TOXIC AIR CONTAMINANTS

Source Type	Recommended Buffer Distance
Freeways and busy arterial roadways	- 500 feet
Distribution Centers with 100 or more daily truck trips or 40 daily truck trips that use refrigeration units	- 1,000 feet
Dry cleaners (onsite dry cleaning)	- 300 feet for any dry cleaning operation - at least 500 feet for operations with 2 or more machines
Large gasoline stations	- 50 feet for typical gas stations - up to 300 feet for large gas stations

IV. EXISTING AIR QUALITY CONDITIONS

Air quality is affected by the rate of pollutant emissions and by meteorological conditions such as wind speed, atmospheric stability, and mixing height, all of which affect the atmosphere's ability to mix and disperse pollutants. Long-term variations in air quality typically result from changes in air pollutant emissions, while short-term variations result from changes in atmospheric conditions.

A. CRITERIA AIR POLLUTANTS

1. Bay Area

In general, the San Francisco Bay Area is considered one of the cleanest major metropolitan areas in the country with respect to air quality. The air pollutants of greatest concern in to the Bay Area and Marin County are ground-level ozone and PM-10. The San Francisco Bay region as a whole does not comply with air quality standards for either pollutant.

The San Francisco Bay Area annually exceeds the California Ambient Air Quality Standard for one-hour ozone, 8-hour ozone and 24-hour average PM-10 levels. Throughout the Bay Area, the previous national one-hour ozone standard (revoked in 2005) was exceeded at one or more stations from zero to three days annually over the last five years and the new eight-hour ozone standard was exceeded from zero to seven days annually. The number of days that, on an annual basis, exceeded the more stringent one-hour State ozone standard at one or more stations in the Bay Area ranged from seven to 19 days over the last five years. The NAAQS for PM-l0 is not exceeded anywhere in the Bay Area, but the more stringent State standard is routinely exceeded in the Bay Area, as well as most other parts of the State. No other air quality standards are exceeded in the Bay Area. As a result, the San Francisco Bay region is considered nonattainment for ground-level ozone at both the State and federal level, and nonattainment for PM-I0 at the State level only. The San Francisco Bay region currently complies with State and federal standards for all other air pollutants (e.g., carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead).

Exceedances of the state and federal ozone standard are the greatest ambient air quality problem. Progress has been made in reducing this problem. Over the last 20 years, the peak one-hour concentrations throughout the Bay Area have declined more than 20 percent. The number of days that standards were exceeded shows a similar trend. The trend has not been consistently downward. Concentrations and number of exceedances generally declined from 1980 to 1994, but increased sharply from 1995 to 1998. Levels in 1999 through 2004 have declined from levels in 1995. Indications are that the Bay Area will attain the NAQQS in a timely manner; however, continued progress is required to meet the more stringent state standards ozone standards.

PM-l0 is another pollutant of concern since the area exceeds the state ambient air quality standards. Since PM-I0 sampling in the Bay Area began in 1988, mean annual levels have decreased by about 25 percent. The calculated number of annual exceedances of the 24-hour standard has decreased from a high of over 100 days in 1991 to about 50 days in 2001. The national 24-hour standard was last exceeded in 1991.

Carbon monoxide concentrations have declined substantially over the last 20 years. Current peak levels in the Bay Area are less than half of 1980 levels and neither state nor national standards have been exceeded since 1991. As a result, the area has attained the standard. Much of the decline is attributed to cleaner motor vehicles and use of cleaner burning fuels.

2. Marin County

The BAAQMD monitors air pollutant levels continuously throughout the nine-county Bay Area Air Basin. The San Rafael monitoring station is the only monitoring station in Marin County. A summary of air quality monitoring data is shown in Table 3. The values in the table are the highest air pollutant levels measured at these stations over the past 5 years (2000-2004). The number of days that measured concentrations exceeded the NAAQS or CAAQS are given in Table 4. Air quality conditions in Marin County are described for each criteria air pollutant below:

TABLE 3 -- HIGHEST MEASURED AIR POLLUTANT CONCENTRATIONS

Pollutant	Average Time	Measured Air Pollutant Levels				
		2000	2001	2002	2003	2004
San Rafael						
Ozone (03)	1- Hour	0.07 ppm	0.09 ppm	0.08 ppm	0.09 ppm	0.07 ppm
	8-Hour	0.06 ppm	0007 ppm	0006 ppm	0.07 ppm	0006 ppm
Carbon Monoxide (CO)	8- Hour	2.3 ppm	2.4 ppm	1. 9 ppm	2.0 ppm	2.3 ppm
Nitrogen Dioxide (N02)	I-Hour	0.06 ppm	0.06 ppm	0006 ppm	0.09 ppm	0007 ppm
	Annual	00016 ppm	0.013 ppm	0.017 ppm	0.018ppm	0.016ppm
Fine Particulate Matter (PM-2.5)	1- Hour	NA	NA	NA	NA	NA
	Annual	NA	NA	NA	NA	NA
Respirable Particulate Matter (PM-l 0)	24- Hour	40 ug/m^3	**74** ug/m^3	**70** ug/m^3	41 ug/m^3	40 ug/m^3
	Annual	19 ug/m^3	21 ug/m^3	21 ug/m^3	18 ug/m^3	18 ug/m^3
Bay Area (Basin Summary)						
Ozone (03)	1- Hour	**0.15** ppm	**0.13** ppm	**0.16** ppm	**0.13** ppm	**0.11** ppm
	8- Hour	**0.11** ppm	**0.10** ppm	**0.11** ppm	**0.10** ppm	0.08 ppm
Carbon Monoxide (CO)	8-Hour	6.3 ppm	5.1 ppm	4.5 ppm	4.0 ppm	3.4 ppm
Nitrogen Dioxide (N02)	1- Hour	0.11 ppm	0.11 ppm	0.08 ppm	0.09 ppm	0007 ppm
	Annual	0.025ppm	0.024ppm	0.0 14ppm	00021ppm	0.019ppm
Fine Particulate Matter (PM-2.5)	I-Hour	NA	NA	77 ug/m^3	56 ug/m^3	**74** ug/m^3
	Annual	NA	NA	14 ug/m^3	11.7 ug/m^3	11.6 ug/m^3
Respirable Particulate Matter (PM-I0)	24- Hour	**76** ug/m^3	**109** ug/m^3	**84** ug/m^3	**60** ug/m^3	**65** ug/m^3
	Annual	**24** ug/m^3	**26** ug/m^3	**25** ug/m^3	**25** ug/m^3	**26** ug/m^3

Note: ppm = parts per million

Values reported in bold exceed ambient/t air quality standard

NA = data not available

TABLE 4. SUMMARY OF MEASURED AIR QUALITY EXEEDANCES

	Standard	Monitoring Station	Days Exceeding Standard				
			2000	2001	2002	2003	2004
Ozone (0_3)	NAAQS 1-hr	San Rafael	0	0	0	0	0
		BAY AREA	3	1	2	1	0
	NAAQS 8-hr	San Rafael	0	0	0	0	0
		BAY AREA	4	7	7	7	0
	CAAQS 1-hr	San Rafael	0	0	0	0	0
		BAY AREA	12	15	16	19	7
Fine Particulate Matter (PMIO)	NAAQS 24-hr	San Rafael	0	0	0	0	0
		BAY AREA	0	0	0	0	0
	CAAQS 24-hr	San Rafael	0	2	2	0	1
		BAY AREA	7	10	6	6	7
Fine Particulate Matter (PM2s)	NAAQS 24-hr	San Rafael	0	--	--	--	--
		BAY AREA	1	5	7	0	1
All Other (CO, N02, Lead, S02)	All Other	San Rafael	0	0	0	0	0
		BAY AREA	0	0	0	0	0

Source: BAAQMD, Bay Area Air Pollution Summaries 2000-2004

Ozone. In San Rafael, state ozone levels were not exceeded over the last five years. Ozone level shave not exceeded standards since 1999. These high ozone levels in Marin County occurred in October of 1999 on a Sunday. Exhibit 1 shows ozone concentration maps produced by EPA for October 10, 1999 when the highest levels were measured at San Rafael. It should be noted that this map is based on computer interpolation of a sparse data set for the western portion of the Bay Area. On a typical day during the summer ozone season, ozone levels are usually moderate to low over Marin County, with the lowest levels occurring at the western rural portions of Marin County. This pattern occurs since prevailing winds are from the west, where there are no sources of ozone precursor emissions. During the early or late portions of the season (late spring or early fall), light easterly winds can affect ozone precursor pollutants over Marin County leading to higher concentrations, especially over the eastern portions of the County. Ozone levels in western Marin County tend to always be low to moderate due to the rural nature of the area and persistent marine influence.

Carbon Monoxide. Highest carbon monoxide concentrations measured in San Rafael have been well below the national and state ambient standards. Since the primary source of carbon monoxide in Marin County is automobiles, highest concentrations would be found near congested roadways. In particular would be local congested roadways that carry large volumes of traffic. Carbon monoxide emitted from a vehicle is highest near the origin of a trip and considerably lower when vehicles are operating in a hot-stabilized mode (usually five to ten

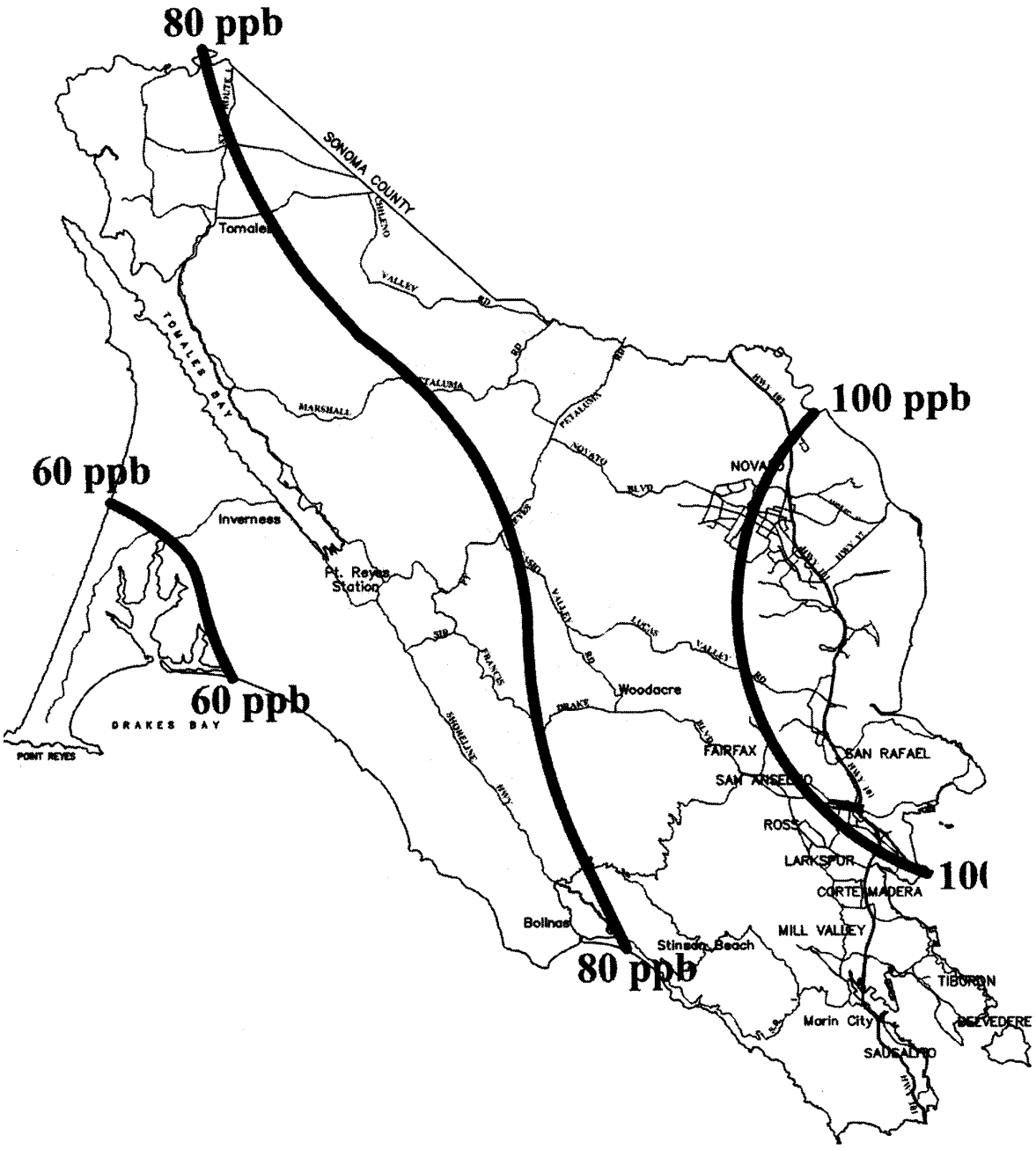
minutes into a trip). Vehicles near the origin of a trip are considered to be in Cold-Start mode. Vehicle operation on US 101 is usually in a hot-stabilized mode so the individual emission rates are much lower than those encountered on arterial roadways leading to the freeway. The highest concentrations of carbon monoxide in Marin County are likely to be found adjacent to large congested intersections, particularly in and around San Rafael.

PM-10. Measured exceedances of the PM-10 standards occurred on five separate days over the last five years. However, PM-10 is only measured once every sixth day at San Rafael (most monitoring stations measure PM10 every 6th day according to a national schedule). It is estimated that there were 30 days over the past five years that the State PM-l0 standard was exceeded. Most stations in the Bay Area reported exceedances of the State standard on the same days fall/winter days as reported in San Rafael. This indicates a regional air quality problem. Although not measured, elevated PM-10 and carbon monoxide levels in late fall and winter are a concern in sheltered valleys. The primary sources of these pollutants are wood smoke and local traffic. Meteorological conditions that are common during this time of the year result in calm winds and strong surface-based inversions that trap pollutants in these valleys. The build up of these pollutants is greatest during the evenings and early morning periods. The high levels of PM-l0 result in not only health effects, but also reduced visibility and odors.

Other Pollutants. Other criteria pollutants, such as nitrogen dioxide, sulfur dioxide, and lead have always been measured at low levels in Marin County. These pollutants should not pose a major air pollution concern in Marin County.

Additional discussion of air quality emissions in Marin County is provided on pages 25 through 27 of *Marin Profile 2005* prepared by the Marin Economic Commission.

EXHIBIT 1 -- MAP OF OZONE CONCENTRATIONS ON DAY WITH HIGHEST LEVELS IN MARIN (October 10, 1999)



Source: EP A (www.epa.gov/cgi-bin/aimow)

B. TOXIC AIR CONTAMINANTS

The BAAQMD and CARB measure concentrations of air toxics throughout the Bay Area. Compounds measured by the BAAQMD include benzene, 1,3-butadiene, carbon tetrachloride, chloroform, ethylene dibromide, ethylene dichloride, methyl tert buytl ether (MTBE), methylene chloride, acetaldehyde, perchloroethylene, toluene, 1,3-butadiene, and formaldehyde. Since the ambient concentrations of these toxic air contaminants are very small, they are measured and reported as part per billion (ppb) on a volume basis. Table 5 contains a summary of the measured concentrations for each of the compounds at the San Rafael monitoring station in 2002. Also included in Table 5 are the overall Bay Area monitoring results along with the calculated cancer risk. The information used to develop this table was obtained from the California Air Resources Board 2001 Almanac of Emissions and Air Quality (available at *http://www.arb.ca.gov/aqd/almanac/almanac.htm)* and the BAAQMD's 1999 status report for the Toxic Air Contaminant Control Program (available at http://www.baaqmd.gov/pmt/air_toxics/annual_reports/index.htm).

Table 5 reports concentrations of air toxic contaminants that pose the greatest health risk. Not all contaminants shown in Table 5 are measured at San Rafael. As can be seen from Table 5, the maximum measured toxic air contaminant concentrations in San Rafael are similar or slightly higher than overall Bay Area values. The BAAQMD conducts these measurements at the air monitoring station located on 4th Street in San Rafael. This station is in close proximity to a dry cleaning shop, which highly influences some compounds, specifically perchloroethylene. Several of the highest concentrations measured in the Bay Area were measured in San Rafael (perchloroethylene). Since the station is located in the most urbanized portion of Marin County, the levels measured are likely representative of the highest levels in Marin County.

Emissions of the major air toxic contaminants are as follows:

- Diesel particulate: Heavy-duty trucks, buses, ferries, construction equipment, and electrical generation.
- 1,3 Butadiene: Primarily on-road motor vehicles. Like carbon monoxide, older model vehicles without adequate catalytic converters have much higher emission rates.
- Benzene: Primarily on-road motor vehicles and gasoline evaporation.
- Formaldehyde: Emitted both directly and indirectly into the atmosphere. It is primarily formed through photochemical oxidation in the atmosphere with elevated levels of ozone and nitrogen oxides. Sources of emissions leading to elevated formaldehyde levels are fuel combustion from a variety of mobile and stationary sources. A primary source is from motor vehicle operations.

In 1998, the CARB identified diesel particulate matter as a toxic contaminant based on its potential to cause cancer and other adverse health effects. Typical sources of diesel exhaust in the Bay Area include trucks, buses, ships, trains, construction equipment and backup power generators. Diesel engines emit a complex mixture of air pollutants. The visible emissions are particulate matter. Some of the gaseous emissions become particulate matter after they cool or undergo chemical reactions in the atmosphere. Particulate matter from diesel is not measured. However, the CARB has conducted receptor modeling to assess the health risk potential. The health risk associated with diesel in the Bay Area is estimated to be about 500 excess cancer cases per one million people. Compared to the combined health risk value of about 200 for all of the other most prevalent toxic air contaminants, diesel particulate matter poses the greatest health risk in the Bay Area. The ARB has approved a comprehensive Diesel Risk

Reduction Plan to reduce diesel particulate matter emissions from new and existing diesel engines. The goal of the plan is to reduce diesel particulate emissions by 75 percent in 2010 and 85 percent or more by 2020.

Bay Area cancer risks represents the number of excess cancer cases per million people based on a lifetime exposure (70-year) to the annual average concentration in the Bay Area. The cancer risk reported in Table 4 is based on those annual averages reported and changes from year-to-year based on current monitoring results. It is important to note a couple of points with regard to air toxic contaminants: (1) The health risks are based on the average concentration for the entire region and the health risk at individual locations will vary considerably; and (2) Since 1990, average concentrations of toxic air contaminants and the associated health risks have been reduced (by 50 percent or more for many compounds).

C. EXISTING SOURCES OF AIR POLLUTION

Sources of air pollution in and around Marin County are primarily traffic or on-road vehicles. Table 6 summarizes emissions for Marin County and the Bay Area. For ozone, traffic accounts for 75 to 95 percent of the emissions of ozone precursor pollutants (NOx and ROG). Area wide sources, which include construction activities, residential wood smoke, off-road travel, and agriculture, account for the greatest portion of PM-I0 emissions (about 85 percent).

1. Mobile Sources

Mobile sources of air pollution make up a large portion of the emissions inventory for Marin County. Mobile sources include traffic, boats, and local aircraft. Approximately 73 percent of the ROG and 93 percent of the NOx emitted in Marin County is from mobile sources.

2. Stationary Sources

Emissions of criteria air pollutants from permitted stationary sources in Marin County can be found by facility on the ARB's website: (*http://www.arb.ca.gov/ei/maps/statema/lcntymap.htm).* Exhibit 2 shows locations of the largest (most significant) stationary air pollution sources in Marin County.

Excluding gas stations, dry cleaning facilities and repair shops, the ARB's emission inventory database indicates approximately 55 permitted facilities throughout Marin County. According to the ARB's database, the largest stationary source of nitric oxides is the Central Marin Sanitation District. The largest source of reactive organic gases is Redwood Landfill near Novato. San Rafael Rock Quarry and the Marin Sanitary Service in San Rafael are the largest stationary sources of PM-l0. These individual sources not only generate emissions directly from the facilities, but also from truck traffic associated with their operations.

3. Toxic Air Contaminants

Emissions of air toxic contaminants from stationary sources in Marin County can be found in the most recent version of the BAAQMD's annual Toxic Contaminant Control Report (see website *http://www.baaqmd.gov/pmt/airtoxics/annualreports/index.htm*). A majority of these sources are dry cleaning facilities, which emit perchloroethylene. However, the most prevalent toxic contaminants in Marin County are benzene and diesel from mobile sources and

formaldehyde, which comes from a variety of sources. Other sources of toxic air contaminants include sanitary districts or landfills, wastewater treatment facilities, and manufacturing facilities.

4. Dust

Construction and agricultural activities result in the generation of dust, which leads to elevated PM-l0 levels in the county and region. Most agricultural activities in Marin County do not occur near residential areas; and therefore, have not been a concern. Dust from construction activities can affect nearby active land uses. Activities that generate visible dust clouds extending beyond their boundaries are a source of air pollution that can be controlled.

5. Odors

Significant sources of offending odors are typically identified based on complaint histories received and compiled by the BAAQMD. It is difficult to identify sources of odors without requesting information by facility from the BAAQMD. Typical large sources of odors that result in complaints are wastewater treatment facilities, landfills, food processing facilities and agricultural operations. Other sources typically result in very localized sources of odors. Locations of odor sources in Marin County are also shown in Exhibit 2.

6. Commercial Aircraft Over Flights

Changes to commercial aircraft over flights, both increased number and changes in flight patterns, have recently become a sensitive environmental issue in Marin County. The primary issue has been noise associated with these over flights. Commercial aircraft are a source of air pollution, especially during landing and take off operations. Aircraft emit buoyant exhaust plumes that do not easily mix downward. Air pollutants that are emitted above about 3,000 feet ASL (considered the mixing height) generally do not mix with the lower atmosphere and are not considered by EPA or the BAAQMD to be part of an air basin emissions inventory[1]. Almost all commercial flights over Marin County are well above 3,000 feet. Any commercial aircraft emissions that could mix downward would be well dispersed and affect areas well downwind of Marin County (e.g., Sacramento or San Joaquin Valley). A study conducted by the Volpe National Transportation Systems Center (USDOT FAA 2000) found that under credible worst-case modeling assumptions, concentrations of carbon monoxide and hydrocarbons were negligible due to mixing. In that study, impacts from an older model Boeing 747 flying at an altitude of 3,000 feet were modeled and found to be negligible. Emissions from commercial aircraft flying over Marin County normally do not affect the local air quality. On some occasions, commercial flight tracks over Marin County are below 3,000 feet (e.g., approach to Oakland International Airport). However, emissions from these flights also are not expected to affect air quality in Marin County. The release of liquid substances from commercial aircraft (e.g., deicing agents) would be rapidly dispersed and would not be expected to affect local air quality.

[1] Mixing height or depth is the expanse in which air rises from the earth and mixes with air above it until it meets air equal or warmer in temperature (the inversion cap). The 3,000-foot value is the annual mixing height in the contiguous United States. Generally, in the morning hours the mixing height is lower than 3,000 feet and tends to increase in afternoons. For a large part of a typical day and year, the mixing heights are less than typical altitudes of aircraft operating over Marin County.

TABLE 5 -- SUMMARY OF 2002 MEASURED TOXIC AIR CONTAMINANT CONCENTRATIONS (µg/m³)

Toxic Contaminant	Concentration (in µg/m³) San Rafael	Bay Area	Unit Risk (µg/m³)⁻¹	Cancer Risk Chances in one million San Rafael	Bay Area
Gaseous TACs					
1,3-Butadiene	--	0.28	1.7E-04	--	47.6
Benzene	1.36	1.52	2.9E-05	39	44.1
Carbon Tetrachloride	0.70	0.70	4.2E-05	29	29.4
Formaldehyde	--	2.67	6.0E-06	--	16.0
Acetaldehyde	--	1.08	2.7E-06	--	2.9
Perchloroethylene	0.54	0.34	5.9E-06	3	2.0
Methylene Chloride	0.95	1.34	1.0E-06	1	1.3
MTBE	1.79	2.74	2.6E-07	1	0.7
Chloroform	0.05	0.10	5.3E-06	0	0.5
Trichloroethylene	0.20	0.10	2.0E-06	0	0.2
Particulate TACs					
Chromium (hexavalent)	--	1.00E-04	1.5E-01	--	15.0
Dioxin	--	2.50E-08	3.8E+01	--	1.0
Nickel	--	3.83E-03	2.6E-04	--	1.0
PAHs	--	4.20E-04	1.1E-03	--	0.5
Lead	--	9.17E-03	1.2E-05	--	0.1
Total for all TACs excluding diesel particulate matter				--	162

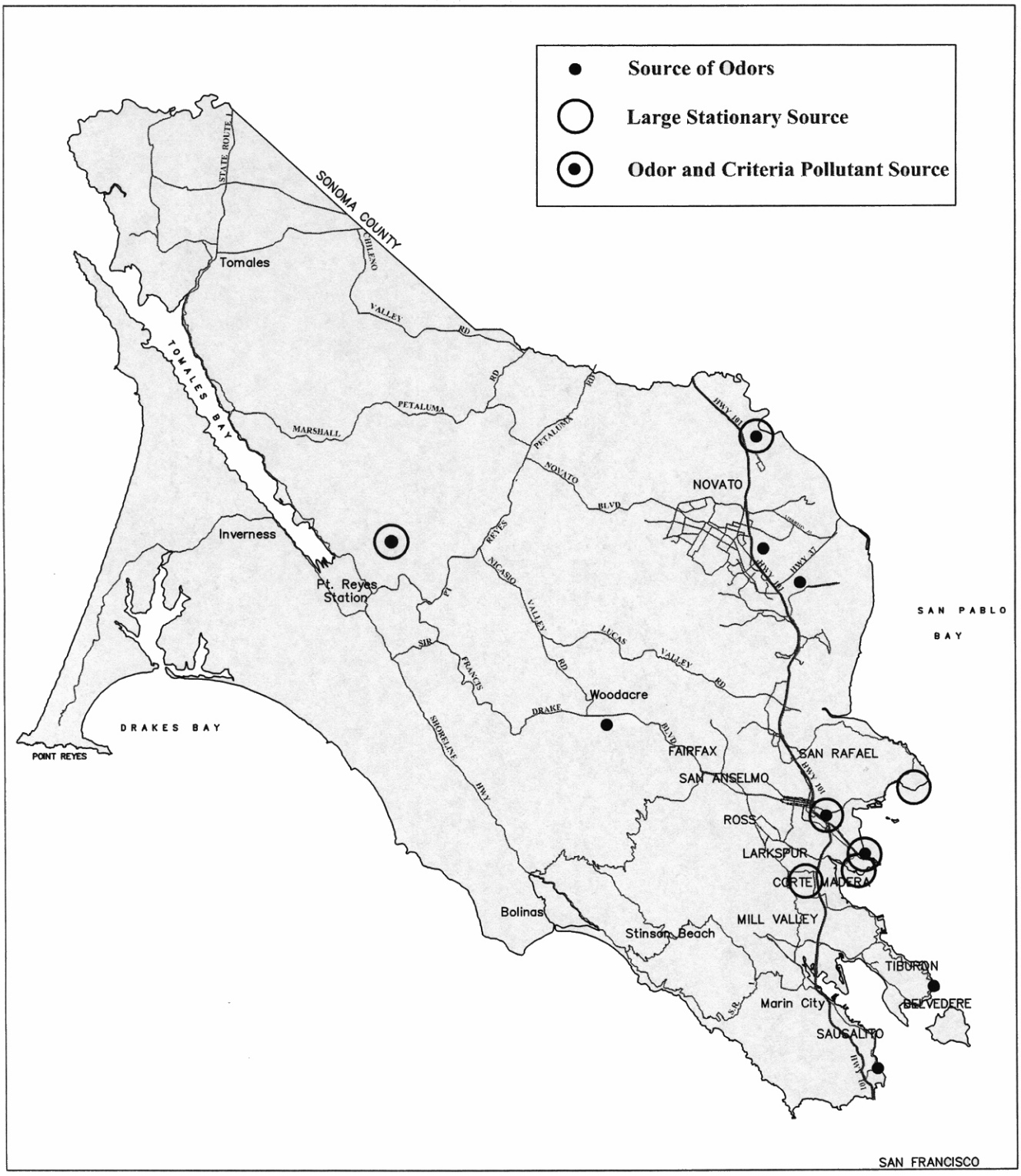
NA = data not available
PPB = parts per billion
nglm3 = nanograms of contaminant per cubic meter of air
uglm3 = micrograms of contaminant per cubic meter of air
Data reported as <x.xx indicates the concentration was below the method detection limit of x.xx.
Source: (1) Air Resources Board Almanac 2001 - Chapter 6, and (2) 1999 Status Report: BAAQMD Toxic Air Contaminant Control Program

TABLE 6. AIR POLLUTANT EMISSIONS INVENTORY IN TONS PER DAY
(for Ozone Precursors and PM-10)

Source: California Air Resources Board (http://www.arb.ca.gov/app/emsinv/fcemssumcat.html)

Source	Reactive Organic Gases (ROG)			Oxides of Nitrogen (NOx)			Particulate Matter (PM-10)		
	1995	2000	2010	1995	2000	2010	1995	2000	2010
Marin County									
Stationary Source	2.7	2.6	2.6	0.2	0.5	0.4	0.2	0.2	0.2
Area-Wide Sources	4.0	3.8	3.7	0.9	0.9	0.8	5.9	6.1	6.3
Mobile Sources	22.1	16.9	8.6	21.4	16.9	10.1	0.9	0.9	0.9
TOTAL (rounded)	29	23	15	23	18	11	7	7	8
Bay Area									
Stationary Source	138	125	126	110	89	90	21	17	19
Area-Wide Sources	94	90	86	18	17	17	125	130	135
Mobile Sources	353	319	186	531	452	303	21	21	20
TOTAL (rounded)	656	534	399	659	558	411	167	169	174

EXHIBIT 2: LOCATIONS OF LARGE STATIONARY AIR POLLUTANT SOURCES AND POTENTIAL SOURCES OF ODORS



D. SENSITIVE RECEPTORS

Sensitive receptors, people who are particularly susceptible to the adverse effects of air pollution, are generally referred to as hospitals, schools, playgrounds, childcare facilities, and convalescent facilities. The BAAQMD considers residences to also be sensitive receptors. In the past, maps have been developed that show the locations of schools, hospitals, and convalescence homes to represent sensitive receivers. These maps are not particularly useful since air quality standards are applicable to all areas and not just sensitive receptors. Many people who are susceptible to air pollution (e.g., asthmatics) also reside in residences. Both State and National ambient air quality standards were developed with intent to protect sensitive receptors from the adverse impacts of air pollution.

E. ROADSIDE CONCENTRATIONS AND HEALTH RISK

The effect of air pollution from traffic has been typically described by the resulting concentration of CO. This is usually predicted using dispersion modeling. DPM from truck traffic on freeways or busy arterials has been found to present a substantial health risk. Therefore, the impacts of DPM are analyzed for sensitive land uses near these roadways.

Carbon monoxide emissions from traffic along major roadway segments with high traffic volumes and poor level of service (LOS) were evaluated. This included County roadway segments operating at LOS of D, E, or F. The traffic-generated emissions of CO were predicted using the Caline4 line source dispersion model. The model requires inputs of geometry, traffic volumes, emission factors and meteorology. Existing traffic volumes for selected roadway segments were used. Emission factors used were calculated using the EMFAC2002 model, developed by the California Air Resources Board, with default assumptions for Marin County during winter that include a temperature of 45 deg. F. Slow speeds of 5-15 miles per hour were used to develop the emission factors. Meteorological conditions indicative of elevated CO levels in the Bay Area were used, which include a low wind speed of 1 meter per second, worst-case wind angle, and F stability. Results are reported in Table 7.

TABLE 7. MODELED ROADSIDE CARBON MONOXIDE LEVELS

Roadway Segment Description	Modeled Level*	
	1-Hour	8-hour
U.S. 101 Puerto Suello Hill	7.8 ppm	5.2 ppm
1-580 near the Richmond-San Rafael Bridge	5.7 ppm	3.7 ppm
Sir Francis Drake Blvd. West of U.S. 101	6.6 ppm	4.3 ppm
State Route 1 near Almonte Blvd.	5.6 ppm	3.6 ppm
National Ambient Air Quality Standard	35 ppm	9ppm
California Ambient Air Quality Standard	20 ppm	9.0 ppm

* Includes background level of 4 ppm for I-hour and 2.5 ppm for 8-hour

Diesel particulate matter emitted from trucks or other diesel fueled vehicles on freeways in Marin County affects local air quality. The health impacts associated with the DPM exhaust are expressed in terms of increased risk of contracting cancer by individuals who live or work near the sources, such as freeways. This analysis involved the development of DPM emissions for traffic on US 101 and 1-580 using the EMFAC2002 emission factor model with defaults for Marin County. The EMF AC results

were then adjusted to the traffic mix on US 101 and 1-580 reported by Caltrans2. Emission factors were input to the Ca13qher dispersion model that is acceptable to the BAAQMD for this type of analysis. Modeled concentrations were calculated for various distances from the edge of the freeway. The maximum individual cancer risks were computed using the BAAQMD recommended cancer risk factor of 3 x 10-4 cancer cases per µg/m3 of diesel particulate matter, which are based on "best estimates" of plausible cancer potencies as determined by the California Office Of Environmental Health Hazard Assessment. The existing cancer risk posed by traffic on freeways in Marin County is expressed in terms of distance from the edge of the travel lanes in Table 8. A risk of less than l0 in one million is considered to be less than significant under current BAAQMD CEQA Guidelines. It should be noted, as discussed previously, that emission rates of DPM from traffic are predicted to decrease substantially in the future.

TABLE 8.
SUMMARY OF DPM CANCER RISK AT DISTANCES FROM MARIN COUNTY FREEWAYS

Freeway Segment	Cancer Risk at Receptor Distance (per million)				
	50 ft	1 00 ft.	200 ft.	500 ft.	1,000 ft.
U.S. 101 Southern Marin	15	12	8	4	3
U. S. 101 Central Marin	35	27	19	10	6
U.S. 101 Northern Marin	28	22	15	8	5
1-580 east of San Rafael	29	22	15	8	4

V. AIR QUALITY TRENDS

As previously mentioned, levels of air pollution are related to emissions and meteorology. Short-term variations in air pollutant levels are generally related to changes in meteorology, while long-term variations are related to changes in emissions.

Efforts to reduce air pollutant levels are aimed primarily at reducing emissions from various sources. Other efforts, such as programs like Spare the Air are aimed at temporarily reducing emissions when weather forecasts indicate the potential for elevated air pollutant levels. The BAAQMD along with the CARB conducts detailed computer modeling of ozone levels both in the Bay Area and levels transported to other areas. The modeling is a large effort that is used to identify types of sources of air pollution to further reduce. The modeling is also conducted to predict attainment of air quality standards. Results of these studies are the basis of current air quality regulations and plans.

Table 6 shows the past (1995), near current (2000) and projected (2010) emission inventory for both Marin County and the Bay Area. The emissions inventory shown was prepared for ozone precursor pollutants (ROG and NOx) and PM-l0. Although population and vehicle activity has increased in the Bay Area, emissions of ozone precursor air pollutants have decreased. This trend is expected to continue through 2010. The majority of the decrease is anticipated from vehicle activity. Although PM-l0 emissions are expected to stay relatively flat, some reductions in PM-l0 concentrations are expected. Many of the sources that contribute to ozone formation also lead to PM-l0 formation through chemical

[2] Based on *2004 Average Annual Daily Truck Traffic on the California State Highway System* – http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/

reactions in the atmosphere. These secondary particulates contribute to overall PM-l0 concentrations, especially on days of elevated PM-l0 levels in the fall and winter.

VI. COUNTYWIDE PLAN POLICY REVIEW

Table 9 provides a review of each of the policies and programs from the current Countywide Plan related to air quality issues.

The following provides a discussion of the major air quality issues to be addressed as part of the Countywide Plan update.

- It is recommended that policies to control emissions from construction sites be included. The BAAQMD CEQA Guidelines contain feasible control measures for PM-l 0 at construction sites. These control measures are shown in Table 10.

- New projects should be consistent with local and regional population and vehicle use projections. This means that assuming the Countywide Plan is consistent with regional planning projections, projects should be evaluated for consistency with the Countywide Plan. If projects do not require a General Plan Amendment, no further ana1ysis should be required (they would be assumed to be consistent with plan population and travel projections). The countywide plan should be evaluated for consistency with ABAG population projections, MTC vehicle miles traveled projections, and implementation of Clean Air Plan Transportation Control Measures (TCMs) listed in Table 11. There are two tests for the plan: 1) population growth under the plan is similar or less than ABAG projections and 2) the rate of VMT is expected to increase at a rate similar or less than the rate of population. If these two conditions are met, than the Countywide Plan would be consistent with the Bay Area Clean Air Plan as long as reasonable efforts are made to implement plan TCMs; otherwise, it would not be consistent and growth under the plan would be considered to hinder the process of the region obtaining state and federal air quality standards (a significant impact).

TABLE 9 -- EVALUATION OF EXISTING COUNTYWIDE PLAN AIR QUALITY POLICIES AND PROGRAMS

Existing Policy or Program	Suggestions for Improvements
Policy EQ-2.75 County's Air Quality Standards. The County shall adhere to the Federal or State air quality standards, (Table EQ-5) whichever are more stringent, for management of locally generated pollutants.	Needs refinement: The BAAQMD encourages local jurisdictions to include ambient air quality standards in General Plans. Recommend that these standards be updated with standards shown in Table 1 of this report.
Policy EQ 2.76 Coordination of Air Quality Planning Efforts. The County shall coordinate air quality planning efforts with local, regional, and State agencies.	Needs refinement: This policy recommends that projects exceeding the thresholds under Program EQ 2.76a undergo an air quality analysis that is subject to BAAQMD review. The BAAQMD normally does not conduct a review of project-related air quality impacts unless the District acts as a lead or responsible agency. The BAAQMD CEQA Guidelines were developed to assist local jurisdictions in evaluating the significance of air quality impacts from projects or plans. County staff should evaluate air quality impacts of projects in accordance with those guidelines
Program EQ 2.76a Project Review for Air Quality Concerns. The County shall notify local and regional jurisdictions of proposed projects in unincorporated areas which may affect regional air quality, as governed by project type and size thresholds in Table EQ 6.	Needs Refinement: Consider update to Table EQ 6, since BAAQMD Guidelines have been updated since time of last plan update.
Program EQ-2.76b Cooperative Enforcement of Federal, State and Regional Air Quality Standards. The County shall cooperate with the BAAQMD and California Air Resources Board in enforcing the provisions of the Clean Air Act, State, and regional policies and established standards for air quality.	Needs Refinement: Consider adding reasonable and feasible control measures for construction activities
Policy EQ-2.77 Location of Land Uses Near Air Pollution Sources. The County shall consider air pollution impacts when locating pollution-sensitive land uses near sources of air pollution	Needs Refinement: Recommend that Policy include sources of odors. An example of such sources is shown in Exhibit 2, however, they may not be all sources (especially nuisance sources).

Existing Policy or Program	Suggestions for Improvements
Program EQ-2.77a Location of Air Pollution Point Sources Near Other Land Uses. The County should consider air pollution impacts when locating air pollution point sources such as manufacturing, extracting, and hazardous materials storage sites proximate to residential areas and other sensitive receptors.	Needs Refinement: Consider screening distances between odor sources and receptors (if screening distances are not met than detailed studies should be required to determine project compatibility). Recommended screening distances need to consider both the type of source and type of receptor, as well as other factors (e.g., odor control equipment, complaint history). Table 4 of the BAAQMD CEQA Guidelines provides project-screening distances, but these assume worst-case conditions (i.e., receptors downwind of uncontrolled sources).
Program EQ-2.77b Upwind Location of Sensitive Receptors. The County should consider the potential air pollution impacts of locating sensitive receptors (facilities where individuals are highly susceptible to the adverse effects of air pollutants) near freeways, arterials and other major transportation facilities and should urge location of these uses upwind of such transportation facilities.	Needs Refinement: Recommend that references to "Upwind" be taken out of Program EQ-2.77b. Winds are usually light and variable during meteorological conditions that are conducive to elevated pollution levels; therefore, locations that are normally upwind could be susceptible to higher levels.
Policy EQ-2.78 Air Quality Impacts of Proposed Projects. As part of its Environmental Review Process, the County shall review proposed projects for their potential impact on air quality conditions	Applicable
Program EQ-2.78a Air Quality Mitigation. The County shall require projects which generate high levels of air pollutants to incorporate air quality mitigation in the project design.	Applicable
Policy EQ-2.79 Vehicular-Generated Pollutants. The County shall support a transportation program which serves to reduce vehicle trips and/or increases ridesharing so as to reduce pollutants emitted by vehicular combustion engines.	Needs Refinement: Recommend including transportation control measures recommended by BAAQMD
Policy EQ-2.80 Vehicular Congestion During Peak Hours. The County shall seek ways to reduce vehicular congestion during peak commuting hours in order to reduce emissions from combustion engines during those times.	Needs Refinement: Recommend including applicable transportation control measures recommended by BAAQMD

TABLE 10 -- FEASIBLE CONTROL MEASURES FOR PM-10 CONSTRUCTION EMISSIONS

Control Type	Measures
Basic Control Measures: The following controls should be implemented at all construction sites.	♦ Water all active construction areas at least twice daily. ♦ Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard. ♦ Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and tagging areas at construction sites. ♦ Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites. ♦ Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.
Enhance Control Measures: The following measures should be implemented at construction sites greater than four acres in area.	♦ All "Basic" control measures listed above. ♦ Hydroseed or apply (non-toxic) soil stabilizers to inactive construction areas (previously graded areas inactive for ten days or more). ♦ Enclose, cover, water twice daily or apply (non-toxic) soil binders to exposed stockpiles (dirt, sand, etc.) ♦ Limit traffic speeds on unpaved roads to 15 mph. ♦ Install sandbags or other erosion control measures to prevent silt runoff to public roadways. ♦ Replant vegetation in disturbed areas as quickly as possible.
Optional Control Measures: The following control measures are strongly encouraged at construction sites that are large in area, located near sensitive receptors or which for any other reason may warrant additional emissions reductions.	♦ Install wheel washers for all exiting trucks, or wash off the tires or tracks of all trucks and equipment leaving the site. ♦ Install wind breaks, or plant trees/vegetative wind breaks at windward side(s) of construction sites. ♦ Suspend excavation and grading activity when winds (instantaneous gusts) exceed 25 mph. ♦ Limit the area subject to excavation, grading and other construction activity at any one time.

TABLE 11 -- CLEAN AIR PLAN TCMS TO BE IMPLEMENTED BY LOCAL GOVERNMENT

Transportation Control Measure	Description
1. Support Voluntary Employer Based Trip Reduction Programs	♦ Provide assistance to regional and local ridesharing organizations; advocate legislation to maintain and expand incentives (e.g., tax deductions/credits).
9. Improve Bicycle Access and Facilities	♦ Improve and expand bicycle land system by providing bicycle access in plans for all new road construction or modification. ♦ Establish and maintain bicycle advisory committees in all nine Bay Area counties. ♦ Designate a staff person as a Bicycle Program Manager. ♦ Develop and implement comprehensive bicycle plans. ♦ Encourage employers and developers to provide bicycle access and facilities. ♦ Provide bicycle safety education.
12. Improve Arterial Traffic Management	♦ Study signal preemption for buses on arterials with high volume of bus traffic. ♦ Improve arterials for bus operations and to encourage bicycling and walking. ♦ Continue and expand local signal timing programs, only where air quality benefits can be demonstrated.
15. Local Clean Air Plans, Policies and Programs	♦ Incorporate air quality beneficial policies and programs into local planning and development activities, with a particular focus on subdivision, zoning and site design measures that reduce the number and length of single-occupant automobile trips.
17. Conduct Demonstration Projects	♦ Promote demonstration projects to develop new strategies to reduce motor vehicle emissions. Projects include: low emission vehicle fleets and LEV refueling infrastructure.
19. Pedestrian Travel	♦ Review/revise general/specific plan policies to promote development patterns that encourage walking and circulation policies that emphasize pedestrian travel and modify zoning ordinances to include pedestrian-friendly design standards. ♦ Include pedestrian improvements in capital improvement programs. ♦ Designate a staff person as a Pedestrian Program Manager.
20. Promote Traffic Calming Measures	♦ Include traffic calming strategies in the transportation and land use elements of general and specific plans. ♦ Include traffic calming strategies in capital improvement programs.

- The County should support and implement transportation control measures (TCMs) contained in the latest Clean Air Plan. A list of the most recent TCMs that rely on implementation by local jurisdictions is provided in Table 11.

- Encourage land use planning that would result in less air pollutant emissions from vehicle travel. Land use planning features could include: (1) Promoting a mix of land uses that locate neighborhood services within walking distances of residences, (2) providing or funding pedestrian, bicycle, and transit oriented improvements, (3) promote residential infill in areas served by public transit and commercial services, (4) establish appropriate buffer zones, and (5) adopt parking strategies and other transportation demand management measures to reduce vehicle travel and congestion on major roadways. More information is available from the BAAQMD and ABAG: *Improving Air Quality through Local Plans and Programs - A Guidebook for City and County Governments,* April 1994.

- The County may want to consider adoption of a Model Wood smoke Ordinance. In 1998, the BAAQMD approved a model wood smoke ordinance for local governments. This guidance document assists local governments in reducing PM-I0. In some Bay Area locations, up to 40 percent of PM-l0 concentrations originates from wood smoke. If adopted, the ordinance would limit the installation of wood burning appliances in new homes, or renovations of existing homes that involve a fireplace, to pellet stoves, EP A-certified woodstoves or fireplace inserts, or natural-gas fireplaces. These cleaner burning alternatives reduce wood smoke by 75 to 99 percent over a traditional fireplace. The model ordinance is available at the BAAQMD website: http://www.baaqmd.gov/pio/wood_burning/ordinance_background.htm

- The County may want to consider existing and future ways to assist the BAAQMD with the *Spare the Air* programs. These programs are designed to reduce air pollutant emissions on days that meteorological conditions are conducive to elevated air pollution levels. More information on this program is available at http://www.sparetheair.org/.

VII. FINDINGS

The following summarizes the air quality issues in Marin County:

- In general, air quality in Marin County is very good. This is due to the favorable meteorological conditions and the absence of major air pollution sources. Prevailing winds are mostly from off the ocean; therefore, there are no upwind sources affecting the area.

- Ozone and PM-l 0 levels in other portions of Bay Area are exceeded on an annual basis. Sources of air pollution from Marin County can contribute to these air quality problems.

- Planning for attainment of air quality standards is difficult, but substantial reductions in air quality levels have been achieved. The carbon monoxide standard has been achieved, and for the last several years 2003-05, the national ozone standard was not violated. Attainment of the national standard is expected by 2006. Attainment of the more stringent state ozone or PM-l0

standard cannot be predicted at this time.

- Toxic air contaminants present a health risk to persons in urban areas of Marin County and the Bay Area. This risk has decreased considerably in recent years. About 70 percent of the current risk is attributable to diesel particulate matter. The CARB is currently studying and adopting measures to substantially reduce levels of diesel particulate matter.

- Sheltered valleys in Marin County are susceptible to localized build up of PM-l 0 and carbon monoxide emissions during winter. Poor dispersion characteristics of these valleys during cold periods in winter along with wood burning activities and vehicle use could lead to localized exceedances of air quality standards. The BAAQMD does not measure pollutant concentrations in these more-rural locations.

- Local communities, through the planning process (e.g., Marin Countywide Plan), play an important role in reducing air pollution. Land use planning strategies, traffic and circulation strategies and implementation of transportation control measures are important elements of the BAAQMD's plan to attain and maintain air quality standards.

- Population and vehicle use projections made in General Plans must be accurate. Planning inventories for air quality plans are based on these projections. The BAAQMD obtains these projections from the Association of Bay Area Governments (ABAG) and the Metropolitan Planning Commission (MTC). These agencies use data obtained from local jurisdictions.

VIII. REFERENCES

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APPENDIX 1-C

BIOLOGICAL AND WETLAND PROTECTION TECHNICAL BACKGROUND REPORT, APRIL 2002, UPDATED JANUARY 2006

MARIN COUNTYWIDE PLAN

Biological and Wetland Protection Technical Background Report

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I. PURPOSE AND BACKGROUND

A. PURPOSE

This Biological and Wetland Protection Technical Background Report provides a description of the regulatory framework related to sensitive biological and wetland resources, a general description of resources within the County, and a review of the current policies of the current Countywide Plan (CWP). Its purpose is to provide background information on sensitive resource within the County, regulations and programs which provide for their protection, an evaluation of the degree to which the current CWP addresses these resources, and areas of necessary focus in updating the CWP to ensure greater protection and sustainability of the natural environment.

B. BACKGROUND AND METHODS

The Environmental Quality Element Technical Report #3, *Species Protection in Marin*, served as the background report for the Environmental Quality Element of the 1994 CWP. It focused on special-status species known from the County, with limited information on "Significant Natural Areas". This species-specific information has become outdated, does not consider the larger issue of essential habitat and the importance of habitat connectivity in addressing sensitive resources, and provides no information on wetland resources. A major reorganization of certain aspects of the 1994 CWP was considered necessary to thoroughly address these issues and define clear polices and programs which provide for their protection and enhancement.

This Technical Report was based on the review of available information, existing mapping, and consultation with representatives of agencies with resource management authority. It was originally circulated in April 2002. This revision provides an updated version with the latest information on vegetative cover and wetlands mapping for Marin County, current status for special-status species which have changed over the past few years, and the most recent occurrence records for special-status species and sensitive natural communities. Available literature and resource mapping reviewed included: current policies and programs from The Marin Countywide Plan (1994); management plans for open space lands of the Marin County Open Space District (various dates); the Mount Tamalpais Area Vegetation Management Plan of the Marin Municipal Water District and Marin County Open Space District (Leonard Charles & Associates, 1995); the General Management Plan for Point Reyes National Seashore (National Park Service, 1980); the final report on county land use policies and management practices on anadromous salmonids and their habitats (Harris et. al, 2001); the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants of California (2001); mapping prepared as part of the California Land Cover Mapping and Monitoring referred to as the CalVeg program (USDA Forest Service, 2004); mapping prepared as part of the National Wetland Inventory (U.S. Fish and Wildlife Service, various dates); and the occurrence records of the California Natural Diversity Data Base (CNDDB). The National Wetland Inventory (NWI) wetlands mapping and occurrence records of the CNDDB are maintained in Geographic Information System (GIS) of the Marin County Community Development Agency. The occurrence records of the CNDDB provided information on the known distribution of sensitive natural communities and special-status species for Marin County.

The NWI provided a general mapping of wetland resources for Marin County, which has been combined with mapping of perennial and intermittent streams.

Identification of the biological resources in the County was based on existing information, and no detailed field surveys were conducted as part of this assessment. The preparer of this Technical Report has been involved in a wide variety of proposed development and management projects throughout Marin County, and his familiarity with the biological and wetland resources allows for an overview of sensitive resources and major issues of focus in the CWP update.

II. REGULATORY FRAMEWORK

Local, State, and federal regulations have been enacted to provide for the protection and management of sensitive biological and wetland resources. The U.S. Fish and Wildlife Service (USFWS) is responsible for implementation of the federal Endangered Species Act and the Migratory Bird Treaty Act, while the U.S. Army Corps of Engineers (Corps) has primary responsibility for protecting wetlands under §404 of the Clear Water Act. The National Marine Fisheries Service (NMFS) has federal authority over anadromous fish and marine wildlife under the federal Endangered Species Act. At the state level, the California Department of Fish and Game (CDFG) is responsible for administration of the California Endangered Species Act, and for protection of streams and waterbodies through the Streambed Alteration Agreement process under §1601-1616 of the California Fish and Game Code. Certification from the California Regional Water Quality Control Board is also required when a proposed activity may result in discharge into navigable waters, pursuant to §401 of the Clean Water Act and EPA §404(b)(1) Guidelines.

A. SPECIAL-STATUS SPECIES

Special-status species [1] are plants and animals that are legally protected under the State and/or federal Endangered Species Acts [2] or other regulations, as well as other species that are considered rare enough by the scientific community and trustee agencies to warrant special consideration, particularly with regard to protection of isolated populations, nesting or denning locations, communal roosts, and other essential habitat. Species with legal protection under the federal and California Endangered Species Acts often represent major constraints to development, particularly when they are wide ranging or highly sensitive to habitat disturbance and where proposed development would result in a "take" of these

[1] Special-status species include:
Officially designated (rare, threatened, or endangered) and candidate species for listing by the CDFG.
Officially designated (threatened or endangered) and candidate species for listing by the USFWS.
Species considered to be rare or endangered under the conditions of Section 15380 of the CEQA Guidelines, such as those identified on lists 1A, 1B, and 2 in the *Inventory of Rare and Endangered Plants of California* by the CNPS (1994).
And possibly other species which are considered sensitive or of special concern due to limited distribution or lack of adequate information to permit listing or rejection for state or federal status, such as those plant species included on list 3 in the CNPS *Inventory* or animals recognized as "California Special Concern (CSC) species by the CDFG. A CSC species does not necessarily have any legal protective status under the California Endangered Species Act but is of concern to the CDFG because of severe decline in breeding populations.

[2] The federal Endangered Species Act (ESA) of 1973 declares that all federal departments and agencies shall utilize their authority to conserve endangered and threatened plant and animal taxa. The California Endangered Species Act (CESA) of 1984 parallels the policies of ESA and pertains to native California taxa.

species. "Take" as defined by the federal Endangered Species Act (ESA) means "to harass, harm, pursue, hunt, shoot, would, kill, trap, capture, or collect" a threatened or endangered species. "Harm" is further defined by the USFWS to include the killing or harming of wildlife due to significant obstruction of essential behavior patterns (i.e. breeding, feeding, or sheltering) through significant habitat modifications or degradation. The CDFG also considers the loss of listed species habitat as "take", although this policy lacks statutory authority and case law support under the California Endangered Species Act (CESA).

The primary information source on the distribution of special-status species in California is the CNDDB inventory, which is maintained by the Natural Heritage Division of the CDFG. Occurrence data is obtained from a variety of scientific, academic, and professional organizations, private consulting firms, and knowledgeable individuals, and entered into the inventory as expeditiously as possible. The occurrence of a species of concern in a particular region is an indication that an additional population may occur at another location if habitat conditions are suitable. However, the absence of an occurrence in a particular location does not necessarily mean that special-status species are absent from the area in question; only that no data has been entered into the CNDDB inventory. Detailed field surveys are generally required to provide a conclusive determination on presence or absence of sensitive resources from a particular location, where there is evidence of potential occurrence.

1. Federal Authority

The USFWS and NMFS have jurisdiction over species that are formally listed as threatened or endangered under the federal ESA. The federal ESA is a complex law enacted in 1973 to protect and recover plant and animal species in danger of becoming extinct and to conserve their ecosystems, with an ultimate goal being the recovery of a species to the point where it is no longer in need of protection. An "endangered" plant or animal species is one that is considered in danger of becoming extinct throughout all or a significant portion of its range. A "threatened" species is one that is likely to become endangered within the foreseeable future. The USFWS also maintains a list of species proposed for listing as endangered or threatened which have been published in the *Federal Register*. In addition, the USFWS maintains a list of candidate species for which sufficient information is available to support issuance of a proposed listing rule.

It is illegal to take any listed species without specific authorization. Any activity that could result in take of a federally-listed species requires a §10 take permit authorization from the USFWS or NMFS. Should another federal agency be involved with permitting the project, such as the Corps under jurisdiction of the Clean Water Act, §7 of the ESA requires the federal lead agency to consult with the USFWS and/or NMFS before permitting any activity that may result in take of a listed species. Section 9 of the ESA and its applicable regulations restrict certain activities with respect to endangered and threatened plants. However, these restrictions are less stringent than those applicable to fish and wildlife species. The provisions prohibit the removal of, malicious damage to, or destruction of any listed plant species from areas under federal jurisdiction. Listed plants may not be cut, dug up, damaged or destroyed, or removed from any other area (including private lands) in knowing violation of a state law or regulation.

In addition to the protection offered under the ESA, the federal Migratory Bird Treaty Act (MBTA) provides for protection of migratory bird species, birds in danger of extinction, and their active nests. It

is illegal to posses or take any bird protected under the act without a depredation permit from the USFWS, which includes protection of eggs, young, and nests in active use. Although the MBTA technically provides for protection of most bird species, it is typically applied as a mechanism to protect active nests of raptors and colonial nesting species through the breeding and nesting season.

2. State Authority

The CDFG has jurisdiction over threatened or endangered species that are formally listed under the CESA. The CESA is similar to the federal ESA both in process and substance, providing additional protection to listed species in California. The CESA does not supersede the federal ESA, but operates in conjunction, with some species having different listing status. The CESA is intended to conserve, protect, restore, and enhance listed species and their habitat. Compliance with the CESA is required when a take is considered likely by the CDFG.

The CDFG maintains informal lists of "California Special Concern" (CSC) species. These species are broadly defined as plants and animals that are of concern to the CDFG because of population declines and restricted distribution, and/or because they are associated with habitats that are declining in California. These species are inventoried in the CNDDB, focusing on nesting, roosting, and congregation sites for non-listed species. Species designated as "Fully Protected" or "Protected" may not be taken or possessed without a permit from the Fish and Game Commission and/or the CDFG.

The CESA prohibits the take of any plant listed as endangered, threatened, or rare. A "rare" plant species is one not presently threatened with extinction but may become endangered if its present environment worsens. State listing of plants began in 1977 with passage of the Native Plant Protection Act (NPPA). The CESA expanded upon the NPPA and enhanced legal protection for plants. To align with federal regulations, CESA created the categories of threatened and endangered species. It grandfathered all rare animals into the CESA as threatened species, but did not do so for rare plants.

The California Native Plant Society (CNPS) is a non-profit conservation organization dedicated to the preservation of native flora in California. The CNPS has been involved in assembling, evaluating, and distributing information on special-status plant species in the state, as listed in the *Inventory of Rare and Endangered Plants of California* (2001). A list 1A plant is a species, subspecies. or variety that is considered to be extinct. A list 1B plant is considered rare, threatened, or endangered in California and elsewhere. A list 2 plant is considered rare, threatened, or endangered in California but is more common elsewhere. A list 3 plant is a species for which the CNPS lacks necessary information to determine whether or not it should be assigned to a list. A list 4 plant has a limited distribution in California and is considered a "watch list" by the CNPS.

All of the plant species on List 1 and List 2 meet the requirements of the NPPA (§1901, Chapter 10) or §2062 and 2067 of CESA, and are eligible for state listing. Species maintained by CNPS on Lists 1 and 2 should be considered special-status species under the California Environmental Quality Act (CEQA). Some List 3 plant species also meet the requirements for state listing. Very few List 4 plants are eligible for listing but may be locally important and their listing status could be elevated if conditions change.

The CEQA requires government agencies to consider environmental impacts of discretionary projects and to avoid or mitigate them where possible. Under §15380, CEQA provides protection for both

State-listed species and for any other species which can be shown to meet the criteria for State listing. The CDFG recognizes that Lists 1A, 1B, and 2 of the CNPS Inventory consist of plants that, in a majority of cases, would qualify for listing and these species should be addressed under CEQA review. In addition, the CDFG recommends, and local governments may require, protection of species which are regionally significant, such as locally rare species, disjunct populations, essential nesting and roosting habitat for more common species, or plants on Lists 3 and 4 of the CNPS *Inventory*.

B. SENSITIVE NATURAL COMMUNITIES

In addition to species-oriented management, protecting habitat on an ecosystem-level is increasingly recognized as vital to the protection of natural diversity in the state. This is considered the most effective means of providing long-term protection of ecologically viable habitat, and can include whole watersheds, ecosystems, and sensitive natural communities. Providing habitat connectivity between natural areas is essential to sustaining healthy wildlife populations and allowing for the continued dispersal of native plant and animal species.

The CNDDB is also responsible for maintaining up-to-date records of sensitive natural communities, those considered rare or threatened by the State. Until recently, the classification of natural communities used by the CNDDB was generally a habitat-based approach defined by dominant or characteristic plant species as described in the *Preliminary descriptions* of *the terrestrial natural communities of California* (Holland, 1986). The classification system for "natural communities" now used by the CNDDB is based on the system described in the *Manual of California Vegetation* (Sawyer and Keeler-Wolf, 1995). It is a floristically based system which uses two units of classification, called the alliance and the association in the National Vegetation Classification (Grossman et al., 1998). Although it is just now being used on a broad scale, this quantitative vegetation classification and systematic mapping method will allow conservationists and resource managers a greater understanding of natural ecosystems, their abundance, and their relative security.

The purpose of the CNDDB natural community inventory was originally to identify and determine the significance and rarity of the various vegetation types in the state. While identifying and mapping sensitive natural communities continues to be a primary focus of the inventory, a more thorough understanding of all natural communities is essential to accurately define rarity, identify monitoring trends and threats, and broaden the approach to ecosystem-level conservation of biological diversity. This will presumably lead to mapping of vegetation throughout the state using the newer classification system. In the interim, sensitive natural community types recorded in the CNDDB are still generally mapped according to other older Holland classification system. Considerable work is necessary in updating and refining existing mapping records, identifying new occurrences of sensitive natural communities, and expanding the data base to include the identification of high-quality stands of all natural communities.

1. Federal and State Authority

Although these natural communities have no legal protective status under the state or federal Endangered Species Acts, they are provided some level of protection under CEQA. The CEQA Guidelines identify potential impacts on a sensitive natural community as one of six significance criteria. For example, a discretionary project that has a substantial adverse effect on any riparian habitat, native

grassland, valley oak woodland, or other sensitive natural community would normally be considered to have a significant effect on the environment. Further loss of a sensitive natural community could be interpreted as substantially diminishing habitat, depending on its relative abundance, quality and degree of past disturbance, and the anticipated impacts to the specific community type. Where determined to be significant under CEQA, the potential impact would require mitigation through avoidance, minimization of disturbance or loss, or some type of compensatory mitigation when unavoidable.

C. WETLANDS

Although definitions vary to some degree, wetlands are generally considered to be areas that are periodically or permanently inundated by surface or ground water, and support vegetation adapted to life in saturated soil. Wetlands are recognized as important features on a regional and national level due to their high inherent value to fish and wildlife, use as storage areas for storm and flood waters, and water recharge, filtration, and purification functions. Technical standards for delineating wetlands have been developed by the Corps and the USFWS, which generally define wetlands through consideration of three criteria: hydrology, soils, and vegetation.

In recognition of the importance of wetlands, in 1977 the USFWS began a systematic effort to classify and map remaining wetlands in the country, now known as the National Wetlands Inventory Program (NWI). Using the USGS topographic maps as a base, the wetlands mapping effort provides a generalized inventory of wetlands according to the *Classification of Wetlands and Deepwater Habitats of the United States* (USFWS, 1979) used by the USFWS. Mapping has been prepared through interpretation of aerial photographs, with only limited ground confirmation, which means that a more thorough ground and historical analysis may result in a revision to wetland boundaries in a specific location. The inventory is not an attempt to define the limits of proprietary jurisdiction of any governmental agency. This mapping effort also identifies features according to the broader definition of wetlands used by the USFWS where only one criteria (wetland hydrology, hydric soils, or hydrophytic vegetation) is typically necessary for the location to meet the wetland definition, rather than all three criteria as required by the Corps.

1. Federal Authority

The Clean Water Act was enacted to address water pollution, establishing regulations and permitting requirements regarding construction activities that affect storm water, dredge and fill material operations, and water quality standards. This regulatory program requires that discharges to surface waters be controlled under the National Pollutant Discharge Elimination System permitting requirements which apply to sources of water runoff, private developments, and public facilities.

Under §404 of the Clean Water Act, the Corps is responsible for regulating the discharge of fill material into waters of the United States. The term "waters" includes wetlands and non-wetland bodies of water ("other waters") that meet specific criteria as defined in the Code of Federal Regulations. As noted above, all three of the identified technical criteria must be met for an area to be identified as a wetland under Corps jurisdiction, unless the area has been modified by human activity. In general, a permit must be obtained before fill can be placed in wetlands or other waters of the U.S. The type of permit depends on the amount of acreage and the purpose of the proposed fill, subject to discretion of the Corps.

Certain activities in wetlands or "other waters" are automatically authorized, or granted a nationwide permit which allows filling where impacts are considered minor. Eligibility for a nationwide permit simplifies the permit review process. Nationwide permits cover construction and fill of waters of the U.S. for a variety of routine activities such as minor road crossings, utility line crossings, streambank protection, recreational facilities and outfall structures. To qualify for a nationwide permit, a project must demonstrate that it has no more than a minimal adverse effect on the aquatic ecosystem, including species listed under the ESA. This typically means that there will be no net loss of either habitat acreage or habitat value, resulting in appropriate mitigation where fill activities are proposed.

The Corps assumes discretionary approval over proposed projects where impacts are considered significant, requiring adequate mitigation and permit approval. To provide compliance with the Environmental Protection Agency's §404(b)(1) Guidelines, an applicant must demonstrate that the proposed discharge is unavoidable and is the least environmentally damaging practicable alternative that will achieve the overall project purpose. The 1990 Memorandum of Agreement between the EPA and Corps concerning the Determination of Mitigation under the Guidelines prioritizes mitigation, with the first priority to avoid impacts, the second to minimize impacts, and the third to provide compensatory mitigation for unavoidable impacts.

2. State Authority

Jurisdictional authority of the CDFG over wetland areas is established under §1601-1616 of the Fish and Game Code, which pertains to activities that would disrupt the natural flow or alter the channel, bed, or bank of any lake, river, or stream. The Fish and Game Code stipulates that it is "unlawful to substantially divert or obstruct the natural flow or substantially change the bed, channel or bank of any river, stream or lake" without notifying the CDFG, incorporating necessary mitigation, and obtaining a Streambed Alteration agreement. The Wetlands Resources Policy of the CDFG states that the Fish and Game Commission will "strongly discourage development in or conversion of wetlands...unless, at a minimum, project mitigation assures there will be no net loss of either wetland habitat values or acreage". The Department is also responsible for commenting on projects requiring Corps permits under the Fish and Wildlife Coordination Act of 1958.

In addition, the California Regional Water Quality Control Board is responsible for upholding state water quality standards. Pursuant to §401 of the Clean Water Act, projects that apply for a Corps permit for discharge of dredge or fill material, and projects that qualify for a Nationwide Permit must obtain water quality certification.

III. MAPPING SUMMARY

The GIS section of the Community Development Agency has prepared several maps which summarize existing information on biological and wetland resources in the County. These include:

- • Map 2-1, Vegetation - showing vegetation cover modified from the CalVeg mapping program of the U.S. Forest Service (2004). Cover types have been merged to simplify major vegetation associations in the exhibit. The Vegetation Exhibit gives a generalized indication of the various vegetation types, and their relationship to major drainages, roadways, and urban development in the

County. More accurate mapping of vegetation using the new CNDDB methodology from the Manual of California Vegetation is not available for most of the central and eastern parts of Marin County. This floristic based system of mapping has actually been completed for most of West Marin, including areas encompassed by the Golden Gate National Recreation Area, Point Reyes National Seashore, parts of Mount Tamalpais State Park, and some of the watershed lands of the Marin Municipal Water District. Completing this mapping effort for the entire county would provide quantitative data on the distribution and abundance of plant associations, and would allow for monitoring of trends in their abundance, vulnerability, and rarity in Marin County.

- • Map 2-17, Open Space and Parks - showing designated public open space and watershed lands in the County, distinguishing federal, state, local and water district lands. These open space and watershed lands are vital to maintaining viable habitat for native plants and wildlife in the County. Consideration should be given to how these protected lands are interconnected and where additional open space lands must be secured to maintain critical habitat links, particularly along stream corridors, bayfronts, and ridgelines.
- • Map 2-2, Special-Status Species and Sensitive Natural Communities - showing recorded occurrences of special-status species plant and animal species and of sensitive natural communities based on the CNDDB records. Streams with known occurrences of coho salmon and steelhead trout mapped by the County are also indicated in the exhibit. Designated critical habitat for several federally-listed species mapped by the USFWS is also shown in Map 2-2. Most of the occurrences of special-status species and sensitive natural communities are from the state and federally-protected lands of Point Reyes and Mount Tamalpais, and the marshlands along San Francisco and San Pablo bays. The occurrence records vary in their specificity and the mapped data varies accordingly, with some locations considered very accurate and others covering a wide area of several miles considered to be potential habitat. Streams with known occurrences of the federally-threatened coho salmon and steelhead trout extend throughout the County, including Redwood, Olema, Lagunitas, San Geronimo, Walker, Novato, Miller, Sleepy Hollow, Fairfax, San Geronimo, Ross, Corte Madera, and Arroyo Corte Madera del Persidio creeks.
- • Map 2-3, Wetlands and Streams - showing wetlands and streams based on the NWI and designated perennial and intermittent stream on USGS topographic maps mapped by the County. The wetland mapping has been simplified to show major wetland systems, including marine estuarine, riverine, lacustrine, and palustrine. Summaries of these different systems are contained in the exhibit. Marshland, mudflats, and open water of the bays and lagoons are classified as part of the estuarine system. The rocky shoreline and open waters of the Pacific Ocean are classified as part of the marine system. The man-made reservoirs and channels are classified as part of the lacustrine system. The creeks and streams, scattered smaller stockponds, and seasonal wetlands are classified as part of the palustrine and riverine systems. Most of these features are not technically wetlands but unvegetated "other waters" according to Corps definition, but the mapping provides an indication of the extent of known aquatic and wetland habitat in Marin County.

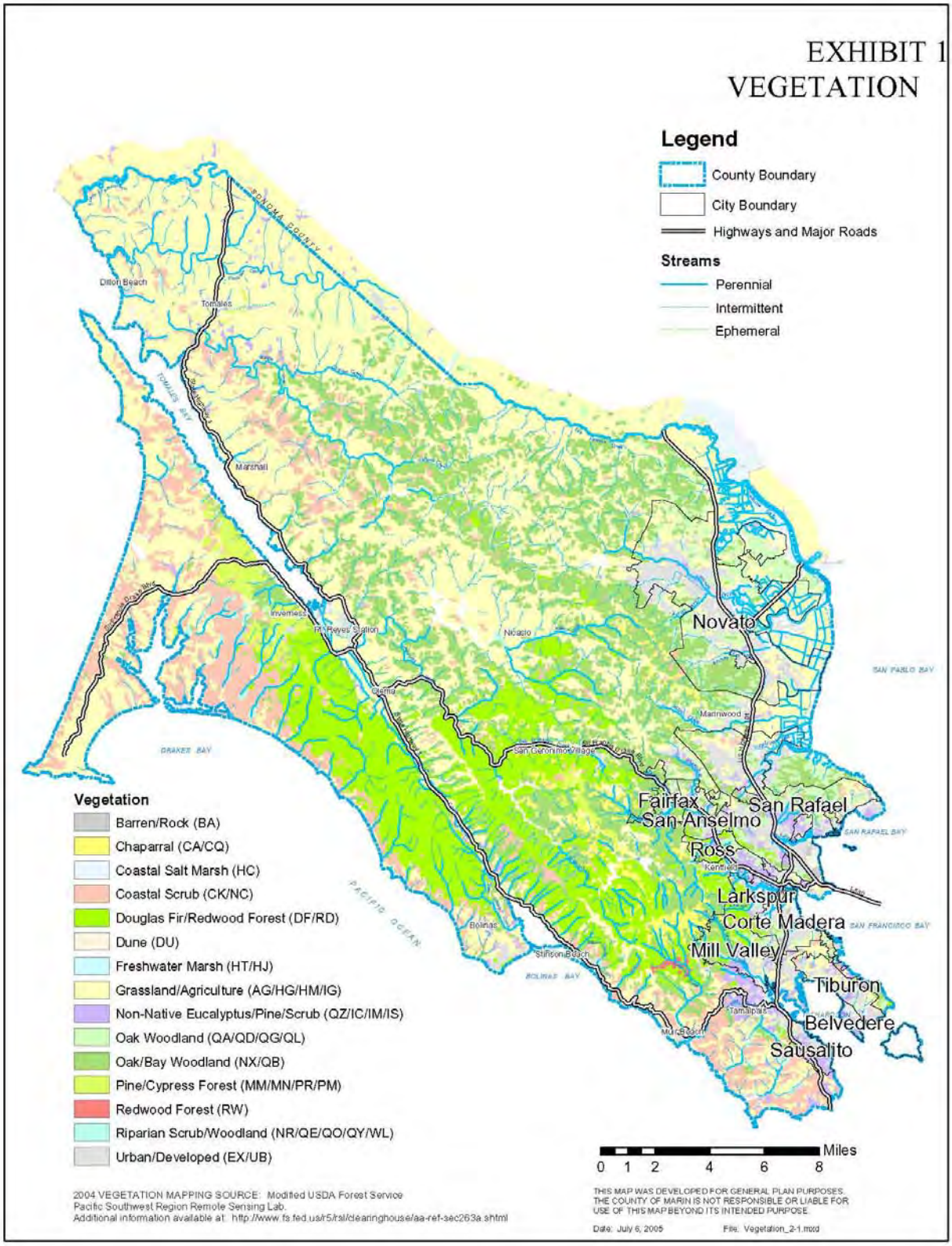
EXHIBIT 1
VEGETATION
Legend
County Boundary
City Boundary
Highways and Major Roads
Streams
Perennial
Intermittent
Ephemeral
Vegetation
Barren/Rock (BA)
Chaparral (CA/CQ)
Coastal Salt Marsh (HC)
Coastal Scrub (CK/NC)
Douglas Fir/Redwood Forest (DF/RD)
Dune (DU)
Freshwater Marsh (HT/HJ)
Grassland/Agriculture (AG/HG/HM/IG)
Non-Native Eucalyptus/Pine/Scrub (QZ/IC/IM/IS)
Oak Woodland (QA/QD/QG/QL)
Oak/Bay Woodland (NX/QB)
Pine/Cypress Forest (MM/MN/PR/PM)
Redwood Forest (RW)
Riparian Scrub/Woodland (NR/QE/QO/QY/WL)
Urban/Developed (EX/UB)
Miles
0 1 2 4 6 8
2004 VEGETATION MAPPING SOURCE: Modified USDA Forest Service
Pacific Southwest Region Remote Sensing Lab.
Additional information available at: http://www.fs.fed.us/r5/rsl/clearinghouse/aa-ref-sec263a.shtml
THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
THE COUNTY OF MARIN IS NOT RESPONSIBLE OR LIABLE FOR
USE OF THIS MAP BEYOND ITS INTENDED PURPOSE.
Date: July 6, 2005
File: Vegetation_2-1.mxd
Dillon Beach
Tomales
Marshall
Inverness
Point Reyes Station
Olema
Nicasio
Novato
Marinwood
San Geronimo Village
Fairfax
San Anselmo
San Rafael
Ross
Kentfield
Larkspur
Corte Madera
Mill Valley
Tiburon
Belvedere
Tamalpais
Sausalito
Bolinas
Stinson Beach
DRAKES BAY
TOMALES BAY
BOLINAS BAY
PACIFIC OCEAN
SAN PABLO BAY
SAN RAFAEL BAY
SAN FRANCISCO BAY

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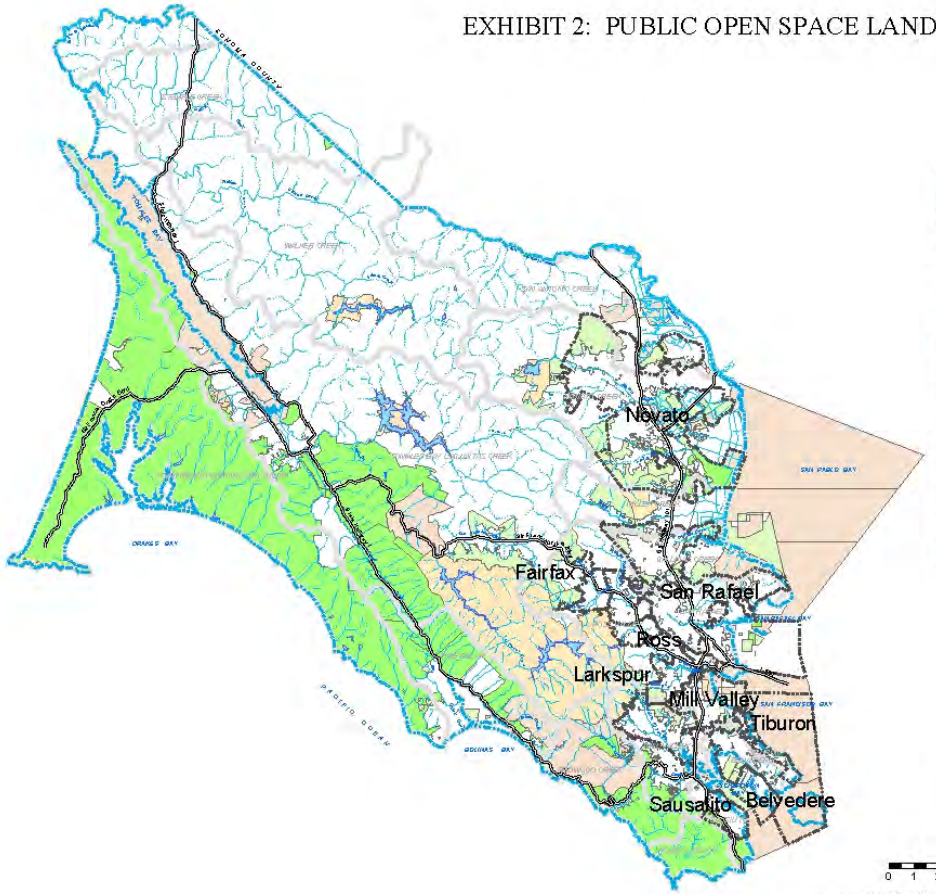
SOURCE: COUNTY OF MARIN JANUARY 2002

EXHIBIT 2: PUBLIC OPEN SPACE LANDS OF MARIN COUNTY



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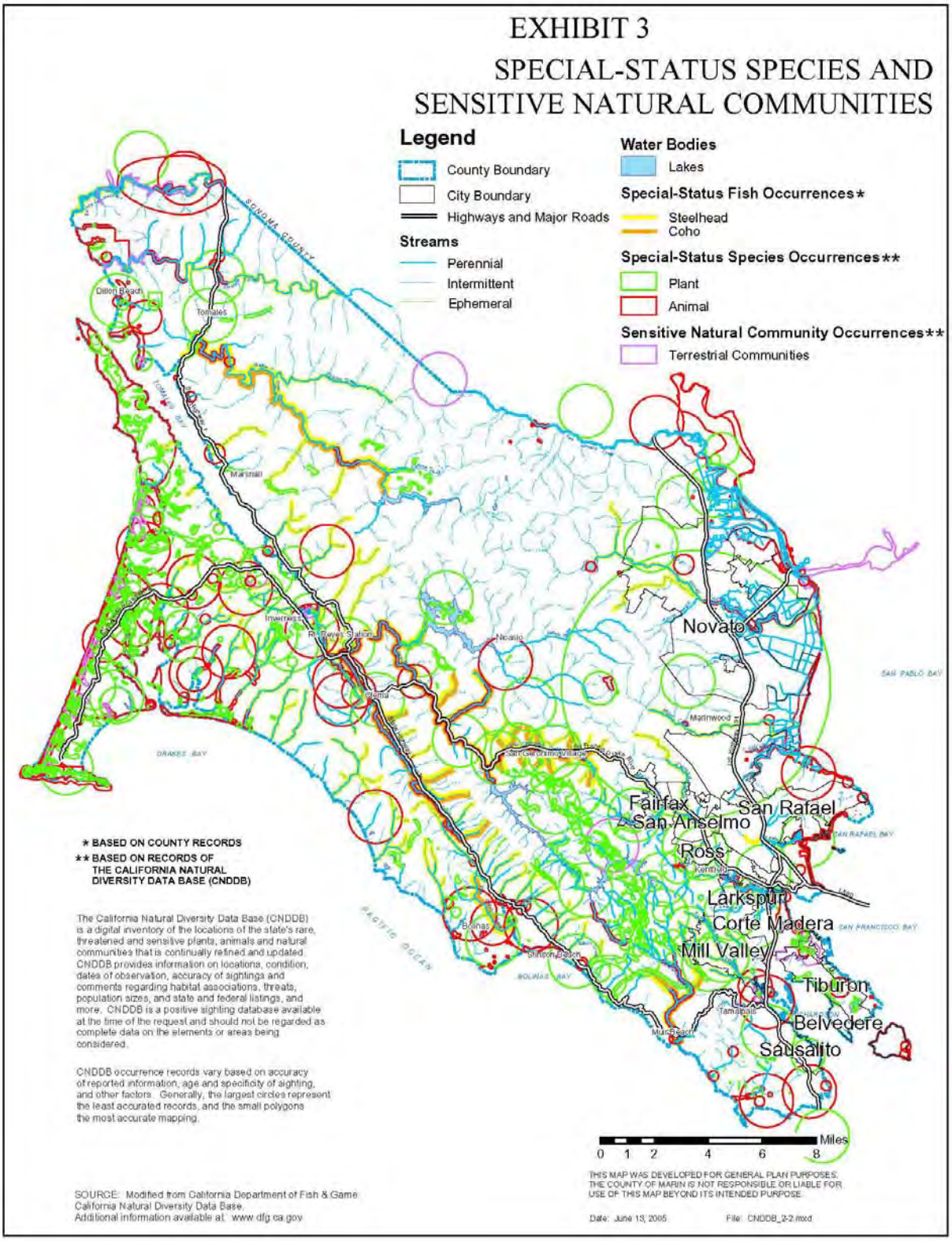
EXHIBIT 3
SPECIAL-STATUS SPECIES AND SENSITIVE NATURAL COMMUNITIES
Legend
County Boundary
City Boundary
Highways and Major Roads
Streams
Perennial
Intermittent
Ephemeral
Water Bodies
Lakes
Special-Status Fish Occurrences*
Steelhead
Coho
Special-Status Species Occurrences**
Plant
Animal
Sensitive Natural Community Occurrences**
Terrestrial Communities
SONOMA COUNTY
Dillon Beach
Tomales
Marshall
Inverness
Point Reyes Station
Olema
Nicasio
Novato
San Geronimo Village
Fairfax
San Anselmo
San Rafael
Ross
Kentfield
Larkspur
Corte Madera
Mill Valley
Tiburon
Tamalpais
Muir Beach
Belvedere
Sausalito
Bolinas
Stinson Beach
Marinwood
DRAKES BAY
PACIFIC OCEAN
BOLINAS BAY
SAN PABLO BAY
SAN RAFAEL BAY
SAN FRANCISCO BAY
* BASED ON COUNTY RECORDS
** BASED ON RECORDS OF THE CALIFORNIA NATURAL DIVERSITY DATA BASE (CNDDB)
The California Natural Diversity Data Base (CNDDB) is a digital inventory of the locations of the state's rare, threatened and sensitive plants, animals and natural communities that is continually refined and updated. CNDDB provides information on locations, condition, dates of observation, accuracy of sightings and comments regarding habitat associations, threats, population sizes, and state and federal listings, and more. CNDDB is a positive sighting database available at the time of the request and should not be regarded as complete data on the elements or areas being considered.
CNDDB occurrence records vary based on accuracy of reported information, age and specificity of sighting, and other factors. Generally, the largest circles represent the least accurated records, and the small polygons the most accurate mapping.
SOURCE: Modified from California Department of Fish & Game California Natural Diversity Data Base.
Additional information available at: www.dfg.ca.gov
Miles
0 1 2 4 6 8
THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES. THE COUNTY OF MARIN IS NOT RESPONSIBLE OR LIABLE FOR USE OF THIS MAP BEYOND ITS INTENDED PURPOSE.
Date: June 13, 2005
File: CNDDB_2-2.mxd

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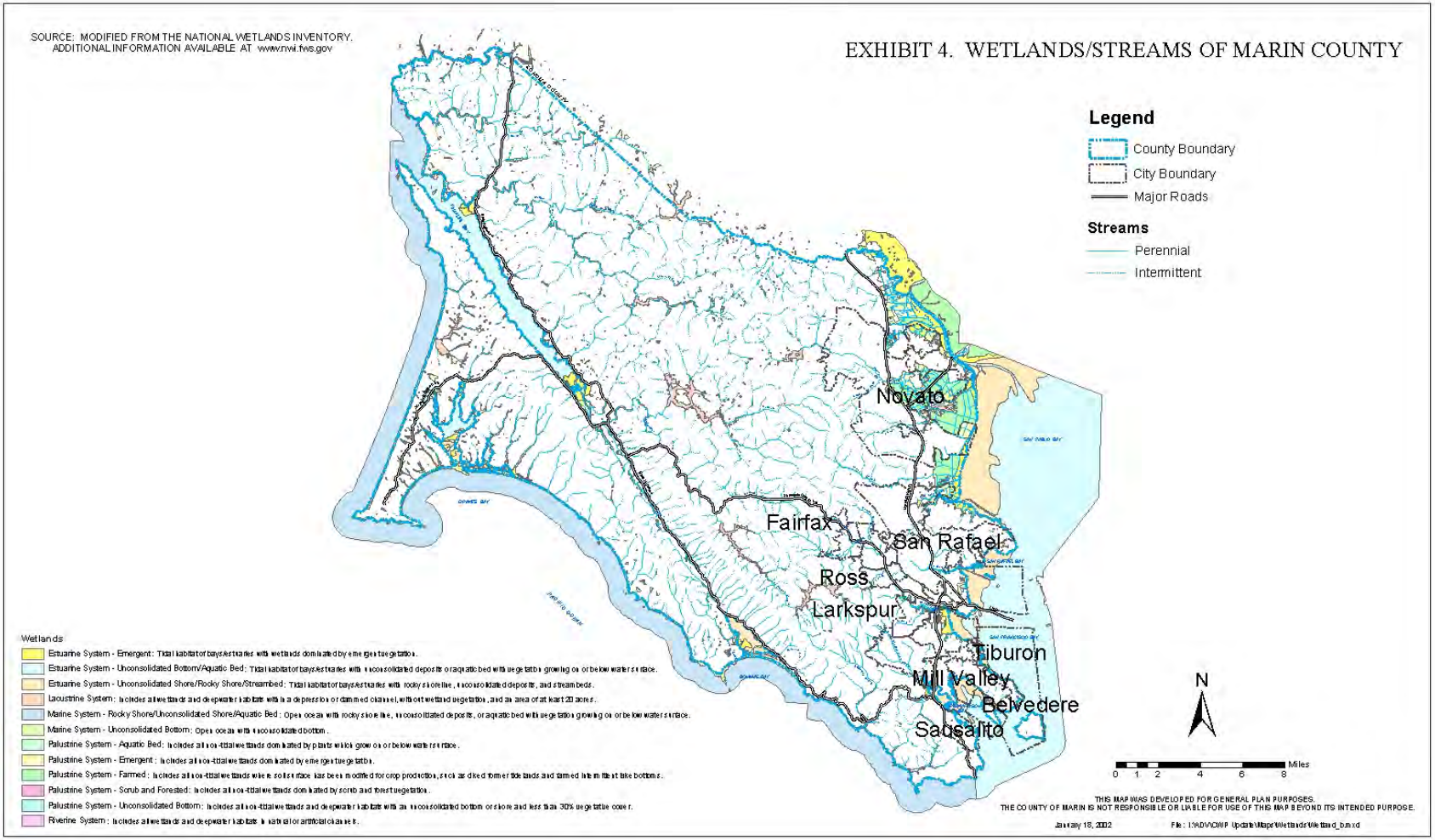
SOURCE: MODIFIED FROM THE NATIONAL WETLANDS INVENTORY.
ADDITIONAL INFORMATION AVAILABLE AT www.nwi.fws.gov
EXHIBIT 4. WETLANDS/STREAMS OF MARIN COUNTY
Legend
County Boundary
City Boundary
Major Roads
Streams
Perennial
Intermittent
Novato
Fairfax
San Rafael
Ross
Larkspur
Tiburon
Mill Valley
Belvedere
Sausalito
N
0 1 2 4 6 8 Miles
Wetlands
Estuarine System - Emergent: Tidal habitat of bays/estuaries with wetlands dominated by emergent vegetation.
Estuarine System - Unconsolidated Bottom/Aquatic Bed: Tidal habitat of bays/estuaries with unconsolidated deposits or aquatic bed with vegetation growing on or below water surface.
Estuarine System - Unconsolidated Shore/Rocky Shore/Streambed: Tidal habitat of bays/estuaries with rocky shoreline, unconsolidated deposits, and streambeds.
Lacustrine System: Includes all wetlands and deepwater habitats with land depression or dammed channel, without wetland vegetation, and an area of at least 20 acres.
Marine System - Rocky Shore/Unconsolidated Shore/Aquatic Bed: Open ocean with rocky shoreline, unconsolidated deposits, or aquatic bed with vegetation growing on or below water surface.
Marine System - Unconsolidated Bottom: Open ocean with unconsolidated bottom.
Palustrine System - Aquatic Bed: Includes all non-tidal wetlands dominated by plants which grow on or below water surface.
Palustrine System - Emergent: Includes all non-tidal wetlands dominated by emergent vegetation.
Palustrine System - Farmed: Includes all non-tidal wetlands where soil surface has been modified for crop production, such as diked former tidelands and farmed intermittent lake bottoms.
Palustrine System - Scrub and Forested: Includes all non-tidal wetlands dominated by scrub and forest vegetation.
Palustrine System - Unconsolidated Bottom: Includes all non-tidal wetlands and deepwater habitats with an unconsolidated bottom or shore and less than 30% vegetative cover.
Riverine System: Includes all wetlands and deepwater habitats in natural or artificial channels.
THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
THE COUNTY OF MARIN IS NOT RESPONSIBLE OR LIABLE FOR USE OF THIS MAP BEYOND ITS INTENDED PURPOSE.
January 18, 2002
File: I:\ADV\CWP Update\Maps\Wetlands\Wetland_bm.xd

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IV. SETTING

Marin County is well known for its natural beauty and diversity of natural resources, ranging from the marine environments of the coastal zone to the forests, chaparral, woodlands and grasslands of Mount Tamalpais. Of the total 332,928 acres of land area in Marin County, approximately 50 percent are under public management as parks, open space, conservation easements, and watershed lands. This includes 117,809 acres of park and open space lands, 22,731 acres of public watershed lands managed by the Marin Municipal Water District and the North Marin Water District, and 27,196 acres of easement lands held by the Marin Agricultural Land Trust and the Marin County Open Space District. The majority of the developed urban and suburban uses in Marin County are in the City-Centered Corridor in east Marin County. The remainder is generally in private ownership as grazing land and woodlands at the northcentral and northwest part of the County.

Natural communities in Marin County support a wide diversity of plant and animal species, including a high number of special-status species. Natural community types in the County include: mixed evergreen forest, oak woodland, pine forest, douglas fir/redwood forest, grassland, coastal beach dune, northern coastal scrub, chaparral, coastal salt marsh, riparian, and freshwater marsh. Exhibit 1 shows the distribution of vegetative cover in the county, modified from the 2004 CalVeg mapping program of the U.S. Forest Service. Major distinguishable characteristics include: the extensive grasslands to the north which intergrade with scrub and forest lands in the Point Reyes Peninsula; the forests, woodland, and chaparral covered slopes of Mt. Tamalpais; the grasslands and woodlands of the northcentral and northwestern part of the County; and a mosaic of grassland, woodland, and urban development in the City-Centered Corridor.

Historic land use has altered much of the landscape in the County, including the plant communities and wildlife dependent upon them. Beginning in the mid-nineteenth century and continuing into the present, activities such as livestock grazing, timber operations, clearing and disking for agricultural production, road building, and urban and suburban development have markedly altered the remaining natural communities. Native perennial grasslands have been largely replaced by non-native annual grasslands, and a number of highly invasive species now threaten the remaining grasslands. Fire suppression, livestock grazing, and more recently the affects of Sudden Oak Death have greatly altered the extent of woodland and forest cover. The past affects of timber harvesting and overgrazing continue to affect the aquatic habitat of the streams and creeks in the County, and limits the viability of the anadromous fisheries. These influences on the natural landscape have changed in the past few decades, from one of primarily agricultural-related activities to one of increased development pressure, particularly along the western fringe of the City-Centered Corridor and scattered locations in the Inland Rural and Coastal Recreation Corridors. Urban and suburban development has contributed to considerable fragmentation of the remaining natural areas associated with the system of local parks and open space lands along stream corridors and ridgelines throughout the City-Centered Corridor.

Although past influences have greatly altered the natural landscape, the extensive system of open space lands provides a unique opportunity to work toward the protection and enhancement of biological and wetland resources in the County. However, this can only be successfully achieved through coordinated management efforts between private landowners and public agencies, and through implementation of

effective policies defining permissible uses and necessary development controls established as part of the CWP. Exhibit 2 shows the relationship between public and privately-held lands in the County, identifying watershed lands, federal parks and facilities, state parks and facilities, and County and local parks. This includes the major federal holdings of Pt. Reyes National Seashore, Golden Gate National Recreation Area, Muir Woods National Monument and Point Reyes National Seashore in West Marin; the state park and Marin Municipal Water District watershed lands around Mount Tamalpais; smaller County-held and local parks in the City-Centered Corridor; and state-held lands along the shoreline and open water of the bay.

A. SPECIAL-STATUS SPECIES

The records of the CNDDB indicate that special-status plant and animal species occur in a wide range of habitat types throughout all of Marin County. Most of the reported occurrences are from the National Park Service lands of Point Reyes National Seashore and Golden Gate National Recreation Area, and the State Park and Marin Municipal Water District watershed lands on Mount Tamalpais. Many others occur along the shoreline of the bay, or unique habitat types such as the serpentine-derived soils and outcrops along the Tiburon Ridge. Still others are dependent on the creeks and streams throughout the County for dispersal and essential breeding habitat. Table 1 provides a list of the 75 animal species and 78 plant species reported from Marin County which are monitored by the CNDDB, together with several listed, proposed, and candidate species not carefully monitored by the CNDDB. Exhibit 3 shows the distribution of special-status plant and animal species throughout the County based on the CNDDB occurrence records, with the highest concentrations in the undeveloped lands of West Marin, the Mount Tamalpais vicinity, and shoreline of the bay. Areas of designated critical habitat mapped by the USFWS for a number of federally-listed species are also shown in Exhibit 3. This mapping effort has been simplified to shown occurrences of plant and animal species, together with streams known to support coho salmon and steelhead trout.

It should be noted that the occurrence records of the CNDDB tend to focus on listed species or those with a high inventory priority. Occurrence information for numerous special-status species which are known from or frequent Marin County is either not monitored at all or is recoded on only a sporadic basis by the CNDDB. This includes the possible seasonal occurrence of both listed and non-listed bird species, the limited status of some animal species as a CSC species by the CDFG, the limited status of Species of Concern (SC) to the USFWS, and the limited status of many plant species on Lists 2, 3, or 4 in the CNPS *Inventory*. Some of these species are identified in Table 1, but the number of occurrences from the CNDDB records does not accurately reflect their generally greater abundance and distribution then species that are actually listed under the state or federal Endangered Species Acts.

The USFWS also maintains information on special-status species as part of their project review and consultation responsibilities, and will prepare lists of known or suspected species from a particular county or USGS quadrangle. A request for special-status species known or suspected to occur in Marin County generated a list of 190 species which are listed, candidate, or SC (generally former candidate species in a previous classification system used by the USFWS). These include 55 listed species, 5 proposed and candidate species, and 130 recognized as SC by the USFWS or NMFS. A copy of the species list from the USFWS is contained in Appendix A for review. The much greater number of species in the USFWS list compared to the CNDDB records is due in part to the inclusion of numerous candidate, SC, and species considered to be of local or regional concern due to conservation

significance. A number of marine wildlife species not in the CNDDB inventory are also included in the USFWS list. Discrepancies between the two lists provide an indication of the limitations in collecting and monitoring data on special-status species, and need for detailed assessments when proposed development could affect sensitive habitat.

The USFWS list contained in Appendix A also identifies designated and proposed critical habitat for listed species, where these areas have been mapped within portions of the County by the USFWS and NMFS. Species with designated critical habitat within or extending into parts of Marin County include: coho salmon, winter run chinook salmon, steelhead, marbled murrelet, western snowy plover, Steller sea-lion, Baker's larkspur, and yellow larkspur. These designated critical habitat areas are shown in Exhibit 3, with mapping prepared as part of their official listings contained in Appendix A.

For many of the special-status species known from Marin County, habitat suitability is severely limited by the direct and indirect affects of development. These include the direct loss of habitat as a result of conversion to urban uses, affects of on-going habitat modifications due to vegetation management and agricultural practices, and indirect affects such as non-point discharge into aquatic habitat and recreational activities in the open space lands. The affect of habitat fragmentation is an important consideration in evaluating the recovery of listed species and the viability of natural communities as a whole.

Identification and protection of essential habitat for special-status species must be recognized during the environmental review of proposed development applications and in planning future open space acquisitions. Detailed surveys should be conducted for sites where there is a potential for occurrence of special-status plant and animal species.

TABLE I
SPECIAL-STATUS ANIMAL SPECIES KNOWN OR SUSPECTED FROM MARIN COUNTY

Common Name (Scientific Name)	Status Federal/State	Habitat
Amphibians/Reptiles		
California tiger salamander (*Ambystoma californiense*)	FT/CSC	Breeds in pools and adults occupy surrounding grasslands/open woodlands.
Loggerhead sea turtle (*Caretta caretta*)	FT / –	Open ocean.
Green sea turtle (*Chelonia mydas*)	FT / –	Open ocean.
Northwestern pond turtle (*Clemmys marmorata marmorata*)	SC / CSC	Streams/ponds/lakes.
Leatherback sea turtle (Dermochelys coriacea)	FE / –	Open ocean.
Ridley sea turtle (Lepidochelys olivacea)	FT / -	Open ocean.
California horned lizard (Phrynosoma coronatum frontale)	SC / CSC	Forests/woodlands/grasslands with loose soil.
Northern red-legged frog (Rana aurora aurora)	SC / CSC	Forests/woodlands/grasslands along streamsides.
California red-legged frog (Rana aurora draytonii)	FT / CSC	Forests/woodlands/grasslands along streamsides.
Foothill yellow-legged frog (Rana boylii)	SC / CSC	Streams with rocky substrate.
Western spadefoot toad (Spea hammondii)	SC / CSC	Grasslands/open woodlands with seasonal pools.
Birds		
Tricolored blackbird (*Agelaius tricolor)* (nesting colony)	SC / CSC	Freshwater marsh and surrounding fields.
Great egret (*Ardea alba*) (rookery)	– / –	Colonial nester in large trees.
Great blue heron (*Ardea herodias*) (rookery)	– / –	Colonial nester in trees, cliff-sides, marshes.
Golden eagle (*Aquila chrysaetos*)	- / CSC; FP	Open grasslands/woodlands.
Burrowing owl (*Athene cunicularia)* (burrow sites)	– / CSC	Open grasslands/scrub.
Marbled murrelet (*Brachyramphus marmoratus*)	FT / SE	Old growth forest/coastal estuaries/open ocean.
Western snowy plover (*Charadrius alexandrinus nivosus*) (nesting)	FT / CSC	Nesting along sandy beaches and shorelines
Northern harrier (*Circus cyaneus)* (nesting)	– / CSC	Nesting in marsh and low shrubs.
Back swift (*Cypsefloides niger)* (nesting)	SC / CSC	Nesting on cliffs and behind falls.
Yellow warbler (*Dendroica petechia brewsteri*) (nesting)	SC/ CSC	Nesting in willows and riparian cover.

Common Name (Scientific Name)	Status Federal/State	Habitat
Snowy egret (*Egretta thula*) (rookery)	– / –	Colonial nester in trees, cliff-sides, near marshland.
White-tailed kite (*Elanus leucurus*) (nesting)	SC / FP	Nesting in grassland/marshland with trees.
Tufted puffin (*Fratercula cirrhata*)	– / CSC	Colonial nester on off-shore islands/cliffs.
Saltmarsh common yellowthroat (Geothlypis trichas sinuosa)	SC / CSC	Salt and brackish water marsh.
Bald eagle (Haliaeetus leucocephalus)	FT / SE	Open water of lakes, bays, and ocean shoreline.
Loggerhead shrike (Lanius ludovicianus)	SC / CSC	Open grassland/scrub.
California black rail (Laterallus jamaicensis coturniculus)	– / ST; FP	Coastal saltmarsh.
Black-crowned night heron (Nycticorax nycticorax) (rookery)	– / –	Colonial nester in trees/shrubs near marshland.
Ashy storm-petrel (Oceanodrama homochroa) (rookery)	SC/ CSC	Colonial nester on off-shore islands.
Osprey (Pandion haliaetus) (nesting)	– / CSC	Nesting in trees associated with water bodies.
California Brown pelican (Pelecanus occidentalis oalifornicus)	FE / SE; FP	Coastal/bay shorelines and open water.
California clapper rail (Rallus longirostris obsoletus)	FE / SE	Salt and brackish marsh.
California least tern (Sterna antillarum browni)	FE / SE; FP	Coastal/bay shorelines and open water.
Northern spotted owl (Strix occidentalis caurina)	FT / –	Forest and woodland.
Fish		
Green sturgeon (*Acipenser medirostris*)	PT / CSC	Brackish water, marsh/bays.
Tidewater goby (*Eucyclogorius newberryi*)	FE / CSC	Brackish water, marsh/bays.
Tomales roach (*Lavinia symmetricus ssp. symmetricus*)	– / CSC	Tributaries of Tomales Bay.
Coho salmon (*Oncorhynchus kisutch*)	FT / SE	Spawns in freshwater streams.
Chinook salmon (*Onchorhynchus tshawytscha*)	FT / -	Spawns in freshwater streams.
Steelhead trout (*Oncorhynchus mykiss*)	FT / CSC	Spawns in freshwater streams.
Invertebrates		
Tomales isopod (*Caecidotea tomalensis*)	– / –	Freshwater marsh/ponds.
Monarch butterfly (*Danaus plexippus*) (colonies)	– / –	Overwinters in blue gum eucalyptus.
Black abalone (*Haliotes cracheriodii*)	C / -	Rocky intertidal zone and ocean waters.
White abalone (*Haliotes sorensi*)	FE / -	Rocky intertidal zone and ocean waters.
Williams' bronze shoulderband (*Helminthoglypta arrosa williamsi*)	– / –	Known only from Hogg Island.

Common Name (Scientific Name)	Status Federal/State	Habitat
Peninsula coast range shoulderband snail (*Helminthoglypta nickliniana awania*)	– / –	Known only from Point Reyes headland.
Ricksecker's water scavenger beetle (*Hydrochara ricksecker*i)	– / –	Aquatic habitat/pools and ponds.
Mission blue butterfly (*Icaricia icarioides missionensis*)	FE / –	Shrubs/grasslands with lupine host.
San Bruno elfin (*Incisalia mossii bayensis*)	FE / -	Coastal scrub with stonecrop host plant.
Bumblebee scarab beetle (*Lichnanthe ursina*)	– / –	Coastal dunes.
Tiburon micro-blind harvestman (*Microcina tiburona*)	– / –	Serpentine outcrops near spring/seeps.
Myrtles silverspot (*Speyeria zerene myrtleae*)	FE / –	Scrub/grassland with larval host.
California freshwater shrimp (*Syncaris pacifica*)	FE / SE	Freshwater streams with undercut banks.
Mammals		
Pallid bat (*Antrozous pallidus)*	– / CSC	Roosts in protected locations.
Point Reyes mountain beaver (*Aplodontia rufa phaea)*	– / CSC	Springs/ seeps with dense cover.
Guadalupe fur seal (*Arctocephalus townsendi*)	FT / ST; FP	Open ocean, beaches.
Sei whale (*Balaenoptera borealis*)	FE / –	Open ocean.
Blue whale (*Balaenoptera musulus*)	FE / –	Open ocean.
Finback whale (*Balaenoptera physalus*)	FE / –	Open ocean.
Townsend's western big-eared bat (*Corynorhinus townsendii townsendii*)	– / CSC	Roosts in protected locations.
Grey whale (*Eschrichtius robustus*)	FE / –	Open ocean.
Right wale (*Eubalaena glacialis*)	FE / -	Open ocean.
Steller seal-lion (*Eumetopias jubatus*)	FT / –	Open ocean, beaches.
Greater western mastiff-bat (*Eumops perotis californicus*)	SC / SCS	Roosts in protected locations.
Southern sea otter (*Enhydra lutris nereis*)	FT / FP	Nearshore marsh habitat.
Humpback whale (*Megaptera novaengliae*)	FE / -	Open ocean.
Long-eared myotis bat (*Myotis evotis*)	SC / -	Roosts in protected locations.
Fringed myotis bat (*Myotis thysanodes*)	SC / -	Roosts in protected locations.
Long-legged myotis bat (*Myotis volans*)	SC / -	Roosts in protected locations.
Yuma myotis bat (*Myotis yumanensis*)	SC / - C	Roosts in protected locations.
Sperm whale (*Physeter catodon*)	FE / -	Open ocean.
Salt marsh harvest mouse (*Reithrodontomys raviventris*)	FE / SE; FP	Coastal saltmarsh.
Angel Island mole (*Scapanus latimanus isularis*)	– / CSC	Coastal scrub/prairie on Angel Island.
Point Reyes jumping mouse (*Zapus trinotatus orarius*)	– / CSC	Coastal scrub/grassland from Point Reyes.

TABLE 1
SPECIAL-STATUS PLANT SPECIES KNOWN OR SUSPECTED FROM MARIN COUNTY

Common Name (Scientific Name)	Status Federal/ State/CNPS	Habitat
Pink sand-verbena (*Abronia umbellata ssp. breviflora*)	SC / – / 1B	Coastal dunes/stand.
Blasdale's bent grass (*Agrostis blasdalei*)	SC / – / 1B	Coastal dunes/scrub/prairie.
Point Reyes bent grass (*Agrostis clivicola var punta-reyesensis*)	SC / – / –	Coastal scrub/prairie/ coniferous forest.
Sonoma alopecurus (*Alopecurus aequalis var sonomensis*)	FE / – / 1B	Freshwater marsh/riparian scrub.
Napa false indigo (*Amorpha californica var napensis*)	– / – / 1B	Forest/chaparral/woodland.
Bent-flowered fiddleneck (*Amsinckia lunaris*)	– / – / 1B	Coastal bluff scrub/woodland/ grassland.
Mt. Tamalpais manzanita (A*rctostaphylos hookeri ssp. montana)*	SC / – / 1B	Chaparral/grassland.
Marin manzanita (*Arctostaphylos virgata*)	– / – / 1B	Coniferous forest/chaparral.
Coastal marsh milk-vetch (*Astragalus pynostachyas var p.*)	– / – / 1B	Dunes/marshes/swamps.
Point Reyes blennosperma (*Blennosperma nanum var. robustum*)	SC / SR / 1B	Coastal prairie/scrub.
Small groundcone (*Boschniakia hookeri*)	– / – / 2	Coniferous forests.
Thurber's reed grass (*Calamagrostis crassiglumis*)	SC / – / 2	Coastal scrub/freshwater marsh.
Tiburon mariposa lily (*Calochortus tiburonensis*)	FT / ST / 1B	Serpentine grassland.
Coastal bluff morning-glory (*Calystegia purpurata ssp. saxicola*)	– / – / 1B	Dunes/coastal scrub.
Swamp harebell (*Campanula californica*)	SC / – / 1B	Bogs/ferns/ marshes in coniferous forest.
Flaccid sedge (*Carex leptalea*)	– / – / 2	Bogs/fens/meadows/seeps.
Lyngbye's sedge (*Carex lyngbyei*)	– / – / 2	Marshes/swamps.
Tiburon indian paintbrush (*Castilleja affinis ssp. neglecta*)	FE / ST / 1B	Serpentine grassland.
Humbolt Bay owl's clover (*Castilleja ambigua ssp. humboldtiensis*)	SC / – / 1B	Coastal saltmarsh.
Mt. Vision ceanothus (*Ceanothus gloriosus var. porrectus*)	SC / – / 1B	Coniferous forest/coastal scrub/prairie.
Mason's ceanothus (*Ceanothus masonii*)	SC / SR / 1B	Chaparral/serpentine.
San Francisco Bay spineflower (*Chorizanthe cuspidata var. cuspidata*)	SC / – / 1B	Coastal scrub/prairie/dunes.
Woolly-headed spineflower (*Chorizanthe cuspidata var. villosa*)	– / – / 1B	Coastal scrub/prairie/dunes.
Robust spineflower (*Chorizanthe robusta var. robusta*)	FE / - / 1B	Woodlands, coastal dunes/scrub.
Sonoma spineflower (*Chorizanthe valida*)	FE / SE / 1B	Coastal prairie.
Franciscan thistle (*Cirsium andrewsii*)	– / – / 1B	Forest/coastal bluff scrub/prairie/ coastal scrub.
Mt. Tamalpais thistle (*Cirsium hydrophilum var. vaseyi*)	SC / – / 1B	Forest/chaparral.
Raiche's red ribbons (*Clarkia concinna ssp. raichei*)	SC / – / 1B	Coastal bluff scrub.
Round-headed chinese houses (*Collinsia corymbosa*)	– / – / 1B	Coastal dunes.

Common Name (*Scientific Name)*	Status Federal/ State/CNPS	Habitat
Point Reye's bird's beak (*Cordylanthus maritimus ssp. palustris*)	SC / – / 1B	Coastal saltmarsh/dunes.
Soft bird's beak (*Cordylanthus mollis spp. mollis*)	FE / SR / 1B	Coastal saltmarsh.
Baker's larkspur (*Delphinium bakeri*)	FE / SR / 1B	Coastal scrub.
Yellow larkspur (*Delphinium luteum*)	FE / SR / 1B	Chaparral/coastal scrub/prairie.
Western leatherwood (*Dirca occidentalis*)	– / – / 1B	Forest/chaparral/woodland.
Supple daisy (*Erigeron supplex*)	– / – / 1B	Coastal bluff scrub/prairie.
Minute pocket-moss (*Fissidens pauperculus*)	– / – / 1B	Forest floor along coast.
Marin checker lily (*Fritillaria affinis var tristulis*)	– / – / 1B	Coastal bluff scrub/prairie.
Fragrant fritillary (*Fritillaria liliacea*)	SC / – / 1B	Coastal scrub/prairie/ grassland.
Dune gilia (*Gilia capitata ssp. chamissonis*)	– / – / 1B	Dunes/coastal scrub.
Wooly-headed gilia (*Gilia capitata ssp. tomentosa*)	– / – / 1B	Coastal bluff scrub/outcrops.
Dark-eyed gilia (*Gilia millefoliata*)	– / – / 1B	Coastal dunes.
San Francisco gumplant (*Grindelia hirsutula var. maritima*)	– / – / 1B	Coastal bluff scrub/coastal scrub/ grassland.
Diablo helianthella (*Helianthella castanea*)	– / – / 1B	Forest/chaparral/woodland/coastal scrub/grassland.
Short-leaved evax (*Hesperevax sparsiflora var. brevitolia*)	– / – / 2	Coastal bluff scrub/dunes.
Marin western flax (*Hesperolinon congestum*)	FT / ST / 1B	Chaparral/grassland.
Santa Cruz tarplant (*Holocarpha macradenia*)	FT / SE / 1B	Coastal prairie/coastal scrub/ grassland.
Kellogg's horkelia (*Horkelia cuneata ssp. sericea*)	SC / – / 1B	Coniferous forest/coastal scrub/ chaparral.
Point Reyes Horkelia (*Horkelia marinensis*)	SC / – / 1B	Coastal scrub/prairie/dunes.
Thin-lobed horkelia (*Horkelia tenuiloba*)	– / – / 1B	Coastal scrub/chaparral.
Baker's goldfields (*Lasthenia macrantha ssp. bakeri)*	– / – / 1B	Coniferous forest/coastal scrub.
Perennial goldfields (*Lasthenia macrantha ssp. macrantha*)	– / – / 1B	Coastal bluff scrub/dunes/coastal scrub.
Beach layia (*Layia carnosa*)	FE / SE / 1B	Coastal dunes.
Tamalpais lessingia (*Lessingia micradenia var. micradenia*)	SC / – / 1B	Chaparral/grassland in serpentine.
Maison's lilaeopsis (*Lilaeopsis masonii*)	SC / SR / 1B	Fresh and brackish marsh.
Coast lily (*Lilium maritimum*)	– / – / 1B	Forest/prairie/coastal scrub/marshes/ swamps.
Point Reyes meadowfoam (*Limnanthes douglasii ssp. sulphurea*)	SC / SE / 1B	Freshwater marsh/prairie/seeps.
Large-flowered linanthus (*Linanthus grandiflorus*)	SC / – / 4	Coastal bluff scrub.
Tidestrom's lupine (*Lupinus tidestromii*)	FE / SE / 1B	Coastal dunes.
Marsh microseris (*Microseris paludosa*)	– / – / 1B	Forest/woodland/coastal scrub/ grassland.
Baker's navarretia (*Navarretia leucocephala ssp. bakeri*)	– / – / 1B	Woodland/seeps/pools/grassland/ forest.
Marin County navarretia (*Navarretia rosulata*)	– / – / 1B	Coniferous forest/chaparral.
White-rayed pentachaeta (*Pentachaeta bellidiflora*)	FE / SE / 1B	Grassland on serpentine.

Common Name (*Scientific Name*)	Status Federal/ State/CNPS	Habitat
North Coast phacelia (*Phacelia insularis var. continentis*)	SC / ST / 1B	Coastal bluff scrub/dunes.
Hairless popcorn flower (*Plagiobothrys glaber*)	/ / 1A	Meadows/seeps/marshes/swamps.
Point Reyes rein orchid (*Piperia elegans ssp. decurtata*)	– / – / 1B	Coastal bluff scrub only from Pt. Reyes National Seashore.
North Coast semaphore grass (*Pleuropogon hooverianus*)	SC / SB / 1B	Forest/steeps.
Marin knotweed (*Polygonum marinense*)	SC / – / 3	Marshes/swamps.
Tamalpais oak (*Quercus parvula var. tamalpaisensis*)	– / – / 1B	Coniferous forest only on Mt. Tamalpais.
California beaked-rush (*Rhynchospora californica*)	SC / – / 1B	Bogs/marshes/seeps/coniferous forest.
Point Reyes checkerbloom (*Sidalcea calycosa ssp. rhizomata*)	– / – / 1B	Marshes/swamps.
Marin checkerbloom (*Sidalcea hickmanii ssp. viridis*)	SC / – / 1B	Chaparral.
Purple-stemmed checkerbloom (*Sidalcea malviflora ssp. purpurea*)	– / – / 1B	Forest/prairie.
Tamalpais jewel-flower (*Streptanthus batrachopus*)	SC / – / 1B	Coniferous forest/chaparral.
Mt. Tamalpais jewel-flower (*Streptanthus glandulosus ssp. pulchellus*)	– / – / 1B	Chaparral/grassland.
Santa Cruz microseris (*Stebbinsoseris decipiens*)	SC / – / 1B	Forest/chaparral/coastal scrub and prairie.
Tiburon jewel-flower (*Streptanthus niger*)	FE / SE / 1B	Grassland on serpentine.
Showy Indian clover (*Trifolium amoenum*)	FE / – / 1B	Grassland/coastal bluff scrub.
San Francisco owl's clover (*Triphysaria floribunda*)	SC / – / 1B	Coastal prairie/grassland.

STATUS DESIGNATIONS

Federal:

FE = Listed as "endangered" under the federal Endangered Species Act.
FT = Listed as "threatened" under the federal Endangered Species Act.
PE = Proposed for federal listing as "endangered".
PT = Proposed for federal listing as "threatened".
C = A candidate species under review for federal listing. Candidates include taxa for which the USFWS has sufficient biological information to support a proposal to list as endangered or threatened.
SC = Species of Concern; formerly considered a candidate species for listing by the USFWS.

State:

SE = Listed as "endangered" under the California Endangered Species Act.
SR = Listed as "rare" under the California Endangered Species Act.
ST = Listed as "threatened" under the California Endangered Species Act.
CP = California fully protected species; individual may not be possessed or taken at any time.
CSC = Considered a species of special concern by the CDFG; taxa have no formal legal protection but nest sites and communal roosts are generally recognized as significant biotic features.

CNPS:

1A = Plants of highest priority; plants presumed extinct in California.
1B = Plants of highest priority; plants rare and endangered in California and elsewhere.
3 = Plants requiring additional information; a review list.
4 = Plants of limited distribution; a watch list.

B. SENSITIVE NATURAL COMMUNITIES

Several of the natural communities within the planning area are considered to have a high inventory priority with the CNDDB, and should receive appropriate recognition in planning for the CWP update. These communities have been designated as sensitive due to rarity and continuing loss as a result of development, flood control improvements, and other factors. As indicated in Exhibit 3, sensitive natural communities mapped by the CNDDB in the County include: coastal and valley freshwater marsh, coastal brackish marsh, coastal terrace prairie, central dune scrub, northern coastal salt marsh, northern maritime chaparral, northern vernal pool, and serpentine bunchgrass. Additional stands of native grasslands not mapped by the CNDDB occur in many locations throughout the County, as do the sensitive riparian forest,and scrub communities along creeks and larger drainages. Detailed surveys should be conducted for sites where there is a potential for occurrence of sensitive natural communities, including native grasslands, seeps, riparian scrub and woodland, valley oak woodland, coastal salt marsh, and coastal bluff scrub, among others.

While oak woodlands in general are not considered to have a high inventory priority with the CNDDB, they should be recognized as an important habitat type in the County due to their high wildlife value and their vulnerability to the affects of Sudden Oak Death Syndrome (SOD). Tanoaks and coast live oaks are dying in large numbers, and black oaks, California buckeye, California bay, madrone, huckleberry, and rhododendron are suspected to be hosts or potential carriers of the fungus suspected to cause oak mortality. This fungus, a species of *Phytophthora*, and several beetle species are consistently associated with the dying oaks. It is contributing to significant changes in vegetative cover over large parts of the County, altering habitat for woodland-dependent species and exacerbating hazardous fire conditions where wildlands interface with developed areas.

C. WETLANDS

Wetlands in the County include areas of salt and brackish water marsh along the shoreline of the coast and bay, riparian habitat along creeks and streams, and scattered freshwater seeps and springs. Exhibit 4 shows the extent of major wetland systems mapped as part of the NWI, which consist of a range of characteristic wetland types, together with streams mapped by County staff. These include the marine and estuarine system of the ocean, bays, and lagoons; the riverine and lacustrine systems of major creeks and channels; and the palustine system comprising freshwater marsh, riparian scrub and woodland, and scattered stock ponds. Some wetland features, such as freshwater seeps and springs were generally not identified as part of the NWI because of the general scale of the mapping effort. Detailed wetland delineations would be required to determine the extent of jurisdictional wetlands and other waters as specific locations, particularly where development is proposed.

V. MARIN COUNTYWIDE PLAN REVIEW

The 1994 CWP serves as the principal planning document regulating development and providing for conservation of important resources on a local level for the unincorporated areas of Marin County. Policies and programs from the Environmental Quality Element of the CWP are of particular relevance to the conservation of natural resources, focusing on stream and creekside conservation areas, bayfront

conservation areas, mineral resources, and the built environment. The Community Development Agency is responsible for reviewing individual development applications to ensure compliance with the California Environmental Quality Act (CEQA) and the National Environmental Protection Act (NEPS).

Table 2 provides a review of each of the policies and programs from the current CWP related to biological and wetland resources. This includes a summary statement on whether they still apply and how they should be refined or replaced as part of the CWP update process.

TABLE 2
EVALUATION OF EXISTING COUNTYWIDE PLAN BIOLOGICAL AND WETLAND RESOURCES POLICIES AND PROGRAMS

Environmental Quality Element

RESOURCE CONSERVATION AREAS	
1. Stream and Creekside Conservation Areas	
Policy EQ-2.1 Value of Riparian Systems. Riparian systems, streams and their riparian and woodland habitat are irreplaceable and should be officially recognized and protected as essential environmental resources, because of their values for erosion control, water quality, fish and wildlife, aesthetics, recreation, and the health of human communities.	Needs Refinement - Need to define "riparian" and include reference to function as "movement corridors" for fish and wildlife and importance in function as habitat connectivity.
Policy EQ-2.2 Streams Defined as Blue Lines on USGS Quad Maps. All perennial and intermittent streams, which are defined as natural watercourses shown as solid or dashed blue lines on the most recent appropriate USGS quad sheet, should be subject to these stream and creekside protection policies. A perennial stream is further defined as: a watercourse that flows throughout the year (except for infrequent or extended periods of drought), although surface water flow may be temporarily discontinuous in some reaches of the channel such as between pools. An intermittent stream is further defined as: *a watercourse that flows during the wet season, continues to flow after the period of precipitation, and ceases surface flow during at least part of the dry season.* An ephemeral stream should be subject to these policies if it supports riparian vegetation for a length of 100 feet or more. An ephemeral stream which does not support vegetation for 100 feet or more may also be subject to the SCA policies if it is demonstrated that the stream has value for flood control, water quality, or habitat which supports rare, endangered, or migratory species. An ephemeral stream is defined as: *a watercourse which carries only surface runoff and flows during and immediately after periods of precipitation.*	Needs Refinement - The SCA policies are perhaps the most important in the Plan. Some ambiguity in that "riparian vegetation" is not defined in the SCA policies but is used as a controlling factor in applicability for ephemeral streams and width in perennial and intermittent streams with major areas of stream side vegetation. Need to define riparian as a term in the SCA. May be useful to reorganize SCA as part of larger wetland/streams focus.

Policy EQ-2.3 Definition of Stream Conservation Areas. A Stream Conservation Area (SCA) should be designated along all natural watercourses shown as a solid or dashed blue line on the most recent appropriate USGS quad sheet, or along all watercourses supporting riparian vegetation for a length of 100 feet or more. The zones consist of the watercourse itself between the tops of the banks and a strip of land extending laterally outward from the top of both banks, to a width of 100 feet on each side in the Coastal Recreation and Inland Rural Corridors and to a width of 50 feet on each side in the City-Centered Corridor on smaller infill lots. Where large tracts of land in the City-Centered Corridor are proposed for development, the 100-foot buffer should be applied, where consistent with legal requirements, and other planning and environmental goals. In the Coastal Recreation and Inland Rural Corridors, the zone should be extended if necessary to include an area 50 feet landward from the edge of riparian vegetation.	Needs Refinement - Some ambiguity regarding "riparian vegetation" as in Policy EQ-2.2.
Program EQ-2.3a Protection of Stream Conservation Area. The County shall implement the policies for Stream Conservation Areas through its established permit review processes and/or through adoption of specific new ordinances. When a development permit is applied for, staff will determine whether the proposed development falls within the zone, generally 100 feet from the banks of streams (50 feet from the banks of streams in the City-Centered Corridor). If the project is in this zone, staff will determine whether the proposed use is permitted by right under the Stream Conservation policies, as well as by the underlying zoning. If the proposed use is not a permitted use in Policy EQ-2.4 and it is not a prohibited use in Policy EQ-2.5 of Stream Conservation policies, but it is allowed under the zoning, the applicant may apply for a development permit. In order for such a permit to be issued for an existing parcel, it should be determined that the parcel either: Falls entirely within the Stream Conservation Area; or Development on any other portion of the parcel (outside the SCZ) would have greater impacts on water quality. If the proposal involves the creation of a new parcel, any needed modifications should be made to assure that no development occurs within the Conservation Area to the extent possible. Applicants shall be required to submit adequate information to determine whether the Stream Conservation Area policies are being met. All development permit applications shall be reviewed for conformity with these policies, and in accordance with the California Environmental Quality Act. Proposals which do not conform to Stream Conservation policies, and which cannot be modified or mitigated so that they do conform, shall be denied. Information on 100-year floodplains should be made available for public and staff reference and shall be incorporated into all planning reviews	Needs Refinement - Should include reference to process used by staff to determine applicability of SCA. Is this simply reference to the County's Wetlands/Stream GIS or does it include a site inspection? There may be a need for an independent review by a qualified vegetation ecologist in some instances to define limits of riparian vegetation.
Program EQ-2.3b Establish a Fund to Fence Sensitive Stream Areas. The County should explore the feasibility of creating a fund, established in conjunction with the Resource Conservation District and the Soil Conservation Service, and other relevant agencies, to pay the cost of fencing sensitive streamside areas (on private property) which could be impacted by cattle grazing.	Still Applicable - Unsure of status. May be useful to include reference to Marin County Open Space District as a participating agency.

Policy EQ-2.4 Land uses in Stream Conservation Areas (SCAs). The following uses are permitted in the SCA by development permits, provided these uses are allowed by the underlying zoning: • all currently existing structures and uses including reconstruction and repairs necessary water supply projects • flood control projects • projects to improve fish and wildlife habitat • grazing of livestock and other agricultural uses • maintenance of water channels for erosion control and other purposes • road and utility line crossings • water monitoring installations • trails	Needs Refinement - Need to include reference to minimizing disturbance in the SCA for permitted uses as well. Trails should be preferably sited outside a SCA to minimize disturbance to sensitive wildlife habitat, particularly through riparian vegetation. Livestock grazing and agricultural uses may be permitted by historical precedent, but should be discouraged in the SCA. Program EQ-2.3b should be implemented to control disturbance.
Policy EQ-2.5 Prohibited Land Uses in Stream Conservation Areas. The following new uses are prohibited in the SCA: • roads and utility lines, except at crossings • confinement of livestock • dumping or disposal of refuse • use of motorized recreational vehicles • any structural improvement (excluding repairs) other than those identified in Policy EQ-2.4, including residences, barns, and storage buildings, unless allowed by a development permit in Policy EQ-2.6.	Still Applicable – May be appropriate to review prohibited uses.
Policy EQ-2.6 Other Allowable Land Uses in the Stream Conservation Areas. Other uses may be allowed in the SCA by development permit, provided these uses conform to all other policies for SCAs and are: • allowed by the underlying zoning • on existing parcels that fall entirely within the zone • on existing parcels where it can be conclusively demonstrated that development on any other part of the parcel would have a more adverse effect on water quality or other environmental impacts.	Still Applicable – These parcels may be a priority for acquisition as open space by the Marin County Open Space District.
Policy EQ-2.7 Consideration of Costs. All concerned agencies should take aesthetic, scenic, environmental, and recreational benefits into full consideration when computing costs of alternatives for modifications of streams (applicants will be required to obtain a Streambed Alteration Agreement from the State Department of Fish and Game).	Still Applicable – Unsure of status and how applied.
Policy EQ-2.8 Retention of the Natural Vegetation. The retention of the natural vegetation in an SCA should be encouraged in order to realize benefits such as soil erosion prevention, stream, shade, etc. When vegetation must be removed and soil disturbed within the SCA, or when vegetation has been destroyed or eliminated, the area should be re-seeded or replanted with native plants of the habitat as soon as possible. Broom and other aggressive exotic plants should be removed and replaced with native plants.	Needs Refinement - Need reference to monitoring to ensure re-establishment where vegetation removal is necessary.
Policy EQ-2.9 Minimal Disturbance of Vegetation. Disturbance of vegetation within the SCA should be minimized or avoided whenever possible. Minimizing or avoiding disturbance of streamside vegetation is particularly important for trees and shrubs which provide shade, stability for the streambank, and wildlife habitat. Vegetation may partially block streams creating a ponding effect which may be beneficial fish habitat. Tree growth may be cleared from the stream channel when it unduly restricts flood flows, to protect health, safety, and welfare.	Needs Refinement - Redundant to Policy EQ-2.8 except for reference to flood control maintenance. Perhaps could include reference to flood control improvements that are designed with sufficient capacity to allow for retention of native vegetation in the channel, thereby improving habitat and minimizing need for routine maintenance.

Policy EQ-2.10 Tree and Shrub Plantings. Trees and shrubs to be planted along watercourses should include a variety of species that would naturally grow in or near the creek. In general, the planting of exotic trees should be avoided. When removal of riparian vegetation is unavoidable, and mitigation is required, replacement should be at a 2:1 ratio, whenever feasible. Enhancement and restoration of culverted streams is encouraged, whenever feasible.	Needs Refinement - Reference to "in general" should be deleted and exotic trees prohibited for planting in SCA. Need reference to monitoring to ensure re-establishment where vegetation removal is necessary.
Policy EQ-2.11 Modification of Natural Channels. Modification of natural channels within SCAs for flood control, etc., should be done in a manner that retains and protects the vegetation forming ground cover and shade. Special attention should be given to the protection of riparian vegetation.	Still Applicable - As with EQ-2.9 any flood control improvements should be designed with sufficient capacity to allow for retention of native vegetation in the channel.
Policy EQ-2.12 Protection of Riparian Vegetation. At the time of a site specific development application, the County shall evaluate impacts on riparian vegetation, when the riparian vegetation extends beyond the Streamside Conservation Zone, and incorporate measures to protect the riparian vegetation into the project design.	Needs Refinement – Need to define riparian vegetation and setback standard where it falls outside the SCA.
Policy EQ-2.13 Importance of Stream Conservation Areas (SCAs) to Wildlife Habitat. SCAs are the most important land areas for wildlife, possessing greater numbers and variety than any other area. The value of SCAs for this purpose is therefore recognized. Fishery resources are directly dependent upon the protection of SCAs to provide quality aquatic habitats. It is important that the wildlife habitat areas in streamside communities be permanently maintained and enhanced. Human use of these areas should be restricted as necessary to protect these communities. However, designation of SCAs shall not in any manner authorize trespass upon private property, or increase the right of public agencies to gain access to private property.	Needs Refinement – Need to expand policy to address fishery resources and function of SCA as a movement corridor for aquatic and terrestrial species. Need to address secondary impacts of development and nonpoint discharge on water quality degradation.
Policy EQ-2.14 Monitoring Stream Conservation Areas. A system of monitoring SCAs should be established to assure the protection of vegetation, soils, water quality, and wildlife habitat along streams.	Needs Refinement – Unsure of status and how implemented.
Policy EQ-2.15 Stream Alterations. Before any stream alterations are permitted, the minimum water flows necessary to protect fish habitats, water quality, riparian vegetation, groundwater recharge areas, and downstream users should be determined in conjunction with the State Department of Fish and Game and the Division of Water Rights of the State Water Resources Control Board.	Needs Refinement - Should include clear reference to Streambed Alteration Agreement process of CDFG and possibly Corps permit authorization. Should include reference to other policies regarding protection of vegetation and habitat.
Policy EQ-2.16 Modification and Mitigation of Development Within Stream Conservation Areas. When a fish or other wildlife resource may be substantially affected by development in this zone, modifications and mitigation should be required in the project, to be determined in consultation with the State Department of Fish and Game.	Needs Refinement - Should be coordinated with other policies related to vegetation disturbance and re-establishment. Need to address secondary impacts of development and nonpoint discharge on water quality degradation.
Policy EQ-2.17 Stream Management Programs. Projects and stream management programs which improve the opportunity for fishing and enhance the abundance of sport fish should be encouraged and supported.	Needs Refinement - Should include monitoring for sensitive species and habitat values, in addition to recreational benefits.
Policy EQ-2.18 Soil Disturbance. Soil disturbance should be discouraged within the SCA. Where absolutely necessary it should be limited to the smallest surface area and volume of soil possible and for the shortest practical length of time.	Needs Refinement - Should include program for revegetation of disturbed areas.
Policy EQ-2.19 Surface Runoff. Surface runoff rates in excess of pre-development levels should not be allowed where a new problem will be created or where the runoff will exacerbate an existing problem.	Still Applicable

Policy EQ-2.20 Retention of Sediment. On-site facilities for the retention of sediments or contribution toward regional sediment control measures produced by development should be provided during construction and, if necessary, upon project completion. Continued maintenance of these facilities should be required.	Still Applicable
Policy EQ-2.21 Roads, Road Spoils, and Roadfill Slopes. New roads and roadfill slopes should be located outside the SCA, except at stream crossings. No spoil from road construction should be deposited within the SCA. At road crossings in the SCAs, special effort should be taken to stabilize soil surfaces.	Still Applicable
Policy EQ-2.22 Altering Stream Flow, Bed, or Banks. Filling, grading excavating, obstructing flow, or altering the bed or banks of the stream channel and riparian system shall be discouraged. Such activity will only be allowed after completion of environmental review, identification of appropriate mitigation measures, and issuance of a permit by the Department of Public Works.	Needs Refinement - Altering should be allowed as part of stream habitat enhancement and removal of barriers to fish and wildlife movement. Should acknowledge CDFG Streambed Alteration Agreement process.
Policy EQ-2.23 Seasonal Development Factors. Development work adjacent to and affecting SCAs should be done during the dry season only, except for emergency repairs. Disturbed surfaces should be stabilized and replanted, and areas where woody vegetation has been removed should be replanted with suitable species before the beginning of the rainy season.	Needs Refinement - Should specify period of restricted/permitted activity, with restrictions typically applied from October 15 through April 15.
Policy EQ-2.24 Enhancement of Stream Conservation Areas. Uses and development within SCAs should enhance the appearance of the streamside environment and protect native vegetation. Through careful site analysis and development, views should be preserved and the integrity of the streamside environment should be protected. The County should work in close cooperation with the flood control districts, water districts, and wildlife agencies in the design and choice of materials for construction and alterations within the SCAs.	Still Applicable
Policy EQ-2.25 Public Access to Stream Conservation Areas. Access to publicly owned lands within the SCA should be encouraged and improved where feasible by means of pathways, access points, and bridges. Public access should respect and enhance the environment and will not be allowed if access will destroy or degrade the riparian habitat. Trails should be situated at an adequate distance from the stream course to afford protection of wildlife corridors. Trails may occasionally diverge to the creek to provide visual access. Public lands should be added adjacent to streams where possible to make resources more accessible and usable for passive recreation and to protect and enhance streamside habitat.	Needs Refinement - Trails and other open space improvements should be designed outside or at the edge of the SCA to minimize potential for disturbance to habitat.
Policy EQ-2.26 Restoration of Damaged Portions of Stream Conservation Areas. Damaged portions of SCAs should, wherever possible, be restored to their natural state. When it is not possible to return the SCA to a natural state, the portions of the channels that have been significantly altered for flood control should be improved for urban open space uses such as landscaped areas and paths. These improvements should enhance habitat values.	Needs Refinement - Need to accommodate flood flow capacity and allow for routine disturbance as part of long-term maintenance.
Policy EQ-2.33 Streams in Development Plans. Streams which are part of lands to be developed are a resource for their aesthetic and wildlife values. Vegetated buffer areas of native plants should be included in plans in order to protect the habitat for wildlife, to preserve and focus views, and to assure public safety. Vegetated buffer areas, rather than fencing, should be utilized except where safety issues or specific environmental concerns need to be addressed.	Still Applicable
Policy EQ-2.34 Land Divisions in Stream Conservation Areas. Land divisions should be reviewed for size of parcels and property line locations relative to creeks to allow management of the creek by one property owner, to the greatest extent possible.	Needs Refinement - Need specific reference to avoid creating conditions allowed under Policy EQ-2.6.

Policy EQ-2.35Responsible Agencies/Individuals. Any agency or individual responsible for management of SCAs should undertake the responsibility for implementation of all SCA policies.	Needs Refinement - Unsure of status and how to implement.
3. Bayfront Conservation Areas	
Policy EQ-2.42 Wildlife and Aquatic Habitats. The County shall preserve and enhance the diversity of wildlife and aquatic habitats found in the Marin County bayfront lands, including tidal marshes, seasonal marshes, lagoons, wetlands, agricultural lands, and low-lying grasslands overlying historical marshlands.	Needs Refinement - Need to address secondary impacts of development and nonpoint discharge on water quality degradation.
Policy EQ-2.43 Development and Access Limitations in Bayfront Conservation Areas. Development shall not encroach into sensitive wildlife habitats, limit normal range areas, create barriers which cut off access to food, water, or shelter, or cause damage to fisheries or fish habitats. Buffer zones between development and identified or potential wetland areas shall be provided. On residential and industrial parcels which are already filled and at least 50% developed, minor redevelopment involving less than 25% of the structure may be excluded from policies which apply to the Bayfront Conservation Zone. No additional fill will be allowed. Access to environmentally sensitive marshland and adjacent habitat shall be restricted, especially during spawning and nesting seasons.	Needs Refinement - Minor redevelopment should adhere to minimum setback standards beyond no filling.
Program EQ-2.43a Wetland Impact Mitigation. Development should be sited to avoid wetland areas so that the existing wetlands are preserved. The next priority would be to restore or enhance the wetland environment on-site, provided that no net loss of wetlands occurs. Restoration of wetlands off-site should only be allowed when it has been demonstrated that on-site restoration is not possible and there is no net loss of wetlands. For each acre of wetland lost, two acres shall be restored and should be of the same type of wetland habitat as the wetland which was lost.	Needs Replacement - This program could be used as a new policy standard regarding all wetlands in the County, including those in the BCA, SCA, and other wetlands such as seasonal wetlands and seeps. The new Policy/Program should be revised to reflect need for a wetland delineation where jurisdictional waters may be affected, coordination with trustee agencies, and preparation of a detailed wetland mitigation plan if complete avoidance is infeasible. Any replacement wetlands should result in an increase in habitat acreage and values. The new Policy/Program should acknowledge that off-site mitigation may be preferable where on-site wetlands are of low value and are isolated from other habitat.
Program EQ-2.43b Reduce Impacts to Wetlands. All technically feasible measures will be taken to reduce impacts and losses to the original wetland.	Still Applicable - Unsure of status or how "feasible" is defined.

Program EQ-2.43c Criteria for Evaluating Projects. The following criteria shall be considered when evaluating development projects which may impact wetland areas and should be incorporated into mitigation measures: a) No net losses shall occur in wetland acreage, functions, and values. b) Mitigation should be implemented prior to, or concurrently with, the project component which is causing the adverse impact. c) An area of adjacent upland habitat should be provided for wetland species that require such habitat. d) Mitigation sites should be permanently guaranteed for open space and wildlife habitat purposes. e) Mitigation for wetland destruction should be implemented on a non-wetland site, or a historical wetland site. f) Restoration of wetlands is preferred to creation of new wetland areas, due to the greater likelihood of success. g) Mitigation projects should minimize the need for long-term maintenance and operational manipulation (dredging, artificial water level controls, etc.). Self sustaining projects are encouraged. h) All plans to mitigate or minimize adverse impacts to wetland environments shall include provisions to monitor the success of the restoration project. The measures taken to avoid adverse impacts may be modified if the original plans prove to be unsuccessful. Performance bonds may be required. Mitigation must be commensurate with adverse impacts of the wetland alteration and consist of providing similar values and greater wetland acreage than those of the wetland area adversely affected. All restored or created wetlands shall have the same or equivalent habitat value as the wetland lost.	Still Applicable - Could be incorporated as part of the new Policy/Program EQ-2.43a. Should also address consideration of flood flow requirements in design and protection of wetlands, as indicated in Policies EQ-2.9 and 2.11. Need to address secondary impacts of development and nonpoint discharge on water quality degradation.
Program EQ-2.43d Establish Criteria for Buffer Zones. The County Community Development Agency shall establish criteria for determining the size of upland habitat areas (buffer zones) between development and wetland areas to be used to in review of individual development applications.	Still Applicable - Unsure of status and whether criteria for buffer zone has been established.
Policy EQ-2.44 Tidelands Subzone. The purpose of this subzone is to define those areas which should be left in their natural state because of their biological importance to the estuarine ecosystem. The County shall prohibit diking, filling, or dredging in areas subject to tidal action (Tidelands subzone) unless the area is already developed and currently being dredged. Current dredging operations for maintenance purposes may continue subject to environmental review, if necessary. In some cases, exceptions may be made for areas which are isolated or limited in productivity. In tidal areas, only land uses which are water-dependent shall be permitted, as consistent with federal, state, and regional policy. These include, but are not limited to: • ports • water-related industry and utilities • essential water conveyance • wildlife refuge • water-oriented recreation Exemptions may be granted for emergency or precautionary measures taken in the public interest, e.g., protection from flood or other natural hazard. Removal of vegetation shall be discouraged. Alteration of hydrology should only be allowed when it can be demonstrated that the impact will be beneficial or non-existent.	Needs Refinement - Need to address secondary impacts of development and nonpoint discharge on water quality degradation.

Policy EQ-2.45 Diked Historic Marshlands Subzone. The County shall, through its land use and development regulations, foster the enhancement of the wildlife and aquatic habitat value of the diked historic marshlands subzone. Land uses which provide or protect wetland or wildlife habitat, and which do not require diking, filling, or dredging, shall be encouraged. These uses include, but are not limited to: • restoration to tidal status • restoration to seasonal wetlands • agricultural use • flood basin, and • wastewater reclamation area. In addition, other uses which do not require diking, filling, or dredging, may be allowed if such uses are consistent with the zoning designation and it can be demonstrated that impacts to the bayfront environment are minimized and mitigated. Land uses that provide protection from flood or other natural hazards may be allowed if necessary to protect public health and safety. Existing dredging operations in developed areas may continue, subject to environmental review, if necessary. When development is proposed, priority should be given to water oriented uses such as public access and low intensity passive recreational and educational opportunities. Housing uses, with an emphasis on affordable housing, would provide substantial public benefit and may be considered if environmental impacts can be mitigated. The protection of the bayfront environment should take precedence over the provision of affordable housing.	Still Applicable
Policy EQ-2.46 Freshwater Habitats. Freshwater habitats in the bayfront areas associated with freshwater streams and small former marshes should be preserved and/or expanded so that the circulation, distribution, and flow of the fresh water supply is facilitated.	Needs Refinement - Raises same issues as with Program EQ-2.43a and how policies pertaining to wetlands are organized. This is the only policy that specifically refers to freshwater habitats and it is limited to the BCA, rather than county-wide and including the SCAs. Does not address freshwater seeps and freshwater marsh habitat types specifically.
Policy EQ-2.47 Use of Flood Barriers for Seasonal Habitat. Natural or managed flood basins should be utilized to provide seasonal habitat for waterfowl and shorebirds.	Still Applicable - Unsure of status or how to implement. Does the policy refer to "Flood Barriers" or "Flood Control Basins"? Need specific provisions prohibiting or restricting development within flood basins and flood zones.
Policy EQ-2.48 Transfer of Development Rights. The County shall allow the transfer of the development potential of diked historic marshlands which are restored to tidal status or enhanced as wetlands habitat to upland sites, provided that development on the upland site complies with development standards for the protection of adjacent habitat areas.	Still Applicable - Unsure of status and how implemented.
Policy EQ-2.49 Planned District Development Review with Environmental Assessment. The County shall review all proposed development within the Bayfront Conservation Zone in accordance with the planned district review procedure in order to ensure maximum possible habitat restoration and protection. An Environmental Assessment of existing environmental conditions (biologic, geologic, hazard, and aesthetic) shall be required prior to submittal of development plans.	Needs Refinement - Consideration should be given to similar Planned District Development Review with environmental assessment for areas with SCA and other jurisdictional wetlands as well.

Program EQ-2.49a Environmental Assessment of Bayfront Lands. Environmental assessment (biologic, geologic, hazard, and aesthetic) of existing conditions on proposed development sites will be completed prior to preparation of master plans and development plans. These assessments will include recommendations for siting and design that will avoid adverse environmental impacts. When it is not possible to avoid impact, recommendations shall include provisions for minimizing environmental impact. The assessment should serve as a portion of the Environmental Impact Report on the project and recommendations should be incorporated into the project itself. Refer to Program 2.43a for detailed criteria to be used in formulating recommendations for siting and design.	Needs Refinement - Refer to the comments under Program EQ-2.43a for clarification of wetland policies.
Policy EQ-2.50 Coordination with Trustee Agencies within Bayfront Conservation Areas. The County shall facilitate consultation and coordination with the trustee agencies (Department of Fish and Game, U.S. Fish and Wildlife Service, the Corps of Engineers, EPA, Regional Water Quality Control Board, and BCDC) during environmental review and during review of other proposals for lands within the Bayfront Conservation Zone.	Needs Refinement - Refer to the comments under Program EQ-2.43a for clarification of wetland policies. Typically not the County's responsibility to facilitate consultation for individual development applications affecting jurisdictional waters or special-status species. Evidence of authorization from jurisdictional agencies should be provided to County before issuance of a grading or construction permit as an assurance that coordination has been performed.
Program EQ-2.50a Early Consultation with Other Agencies. Any development project within the Bayfront Conservation Zone is subject to the review, and possibly the permit process, of federal and state agencies with jurisdiction over wetlands. It is critical that the applicant consult with these agencies at the very outset of a development project. The County will make every effort to coordinate its review process with the review process of other agencies, consulting with them on the environmental assessment and the master plan. The applicant will be informed at the first contact with the Community Development Agency which other agencies are likely to claim jurisdiction and what the policies and standards of those agencies are regarding development activities in the Bayfront Conservation Zone. The National Wetland Inventory Maps (NWI) will aid County staff in providing this information to applicants.	Needs Refinement - Refer to the comments under Program EQ-2.43a for clarification on wetland policies.
Policy EQ-2.51 Minimal Impacts Within Bayfront Conservation Zone. The County shall ensure that development in the County occurs in a manner which minimizes the impact of earth disturbance, erosion, and water pollution within the Bayfront Conservation Zone.	Needs Refinement - Refer to the comments under Program EQ-2.43a for clarification on wetland policies.
Policy EQ-2.58 Protection of Existing Agricultural Lands. The County shall protect existing agricultural lands in the Bayfront Conservation Zone. These lands are an important resource for the County because they: • are a visual and scenic resource; • play an integral role in other agricultural and dairy operations in Marin County; • are a productive economic resource; and • are compatible with water-related wildlife habitat. Such agricultural activities could consist primarily of grazing operations and crop production harmonious with adjoining marshes, wetlands, grasslands, or other sensitive lands. Agricultural lands provide habitat for many wildlife species. These habitats may be important for migratory species during times of flood and after silage has been cut.	Needs Refinement - Need to address potential conflicts where poor agricultural practices contribute to severe erosion and water quality degradation. Need to recognize and protect sensitive habitat features consistent with other policies
Policy EQ-2.59 Natural Vegetation. Agricultural activities should minimize removal of natural vegetation and avoid the removal of wetland vegetation, where possible.	Still Applicable

Policy EQ-2.60 Pesticides, Insecticides and Similar Materials. The County will encourage the use of integrated pest management practices to control pests with the least possible hazard to people, property, and the environment. It is a suggested goal of the County to urge the reduction in the use of pesticides and chemical treatments whenever possible. Non-toxic strategies for pest control, such as modifying habitats, using physical controls, and biological controls are encouraged as an alternative to chemical treatment.	Still Applicable
Policy EQ-2.66 Use of Shoreline Areas. Public use of the shoreline areas is desirable and should be encouraged consistent with ecological and safety considerations.	Needs Refinement - Needs to acknowledge appropriate setbacks and potential for disturbance of special-status species and sensitive natural communities.
Policy EQ-2.67 Ensuring Public Access of Shoreline Areas. The County shall ensure that public access is provided and protected along the bayfront and significant waterways. Public access easements are the primary means available for increasing public access opportunities. Dedications of these easements result from a condition imposed on development plan approval. Public access should be allowed only where access can be accommodated without damaging the wildlife habitat.	Needs Replacement - Redundant to Policy EQ-2.66. Could merge two policies into one.
Policy EQ-2.69 Evaluation of New Public Access Areas. The County shall evaluate potential new public access areas in order to determine the feasibility of providing access and the priorities for acquisition, based on the following criteria: • desirability of the site; • capacity to sustain use without significant adverse impacts on the bayfront habitat and wildlife; • potential for hazard to public safety or health; • availability of other public access points in the area; and, • compatibility with adjacent land uses.	Needs Refinement - As with the general wetland policies, this policy needs to address public access along the SCAs as well.
Policy EQ-2.70 Siting and Design of Public Access. Public access should be sited and designed to facilitate public use and enjoyment of the bayfront lands, along with protection of wildlife habitat. Where possible, buffers and upland habitat should remain, or be constructed, between wetland habitats and public use areas. Public areas should be clearly marked, and continuous ten-foot walkways from the nearest roads to the shoreline and along the shoreline should be provided. Public access areas should be designed to minimize possible conflicts between public and private uses on the properties. In general, walkways should be set back at least ten feet from any proposed structure. Public access shall designed to avoid disturbance of wetlands and sensitive wildlife habitat areas.	Needs Refinement - Redundant to Policy EQ-2.69. Could merge two policies into one.
5. Mineral Resources	
Policy EQ-2.84 Reclamation of Mined Lands. The County shall assure that all mining operations provide for adequate reclamation of mined lands before issuing mining or quarrying permits.	Still Applicable - Unsure of status and provisions for protection of special-status species, sensitive natural communities, and wetlands.
Program EQ-2.84a Reclamation Requirements. The County shall continue to enforce the reclamation requirements of Marin County Code Section 23.06.	Still Applicable
Program EQ-2.84b Wetlands. The County shall augment Section 23.06.40(5) Application to require Reclamation Plans to include a) protection of wetlands, if any and b) reduction of negative visual impacts.	Still Applicable - Unsure of status and how implemented.

Policy EQ-2.85 Excavation of Wetlands. Wetlands proposed for excavation shall be reviewed for significant habitat value and will be protected in lieu of mining where significant mineral resources have been identified.	Needs Revision - Need to acknowledge possible jurisdictional permitting and requirement for replacement mitigation. Loss of any wetland habitat is typically considered significant, requiring mitigation.
Program EQ-2.85a Return to Wetland Status. Wetlands that are mined shall be reclaimed and returned to wetland status after conclusion of mining operations.	Needs Revision - Reclamation to wetland may be a suitable long-term use, but this policy does not address loss during mining operation. Off-site mitigation may be required to address wetland loss if avoidance is not possible and jurisdictional wetlands are affected by mining activities.
Policy EQ-2.86 Removing a Site from Application of these Policies. When a site is mined and satisfactory evidence is presented that it no longer contains the threshold amount of resource, the County shall institute action to remove the site from the application of these mineral resource preservation policies.	Still Applicable - Unsure of status.
6. Species Protection	
Policy EQ-2.87 Species Preservation in the Environmental Review Process. Environmental review of development applications shall consider the impact of the proposed development on species and habitat diversity. Environmental review documents should propose mitigation measures for ensuring the protection of the habitat and species therein.	Needs Replacement - This section needs major reorganization. Special-status species should be broken out as a separate focus issue from sensitive natural communities and from wildlife habitat and movement corridors. Along with wetlands, these should be the major focus issue of the relevant policies of the updated Plan.
Program EQ-2.87a Species and Habitat Protection. All project permits, including development, grading, and tidelands permits, shall include conditions or mitigation measures to ensure the continued health and survival of the habitat and the plants and wildlife, to the greatest extent possible.	Needs Refinement - Need to establish standards and integrate with other relevant policies such as BCA and SCA.
Program EQ-2.87b Wildlife Corridors. Development permits shall include conditions or mitigation measures to ensure that corridors for wildlife movement and dispersal are not destroyed or altered in such a way as to destroy or significantly diminish the use of the site as a corridor for animal movement and dispersal.	Needs Refinement - Need to establish standards and refer to other relevant policies such as BCA and SCA. These programs and policies should be integrated into a functional method to provide adequate protection and identify key areas for acquisition and restoration. The revised program/policy should address both terrestrial and aquatic species, using the SCA and upland wildlife corridors as a mechanism to provide habitat connectivity and sustainability.
Program EQ-2.87c Edge Habitats. Development applications shall be conditioned or modified to ensure that edge habitats are not destroyed or altered in such a way as to destroy or significantly diminish the diversity of species using the site.	Needs Refinement - Need to establish standards and integrate with other relevant policies such as BCA and SCA.

Program EQ-2.87d Regeneration of Species. The County should encourage plans to regenerate plant species, when an environmental assessment indicates this is the preferred course of action.	Needs Replacement - Unsure what purpose the policy serves, unless this is in regards to special-status plant species vulnerable to extirpation in some or all locations in the County. Use of native plant species should be encouraged as part of mitigation, buffering, and habitat enhancement and restoration.
Program EQ-2.87e Development Near Park Lands. When development is proposed on lands adjacent to State or Federal parklands, the County shall require the removal of all invasive exotic vegetation prior to development.	Needs Replacement - Separate policies and supporting programs should be developed addressing invasive exotics, for both aquatic and terrestrial habitats. These policies should apply for the entire County, not just adjacent to parklands.
Policy EQ-2.88 Protection of Special Status Species. Development shall be restricted or modified in areas which contain special status species and migratory species of the Pacific Flyway and/or significant natural areas, wetlands, riparian habitats, and freshwater habitats, to ensure the continued health and survival of these species and areas	Needs Replacement - As indicated under EQ-2.87, the issues of special-status species and sensitive natural communities should be separate policy areas, each with supporting programs. Both policy areas should have requirements for identification of any sensitive resources as part of the environmental review process, preservation and restoration, coordination with trustee agencies, and appropriate mitigation where avoidance is not feasible.
Program EQ-2.88a Special Status Species and Significant Natural Areas. Development permits shall include conditions or mitigation measures to ensure the continued health and survival of special status species, migratory species of the Pacific Flyway and Significant Natural Areas (as defined by the California Department of Fish & Game), wetlands, riparian habitats, and freshwater habitats. Development projects shall be modified to either avoid impact to sensitive communities or mitigate impacts by providing on- or off-site replacement.	Needs Replacement - Should be revised as part of other policy modifications to provide for coordination with jurisdictional agencies and adequate mitigation where sensitive resources are adversely affected by proposed development.
Program EQ-2.88b Environmental Assessment for Significant Natural Areas. The County shall require that applicants provide an environmental assessment for development proposed on sites identified as Significant Natural Areas. The assessment shall be conducted by a qualified biologist and shall identify the presence of specific sensitive species and measures for protecting the species and habitat.	Needs Replacement - Should be expanded to include environmental assessment for special-status species, sensitive natural communities, and wetlands. Should include assessment of all undeveloped lands with potential for occurrence of sensitive resources, not just identified Significant Natural Areas.

Program EQ-2.88c Species Protection Resource Center. The County Community Development Agency should establish and maintain a Species Protection Resource Center in order to accurately assess the potential impacts of proposed development on species and habitat diversity. The Resource Center shall contain: 1) All up-to-date information on verified sightings of special-status species and significant natural areas as compiled by the California Department of Fish and Game, Non-Game Heritage Division; 2) All reports and recovery programs for special-status species and significant natural areas; 3) All up-to-date information from the United States Fish and Wildlife Service, including sightings and inventories of the migratory species of the Pacific Flyway; and, Reports, siting and recovery programs from reliable, local sources such as the Point Reyes Bird Observatory and the Marin Audubon Society.	Needs Refinement - Need to reconsider role County can serve as a resource center. It is important to maintain current files on occurrences of special-status species, sensitive natural communities, and wetlands/streams, but may be unrealistic to assume County can adequately function in a role as a resource center. To address site specific resources, adequate controls should be in place which require applicant's to conduct thorough studies as part of environmental review, provides coordination with jurisdictional agencies, and incorporates adequate mitigation when sensitive resources could be affected by a proposed project. On a larger scale, the County can address habitat connectivity, restoration, and enhancement by developing policies and programs which encourage interagency and private landowner coordination on a watershed or County-wide basis.
THE BUILT ENVIRONMENT	
1. General Policies	
Policy EQ-3.2 Air, Water, and Noise Pollution. Air, water, and noise pollution shall be prevented or minimized.	Still Applicable
Policy EQ-3.27 Identification of Wetlands Outside the BFC Zone. At the time of a site specific development application, the County shall require the applicant to identify seasonal and year-round wetlands which may be located outside the BFC zone. Development shall be situated so that wetlands are protected and preserved to the maximum extent feasible. Policy EQ-2.43 shall apply to wetlands outside the BFC zone.	Needs Replacement - Policies should be developed specifically for wetlands outside the BCA zone, not dependent on a deferral to Policy EQ-2.43. This is a major deficiency in the current Plan, creating confusion on applicability to wetlands outside the BCA zone.
Policy EQ-3.3 Radioactive, Chemical, and Biological Health Hazards. Radioactive, chemical, and biological health hazards to humans or wildlife shall not be created, and existing levels shall be reduced. The most current technical information will be utilized to implement this policy.	Still Applicable - Not sure of status or how implemented.
Policy EQ-3.4 Changes to Hydrological and Biological Processes. No operation shall cause irreversible damage or more than minimum reversible change to natural hydrological and biological processes. .	Needs Replacement - Policy should be expanded or incorporated into other policies that address wetlands, water quality, and control of secondary impacts and nonpoint contamination.
Policy EQ-3.6 Wildlife, Vegetation and Habitats. A diversity and abundance of wildlife and marine life shall be maintained. Vegetation and animal habitats shall be preserved wherever possible.	Needs Replacement - Need policy that identifies resources worthy of preservation and enhancement in built environment, such as SCAs, BCAs, and parklands. Restoration and enhancement may be an appropriate emphasis in the built environment as there may be little left to "maintain".

Policy EQ-3.13 Aggressive Exotic Plants. The planting of aggressive exotic plants such as broom and pampas grass should be avoided in any development over which the County has review authority.	Needs Replacement - Policy should be expanded to include program for removal and control of invasive exotics, both plant and animal. Should include requirement for removal as part of development approval and on-going management, perhaps identify target species for terrestrial and marine environments. Recommendation for removal or control of blue gum eucalyptus must recognize its importance as habitat for nesting raptors and Monarch butterflies.
Policy EQ-3.14 Protection of Trees. The County shall strive to protect large trees, trees with historical importance, and oak woodland habitat, and prevent the untimely removal of trees through implementation of a tree preservation ordinance. *Program EQ-3.14a Tree Preservation Ordinance.* The County Community Development Agency shall develop a tree preservation ordinance which will protect significant trees (native, heritage, and large street trees) prior to a specific development proposal. The ordinance will address the following issues: 1. Removal of a certain size of tree (generally greater than 6" in diameter) or type of tree (heritage trees) and establishment of a permit procedure if removal is absolutely necessary. Replacement of tree(s) will be required. 2. Require a permit prior to clearing a site for development. The applicant should provide a diagram which indicates the size and location of trees which will be removed, as well as a plan for replacement of trees. Replacement should occur at a ratio of 2:1, except where physical conditions on the site make this ratio infeasible. 3. Protection of the oak woodland environment to allow opportunities for regeneration and survival of seedlings and saplings. Specifically protect trees with a diameter of 6" or greater, and require replacement at a ratio of 2:1. 4. Enforcement mechanisms (including penalties) for unlawful removal of trees. 5. Protection of Redwood Groves and the California woodland habitat, including provisions to protect regeneration of seedlings and saplings. 6. Protection of trees during construction and specifying a maximum percentage of trees which may be removed. 7. Protection of significant stands of trees (10 trees per acre).	Needs Refinement. Need to acknowledge County's Tree Preservation Ordinance NO. 3291 and adjust recommendations accordingly. Need to review adequacy of Tree Preservation Ordinance.
Policy EQ-3.17 Discourage Use of Pesticides. The County will encourage the use of integrated pest management practices to control pests with the least possible hazard to people, property, and the environment. It is a suggested goal of the County to urge the reduction in the use of pesticides and chemical treatments whenever possible. Non-toxic strategies for pest control, such as modifying habitats, using physical controls, and biological controls are encouraged as an alternative to chemical treatment.	Still Applicable -
Land Uses	
Policy EQ-1.2 Land Use of the Inland Rural Corridor. Agricultural land uses will be emphasized in the Inland Rural Corridor along with other uses that are compatible with agriculture and enhance agricultural preservation in a significant way such as resource and habitat preservation. Existing communities shall be preserved.	Needs Refinement - Need to revise policy to include importance of habitat preservation, restoration and enhancement.

Policy EQ-1.1 Land Use of the City-Centered Corridor. Urban development will be concentrated in the City-Centered Corridor where infrastructure and facilities can be made available to serve urban development. Although urban development is generally concentrated within this corridor, areas within the corridor are designated for resource protection. These areas include the Ridge and Upland Greenbelt Area, the Streamside Conservation Area, and the Bayfront Conservation Zone.	Needs Refinement - Need to revise policy to include opportunities for restoration and enhancement of important habitat to serve as movement corridors and links between open space areas.
Policy EQ-1.3 Land Use of the Coastal Recreation Corridor. Open space, recreational, and agricultural land uses will be emphasized in the Coastal Recreation Corridor along with the preservation of existing coastal communities.	Needs Refinement - Need to revise policy to include importance of habitat preservation, restoration and enhancement.
View Protection	
Policy EQ-3.20 Ridge and Upland Greenbelt-Wooded Hillsides. The preservation of trees on wooded hillsides is of paramount concern. A general scattering of buildings at a very low density may be desirable in order to preserve trees. The intent of this policy is to maximize protection of visual resources (see Figure EQ-12).	Needs Refinement. Policy should encourage "clustering" of buildings to avoid trees rather than allowing a "general scattering".
Policy EQ-3.21 Creekside Development. Along creeks, development must retain the natural vegetation, prevent water pollution, and minimize flood hazards from runoff (see Figure EQ-13).	Needs refinement. Needs to indicate considerations as part of proposed development.
Policy EQ-3.22 Mudflats and Tidal Areas. On low-lying mudflats or tidal fill areas, protection of plant and wildlife habitat is of primary importance. The provision of public access to creeks, streams, and the shoreline should also be encouraged (see Figure EQ-13).	Needs Refinement. Should separate out access to creeks or expand policy to combine both objectives of protection and access.
Environmental Hazards Element	
Policy EH-ll.6 Hazardous Vegetation. The County should plan for the systematic and environmentally sound reduction of hazardous vegetation, in order to reduce the buildup of old and hazardous vegetation created by effective fire suppression activities over the last 40 years.	Needs Replacement. Policy should be replaced and expanded to address sensitive biological resources which could be affected by fuel reduction efforts, and long term changes resulting from Sudden Oak Death and other factors.
Community Development Element	
Policy CD-2.7 Discouraging Development in Natural Resource or Hazard Areas. T Development should be discouraged in areas which have high natural resource value or which pose a significant hazard to life or property. Where development is permitted in such areas, the development density should be low and structures should be sited in order to minimize adverse impacts. This policy is consistent with the policies in the Environmental Quality and Environmental Hazards Elements. Transfer of development rights (TDRs) from high resource areas to appropriate receiver sites could be used to protect resource values.	Still Applicable. Should be expanded to acknowledge need to minimize conflicts with vegetation management, both for fuel reduction and habitat protection.

The following provides a discussion of the major issues which need to be addressed as part of the update process. These include reorganizing the natural resources portion of the CWP to provide specific policies regarding special-status species, sensitive natural communities, wetlands, wildlife habitat connectivity, and vegetation management. New policies regarding the need to encourage interagency coordination as part of watershed and resource protection, and establishing policies on the appropriateness of mitigation banking should be considered.

A. Special-Status Species

The Environmental Quality Element of CWP includes two policies and associated programs related to species protection. Policy EQ-2.87 presumably addresses "species preservation in the environmental review process", but then includes specific programs that cover a wide range of issues that are only remotely related to species preservation, and includes no clear standards for how these programs are to be implemented. Policy EQ-2.88 addresses "protection of special status species" but then is combined with protection of wetlands, significant natural areas, and sensitive natural communities. Programs under Policy EQ-2.88 include the need for an environmental assessment of proposed development, but this is inappropriately focused on "significant natural areas". Programs related to wildlife corridors, edge habitat, "regeneration of species", and development near park lands are inappropriately combined into this single subsection of the Element, they lack any standards for review and implementation, and are not directly linked to any regulatory basis for County oversight. Revised policies and programs should include acknowledgement of state and federal jurisdiction over sensitive resources, and the need for a thorough inventory and assessment of these resources as part the environmental review process where potential habitat may be affected by proposed development. There are no County ordinances or habitat management plans related to the protection and recovery of special-status species.

A number of special-status species known from Marin County are wide-ranging and the focus of management efforts by trustee agencies. Species of particular concern include California red-legged frog, northern spotted owl, coho salmon, and steelhead trout. The following provides a summary of relevant management issues for each of these species.

Northern Spotted Owl. The USFWS listed the northern spotted owl as a threatened species in 1990. The southern limit of their range extends into Marin County where they occur in Golden Gate National Recreation Area, Muir Woods National Monument, Point Reyes National Seashore, and other parts of the County. On-going studies have been conducted to monitor population health and further define essential habitat, including annual status reports (Fehring et. al, 2001). According to the latest status report, the Marin County population of spotted owl is subject to several threats, including: 1) urban development along park boundaries; 2) disturbance due to intense urban recreational pressures; 3) hazardous fuel management; 4) potential for catastrophic wildfire along the urban/wildland interface; 5) possible genetic isolation; and 6) continued range expansion of the barred owl. Of particular concern is the continuing die-off of tanbark and coast live oaks throughout spotted owl habitat due to SOD, and the long-term impacts this may have on prey populations and owl nesting habitat. Refined policies related to vegetation management should be incorporated into the CWP update which address essential habitat of spotted owl and other special-status species.

Coho Salmon and Steelhead Trout. Coho salmon and steelhead trout are both listed as threatened under the federal ESA within the Central California Coast Evolutionarily Significant Unit. These species are anadromous, spawning in coastal streams and rivers and then migrating to and maturing in the ocean. Both species are known from streams in Marin County. Streams with established or historic records of these species are indicated in Exhibit 3. Where a record of salmon or steelhead has been reported from a stream, the entire drainage has been indicated as supporting the species, although habitat conditions have generally not been confirmed in the field.

Marin County is currently participating in the FishNet 4C program, which is a county-based, regional salmonid protection and restoration program created under a Memorandum of Agreement between the six central California coastal counties of Marin, Mendocino, Monterey, San Mateo, Santa Cruz, and Sonoma. FishNet 4C recognizes the need for these counties to meet the requirements of the ESA in protecting anadromous salmonids and their habitats. Given these requirements, a prime objective of the FishNet 4C program has been to evaluate the land management practices of each county and any written policies related to protecting salmonid populations, and to make recommendations for improving these practices and policies.

Based on the FishNet 4C review, Marin County has a number of policies in place that serve to protect fish habitat. These policies are most comprehensive in the coastal zone where strict development standards protect salmonid streams with riparian buffers. Coastal zone regulations restrict building in floodplains, channel modifications, streamflow withdrawals, and grading. In the non-coastal zone, fish habitat protection measures are less stringent and less consistent. The most important policies pertain to riparian buffers and grading, and all of the county is covered by a comprehensive storm water pollution prevention ordinance.

Identified deficiencies in the FishNet 4C report relate to policy gaps regarding wildlife habitat, streamflow quantity modifications, riparian corridor protection, sedimentation, channel modification, water quality, and fish passage. A summary of Marin County policies relating to anadromous fish habitat conservation is available for review at the Marin County Community Development Agency. These include identified and potential policy gaps in the 1994 CWP. These policy deficiencies should be considered as part of the CWP update. Additional detailed survey work is necessary to confirm habitat conditions and opportunities for restoration and enhancement for coho and steelhead.

California red-legged frog. The USFWS recently designated 209,000 acres of west Marin as critical habitat for the federally-threatened California red-legged frog. Of this land, approximately 52 percent are managed by the National Park Service, the State Department of Parks and Recreation, and the Marin Municipal Water District. The remaining 48 percent are privately owned and are generally under agricultural zoning and used for grazing. Agency management plans include consideration of this species, although some conflicts with agricultural use and water quality degradation are of concern. Future development in the Coast Recreation Zone and the Inland Rural Corridor, including plans for habitat restoration, must consider the affects on this listed species.

B. Sensitive Natural Communities

As noted above under the discussion of special-status species, Policies EQ-2.87 and 2.88 provide some limited acknowledgement of the importance of species habitat protection. This includes programs related to species and habitat protection, wildlife corridors, edge habitat, "regeneration of species", and development near park lands. However, these are inappropriately combined into a single subsection of the Element, they lack any standards for review and implementation, and are not directly linked to any regulatory basis for County oversight. Policies pertaining to the Stream Conservation Areas and Bayfront Conservation Areas provide some degree of protection for riparian and coastal salt marsh communities, respectively. However, additional refinement of these policies is necessary to establish County definitions for critical terms such as “riparian”, “tidal marshes”, and “seasonal marshes”.

Along with wetland resources, the issues of special-status species, sensitive natural communities, and wildlife habitat connectivity should be expanded into separate subsections of the Element to provide a framework for effective protection and restoration of viable habitat for sensitive natural resources. There are no County ordinances related to the protection and enhancement of sensitive natural communities.

The County's Tree Preservation and Protection Ordinance (Ordinance #3291) established regulations for the preservation and protection of native trees, providing some protection of tree resources and woodland habitat in the non-agricultural unincorporated areas of the County. Protected trees under the ordinance are generally native species with trunk diameters of either six or 10 inches, depending on species. The ordinance is intended to: control the removal of protected trees; prevent the unpermitted wholesale removal of a majority of native trees on a parcel prior to application for a development permit; protect woodland environments on agricultural land through an educational outreach program; educate residents of the County about the functions, benefits and values of tree; and allow removal of protected trees when appropriate. A permit is typically required to removal a protected tree unless assessed as part of environmental review of a proposed development application.

C. Wetlands

The Environmental Quality Element of the CWP contains a number of policies and programs which address wetland resources. However, these are spread throughout the element, making it difficult to understand the County's position on wetland resources and how to provide for their protection through the multi-agency permitting process. Relevant policies include those associated with the Stream Conservation Areas (Policies EQ-2.2 through 2.35) and the Bayfront Conservation Areas (Policies EQ-2.42 through 2.70). There are no specific County ordinances addressing protection of creeks, marshlands, or other wetland resources.

The policies addressing the Bayfront Conservation Areas (BCA) include identification of protected lands, development review, coordination with trustee agencies, and general controls to protect sensitive habitat and maintain existing agricultural uses. Programs under Policy EQ-2.43 identify mitigation ratios, list criteria for evaluating proposed project impacts, and mention the need to establish criteria for buffers. However, there is no direct reference to jurisdiction of other agencies, and how the County's review process provides for oversight of coordination called for in Policy EQ-2.50. As noted above, definitions to critical wetlands related terms should be established as part of the update process.

The policies pertaining to preservation and enhancement of Stream Conservation Areas (SCA) provide for general protection of wetlands associated with perennial and intermittent streams. However, there is no direct acknowledgement of the authority of other jurisdictions, process for County oversight, and mitigation framework. Policy EQ-3.27 provides an indirect reference to identification and protection of wetlands outside the BCA, which applies to jurisdictional wetlands in the SCAs as well. The process to verify jurisdictional wetlands as part of development review, provide for their protection and replacement, and ensure adequacy of mitigation and enhancement should be presented in its own subsection of the Element.

D. Wildlife Habitat and Connectivity

The 1994 CWP provides very little discussion of the importance of protecting important wildlife habitat, and maintaining and improving habitat connectivity as a method of sustaining viable habitat for native plants and wildlife. An important task of the CWP update process should be to identify essential habitat links, prioritize land acquisition goals for habitat connectivity purposes, and to determine restoration and enhancement opportunities for fish and wildlife movement corridors,

No specific policies in the CWP relate directly to wildlife habitat protection or maintenance of wildlife movement corridors. Policies EQ-2.13 and 2.42 generally call for the preservation and enhancement of wildlife and aquatic habitats in the Stream Conservation and Bayfront Conservation Areas, respectively. Policy EQ-2.87 generally requires that environmental review of proposed development consider the potential impacts on "species and habitat diversity". Program EQ-2.87b calls for the protection of wildlife corridors, but does not indicate how these features are to be identified or what minimum criteria would ensure that they remain viable. Program EQ-2.87c pertains to edge habitats, but again does not provide any minimum standards to protect these transitional areas. Program EQ-2.87d refers to "regeneration" of plant species, but the intent of this program is unclear. It may have been intended to encourage the use of the identical plant species in replacement plantings or restoration of habitat affected by development with similar species.

E. Vegetation Management

Vegetation management is only briefly addressed in the 1994 CWP. A number of policies call for the protection and monitoring of riparian and marshland habitat, such as Policy EQ-2.14, although no details are provided on whether and how they are implemented. The critical issues of hazardous fuel management, invasive exotics such as broom and star thistle, SOD, and affects on essential habitat for special-status species such as northern spotted owl, contribute to the need to develop clear policies on vegetation management in the CWP update.

Policy EQ-3.13 calls for avoiding planting of exotic species such as broom and pampas grass, but does not provide the restrictions warranted given the affects of these and other invasive species on native vegetation. Appropriate policies should be more restrictive in use of invasive species, require their removal as part of proposed development throughout the County, and include programs to encourage their control and management on public and private lands. Program EQ-2.87e requires the removal of invasive exotic vegetation when development is proposed on lands adjacent to state or federal parklands, but this should be expanded to include restrictions on undesirable plantings and elimination of these species from all lands to be developed, and control where they interface open space. One non-native species of particular note is the blue gum eucalyptus. Although blue gum is an invasive species, it does provide important habitat for native wildlife such as nesting raptors and migrating monarch butterflies. Recommendations for removal or control of blue gum should recognize and balance its value as a biological and aesthetic resource in the County.

F. Interagency Coordination

The coordinated management efforts of the Tomales Bay Watershed Council (TBWC) provides a possible model for countywide implementation of an interagency planning process. The TBWC is

initiating preparation of a draft watershed management plan addressing water quality and health of the 220-square mile Tomales Bay watershed and developing recommendations for the implementation of technically sound management practices. The goals of the watershed management plan are to: ensure water quality in Tomales Bay and tributary streams sufficient to support natural resources and sustain beneficial uses; restore and preserve the integrity of natural habitats and native communities; develop strategies to implement the plan and protect the watershed; and involve and educate the public as watershed stewards. An outline for the draft watershed management plan, including goals and objectives is available for review at the Marin County Community Development Agency.

G. MITIGATION ISSUES

Compensatory mitigation for potential impacts is generally required when complete avoidance of sensitive biological and wetland resources is not feasible. When compensatory mitigation is required, it can be met through a number of different approaches. These can include creating or restoring habitat (either on-site or an alternative location), securing similar habitat in an alternative location in fee title or through establishment of a conservation easement, and more recently, through use of a mitigation banking program. A mitigation bank allows an applicant to meet their mitigation requirements by purchasing "credits" in an area established and approved by trustee agencies for such purposes. While avoidance of sensitive resources is generally the preferred method of mitigating potential impacts, there may be instances where the replacement mitigation is actually of greater habitat value and ecological benefit. One example of this would be allowing the loss of a small, degraded seasonal wetland surrounding by existing development and hydrologically isolated from other wetlands in exchange for creating new wetlands of increased acreage and habitat value as part of a permanently protected wetlands complex.

The Marin County Open Space District has developed a draft policy regarding use of their lands for environmental mitigation projects. The draft policy states that District approval for mitigation on their land does not mean support or approval by the District of the event or project requiring mitigation. Proposed conditions associated with the draft policy include: approval by the Parks, Open Space, and Cultural Commission; the proposed mitigation must be consistent with the approved Land Management Plan or where no plan is available, it must be consistent with general land management practices and/or approved by the District's Resource Ecologist; additional site specific conditions may be required by the District; and projects may be carried out by the District or a third party through issuance of a mitigation project permit by the District.

The CWP update process should consider the appropriateness of the various mitigation options, and whether the County chooses to encourage a particular approach to mitigation. Possible use of District property for mitigation purposes raises questions about its appropriateness and whether providing this mitigation option is actually facilitating development and impacts to sensitive resources. Establishment and use of mitigation banks, whether public or private, is also a controversial approach to mitigation, although of increasing acceptance by local and state agencies where they are of demonstrated success.

VI. SUMMARY OF KEY ISSUES, TRENDS, AND OPPORTUNITIES

The CWP update process provides an opportunity to reevaluate the appropriateness of current policies and associated programs, assess the organizational effectiveness of the current CWP, and determine any additional goals and policies necessary to provide a framework for comprehensive management of natural resources within the County. As described in detail in Section V, numerous aspects of the Environmental Quality Element of the 1994 CWP require considerable reorganization and refinement to provide for adequate protection of sensitive biological and wetland resources, acknowledge the authority of jurisdictional agencies, and define new goals and policies pertaining specifically to special-status species, sensitive natural communities, wetlands, wildlife habitat and connectivity, vegetation management, and interagency coordination.

VII. REFERENCES

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APPENDIX 1-D

BUILT ENVIRONMENT ELEMENT TRANSPORTATION TECHNICAL REPORT #1, THE TRANSPORTATION SYSTEM AND TRANSPORTATION MODELING, JULY 2002

MARIN COUNTYWIDE PLAN

Built Environment Element
Transportation Technical Report #1

The Transportation System and Transportation Modeling

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EXECUTIVE SUMMARY

This technical report for the Built Environment Element of the Countywide Plan defines some of the terminology used in transportation planning and briefly describes the transportation modeling process used for the Countywide Plan update.

The report begins with a description of the types of roads and transit service in Marin. The types of roads include freeways, freeway ramps, primary arterials, secondary arterials, commercial collectors and streets, and residential collectors and streets. A freeway is a limited access, high speed, high volume facility designed to provide access between communities and to the rest of the region as well as providing for through traffic. Freeway ramps are single purpose road segments connecting the freeway with local streets. The purpose of a ramp is to allow motorists to make the transition between the slower speeds on local streets and the faster speeds of the freeway. A primary arterial is a limited access, moderate speed, high volume facility designed to provide access between communities or from a community to the freeway. A secondary arterial is a moderate access, moderate speed, moderate volume facility designed to provide access between various parts of a community. Commercial collectors are highly accessible, moderate to low speed, moderate to low volume facilities designed to provide access to individual commercial parcels and collect their traffic for access to arterial streets. Residential collectors and streets are highly accessible, low speed, moderate to low volume facilities designed to provide access to individual residential parcels and collect their traffic for access to arterial streets.

Transit service may be described as "corridor" or local. Corridor transit is service designed to carry many people in one vehicle for trips between counties. Buses and ferries provide corridor transit service from Marin to San Francisco, for example. Local transit is distinguished from corridor transit in that the service offers many origins and destinations within Marin County but not to San Francisco.

Each type of road has a theoretical design capacity, expressed as lane volume in the peak hour, but such factors as intersections, turning movements, driveways, pedestrians and environmental conditions affect actual operating conditions. A freeway, designed to have the fewest potential conflicting traffic movements, has a capacity of 2,000 vehicles per lane per hour. Local streets are evaluated according to time delay at intersections and average speed.

Level of Service is a qualitative measure used to describe operating conditions on lane segments and intersections. Letters A through F are used to indicate conditions ranging from free flow to severe congestion.

The modeling effort for the Countywide Plan includes five trip types: home-based work, home-based shopping, home-based social/recreational, home-based school, and non-home-based. Home-based trips have home as either an origin or destination. Non-home-based trips do not. For home-based work trips, four different modes were modeled: drive alone, two-person carpool, three-person carpool, and transit. The choice of a given mode determines how many vehicles will be on the roads and how congested the roads will be. Generally, the more carpooling and transit use, the less congested the roads (given the same number of people traveling). If relatively more people are using carpools and transit, the vehicle occupancy rate is higher.

The County's modeling process follows the standard methodology used in transportation modeling. The four steps of the process are trip generation, trip distribution, mode choice, and trip assignment. Trip generation is the number of trips produced and attracted by the land uses within traffic zones. These trips are then distributed to other traffic zones depending on the land use characteristics of other zones and the time of travel between zones. Mode choice is made according to the relative attractiveness of the alternatives and the income of the person making the trip. The computer software has an algorithm, which then assigns vehicles to the network according to specifications entered by the operator (e.g., number of lanes and posted speed limit). The software can print out a copy of the street network with the results printed along the street segments.

I. INTRODUCTION

This report is the first in a series of technical reports for the Built Environment Element of the Countywide Plan. The report will define some of the terminology used in transportation planning, explain some of the characteristics of traffic, and describe Marin County's transportation model, a microcomputer-based set of programs which simulate how the road network and transit system operate in Marin.

One purpose of the technical report series is to present background information and explanations of the work that contributes to the Transportation Element of the Countywide Plan. A second purpose is to provide the information necessary for Marin County residents, elected officials, and local government staff to understand transportation systems and traffic problems. With this understanding, concerned parties can generate solutions that are cost-effective, environmentally sensitive, and politically acceptable.

II. TRANSPORTATION SYSTEMS: DEFINITIONS AND CONCEPTS

A. THE ROAD NETWORK AND TRANSIT SERVICE

For purposes of the Countywide Plan update and discussions of transportation, it is important that everyone know the terms used in transportation planning. This section introduces a few of the most frequently used words and concepts associated with the road network and transit service. The road network consists of freeways, ramps, primary arterials, secondary arterials, commercial collectors and streets, and residential collectors and streets. Transit service consists of corridor transit and local transit.

Elements of the road network are classified according to their function, design, and operation. *Function* is the intended use of the facility, such as access to individual parcels, access to the other parts of the community, access to the rest of the region, and provisions for parking. *Design* characteristics include recommended vehicle speed, recommended traffic volume (the number of vehicles that may be accommodated), and features such as driveways, turning lanes, median barriers, intersections, acceleration/deceleration lanes and interchanges. *Operation* is how the facility performs, actual vehicle speeds (as distinguished from the design speed) and actual traffic volumes, meaning the influence of adjoining development on traffic flow.

The various types of road facilities and transit service are as follows:

1. Freeway

A freeway is a limited access, high speed, high volume facility designed to provide access between communities and to the rest of the region, as well as providing for through traffic. Access to the freeway is provided only at interchanges, via freeway ramps (described below). Opposite lanes are separated by a median. The design volume for a freeway lane is 2,000 vehicles per hour, the highest volume for all

roads. Local freeway lanes carry 1,200-2,000 vehicles in the peak hour of operation, depending on conditions. The posted speed is currently 55 or 65 miles per hour, although portions of freeways may have been designed for speeds of 70-75 miles per hour. An example of a freeway is Highway 101 between the Golden Gate Bridge and Novato.

2. Freeway Ramps

Freeway ramps are single purpose road segments connecting the freeway with local streets. The purpose of a ramp is to allow motorists to make the transition between the slower speeds on local streets and the faster speeds of the freeway. While on a ramp, motorists can accelerate or decelerate to match the speed of vehicles on the freeway or local street. A second purpose of a ramp is to provide sufficient vehicle storage to allow the freeway to function independently of local streets. Ideally, the ramp should accommodate enough vehicles to prevent vehicles backing up onto local streets while trying to enter a congested freeway, or conversely, from backing up on the freeway while trying to enter congested local streets. Ramp capacities are similar to freeway capacities, accommodating up to 2,000 vehicles per hour, subject to the limitations imposed by freeway or local street congestion. An example of a ramp is the northbound segment of Irwin Street in San Rafael that enters Highway 101.

3. Primary Arterial

A primary arterial is a limited access, moderate speed, high volume facility designed to provide access between communities or from a community to the freeway. The opposing lanes of a primary arterial are usually divided by a median with access limited to intersections. Turn lanes are typically provided at intersections in order that turning vehicles do not obstruct through traffic. Parking is usually prohibited on arterials. Speeds on primary arterials range between 35 and 45 miles per hour but may vary depending on the specific location and facility. Volumes range between 500 and 1,500 vehicles per lane during the peak hours of operation. An example of a primary arterial is Sir Francis Drake Boulevard through Kentfield and Greenbrae.

4. Secondary Arterial

A secondary arterial is a moderate access, moderate speed, moderate volume facility designed to provide access between various parts of the community. Opposing lanes are divided by striping and turns to adjoining parcels on both sides of the street are usually allowed. Turn lanes are often provided at intersections. Bi-directional center turn lanes may be provided along the length of the road in commercial areas. On-street parking is permitted if the pavement is wide enough. Speeds on secondary arterials are 30 to 45 miles per hour but may vary depending on the specific location. Lane volumes are 200-600 vehicles per hour in the peak hour of operation. An example of a secondary arterial is Wolfe Grade between Greenbrae and San Rafael.

5. Commercial Collector and Street

Commercial collectors are highly accessible, moderate to low speed, moderate to low volume facilities designed to provide access to individual commercial parcels and collect their traffic for access to arterial streets. These facilities usually do not have median dividers and have frequently spaced curb cuts for driveways to individual parcels. In busy pedestrian areas, driveways may be limited to minimize interruption of pedestrian flow. On-street parking is usually permitted. Speeds on commercial

collectors and streets range between 25 and 35 miles per hour. Peak-hour lane volumes are 200 to 600 vehicles. An example of a commercial collector is San Anselmo Avenue in San Anselmo.

6. Residential Collector and Street

Residential collectors are highly accessible, low speed, moderate to low volume facilities designed to provide access to individual residential parcels and to collect their traffic for access to arterial streets. These facilities rarely have median dividers or special turn lanes. Curb cuts for driveways to individual sites are common. On-street parking is typically permitted. Speeds on residential collectors and streets are 25 to 30 miles per hour. Peak hour lane volumes vary from 0 to 600 vehicles per hour. An example of a residential collector is Idylberry Road in Upper Lucas Valley.

7. Corridor Transit Service

Corridor transit service is designed to carry many people in one vehicle for trips between counties. Marin residents would use corridor transit for trips to San Francisco, Sonoma, or the East Bay. Sonoma residents would use corridor transit for trips to Marin or San Francisco. The Golden Gate Bridge, Highway, and Transportation District provides bus service between the three counties with emphasis on the transbay commute.

During the peak commute hours, buses circulate through one or more neighborhoods to pick up passengers, and then enter the freeway and travel to San Francisco, with a limited number of stops along the way. For example, a route that originates in Santa Rosa might involve stops in Rohnert Park, Petaluma, Novato, and San Rafael. Depending on ridership and operating costs, intermediate stops may be added or deleted (recent trends have been for stops to be deleted). Some routes involve no stops once the bus enters the freeway. Within San Francisco, buses may make several stops before reaching the Financial District, their final destination.

Outside the peak commuting hours, service involves buses following fixed routes at regular intervals, stopping at a variety of locations before entering another county.

The Bridge District and Red and White Fleet provide ferry service to San Francisco from Larkspur, Tiburon, and Sausalito. Commuters who use the ferry may drive or ride "feeder" buses to the terminals. Feeder buses follow regular routes through neighborhoods picking up passengers for rides to the ferry terminals.

Several operators provide specialized intercounty transportation. For example, Greyhound, which has a station in San Rafael, provides bus service to many cities within California and the nation. The Marin Airporter and Sonoma Airporter provide bus service from Marin and Sonoma to the San Francisco International Airport and Oakland International Airport.

Another type of intercounty service, the "club bus," is being encouraged for major employers in Marin. People who share common origins, destinations, and commute times would charter or lease a bus to carry them to and from work. Similar to express service, a club bus would make several stops to take on passengers, and then carry them non-stop to one destination. Club buses are especially useful for long distance commuting.

8. Local Transit

Local transit is distinguished from corridor transit in that the service offers many origins and destinations within Marin County but not to other counties. For a given passenger, there may be many stops between origin and destination. Buses run along fixed routes at regular intervals. Transfers between routes are often necessary. In Marin, local transit service is provided by the Golden Gate Bridge District under contract with the Marin County Transit District.

B. ROAD NETWORK CAPACITY AND OPERATIONS

Each of the road types listed above has a capacity, expressed as lane volume in the peak hour. Although every road type has a maximum theoretical capacity inherent to its design, day-to-day capacity is determined by operations. For analytical convenience, traffic engineers observe three types of capacity: segment, weaving, and intersection. The combination of segment and weaving capacities are used to evaluate freeway operation; the combination of segment and intersection capacities is used to evaluate local streets.

The freeway is designed to maximize lane carrying capacity by eliminating potential conflicts such as intersections and left turns across oncoming traffic. Maximum capacity is also facilitated by eliminating friction, such as parking along the right lane and turns into driveways. As a result, the segment capacity in an uninterrupted section of freeway is set by the interaction of drivers in the lane, the distance drivers allow between vehicles, occasional topographical changes (e.g., hills), weather conditions, and the number of lanes. The typical freeway lane is designed to carry approximately 2,000 vehicles per hour.

As volume reaches capacity, speeds decrease and vehicle density per lane increases (vehicle density is the number of vehicles per unit of road space, usually one mile). As the traffic volume on the freeway and ramps feeding the freeway continue to build, the weave between the ramp traffic and through traffic becomes critical ("weave" is the merging of vehicles from the ramp onto the freeway). When both the freeway and ramps approach capacity, they do not function independently: the weave becomes 1 to 1. Each vehicle from the ramp merges between two vehicles on the freeway. This results in 900 merging vehicles combining with 900 freeway vehicles to fill the freeway lane capacity. The theoretical capacity of 2,000 vehicles is not reached because of inefficiencies in the merge. Additional through traffic on the freeway must then shift to the left if there is available capacity in other lanes; if not, traffic backs up.

On the local street system it is generally turning movements at intersections that restrict traffic flow. If there are many turns, the time delay at intersections may exceed 40 seconds. Traffic engineers try to regulate the turning movements in a way that allows the most vehicles to proceed through the intersection while minimizing interference with through traffic. Examples of regulations include special left- or right-turn lanes, prohibiting left or U-turns, prohibiting parking within a certain distance of an intersection (red curb), time limits on parking (e.g., no parking between 4 and 6 p.m.), and timed sequences of signals from traffic lights. At a signalized intersection, compatible movements may be allowed in one signal phase while other, conflicting movements are accommodated in separate phases. In each phase there is a critical movement, which requires the greatest amount of time. An example would be a left turn across several lanes of opposing traffic. The sum of the time required for critical movements from each phase provides a numerical index for evaluating the intersection's operation.

Road segment capacity is usually not adversely affected unless there is a reduction in the number of lanes, a decrease in lane width, or many turns into driveways or parking spaces. If there are many turning movements, the average travel speed along the segment may fall to between 9 and 17 miles per hour. Engineers measure time delay and speed reductions due to turning movements to evaluate segments. They also calculate "friction factors," a delay of speed caused by decreased lane width or the presence of parked vehicles along a segment. Given a certain traffic demand, engineers use these measures to design a road segment or indicate what improvements may be necessary to upgrade a poorly performing one.

C. LEVEL OF SERVICE

Level of service is a qualitative measure describing traffic conditions on freeways and local streets. The first six letters of the alphabet, A through F, are used to designate conditions ranging from free flow (Level of Service A) to forced flow or breakdown (Level of Service F). The level of service definition is described in terms of speed and travel time, freedom to maneuver, interruptions, comfort, convenience, and safety. For a given road segment with a certain number of lanes, intersections, parking spaces, driveways, etc., each letter beyond A represents increasing vehicle density, decreasing speeds, and greater time delay (i.e., increasing congestion).

Level of service is related to capacity in that level of service deteriorates as the road approaches or reaches capacity. Generally, Level of Service E is associated with traffic flowing at the capacity of a road. Speeds are low and unstable; maneuvering is difficult; comfort and convenience levels are poor; user frustration is high. When the freeway is at capacity, the vehicle density per lane mile is 67 vehicles. Freeway speeds fall below 30 miles per hour. If more vehicles are added to the road, breakdowns or stop-and-go traffic is experienced (Level of Service F).

It may seem like a contradiction in terms to state that when a road is carrying its capacity, its users suffer "high frustration," but recall that capacity is the maximum number of vehicles that can pass by a point in a given period of time under specified conditions. It is also important to note that capacity is reached for only a short time during the commute period in urban areas. In Marin, levels of service E and F are experienced on Highway 101 in the San Rafael area during the peak periods. In the morning, congestion may extend north to Novato; in the evening, south to Mill Valley.

Because Levels of Service E or F are unacceptable to most motorists, local officials choose Level of Service D as the desired target on congested roads, those already suffering Levels of Service E and F. (Level of Service D is accepted as a standard for suburban street operations nationwide.) At Level of Service D, maximum freeway lane volume is 1,850 vehicles per hour, vehicle density per lane mile ranges from 30 to 42 vehicles, and speeds range from 54 to 46 miles per hour.

Although level of service is described in qualitative terms, it is necessary to quantify each level in order to measure it for different types of roads. The transportation model uses such measures as speed, travel time, and volume-to-capacity ratio to determine level of service. Each of these variables is output from the model for each road segment. The volume-to-capacity ratio is the number of vehicles divided by the theoretical design capacity; density is the number of vehicles per unit area of road space, and flow rate is the number of vehicles passing a point during one hour, usually the peak hour.

D. TRIP TYPES

The analysis of transportation demand for the Countywide Plan includes the five different trip types, which have been developed by the Metropolitan Transportation Commission ("MTC") for regional modeling. Those trip types are home-based work, home-based shopping, home-based recreation, home-based school, and non-home-based.

"Home-based" means that the trip either originates from or returns to home. Home-based work trips are commutes that are typically concentrated in the morning and evening peak hours. The distinction between home-based shopping and recreation trips is necessary to reflect the difference in trip lengths: home-based shopping trips are usually much shorter than recreation trips. The non-home-based trips are work-related errands or personal errands performed on the way to or from work or during working hours. Table 1 on page 9 shows trip types as a percentage of total daily trips generated in Marin County.

Table 1. Trip Types as Percentage of Total Daily Trips in Marin County

Type of Trip	Percentage of Total Daily Trips
Home-based Work	26.9%
Home-based Shopping	25.4%
Home-based Recreation	12.4%
Home-based School	7.7%
Non-home-based	27.6%
Total	100.0%

E. MODE CHOICE

Mode choice is defined as the means a person uses to travel from place to place. For most trips, the modes are walking, bicycling, driving alone, or riding in a carpool, vanpool, bus, train, or ferry. How a person chooses to travel is of major importance to designers of transportation systems and services. In oversimplified terms, the number of people who choose to drive determines how many lanes a road should have and how congested the road will be after it is built. The number of people who choose transit determines how many buses, trains, or ferries should be provided and how often they run. It should be noted that there are often significant financial, physical, and political constraints associated with road building or the provision of transit services. These constraints may influence mode choice by limiting the alternatives a person has when choosing how to travel.

Mode choice is one of the most challenging concepts to model. There are many factors that influence a person's choices. In addition to the three general ones mentioned above, the most important factors are a person's income, travel time to the destination, cost of operating a car, transit fares, and employment density at the destination. Employment density greatly influences how effectively an area is served by automobile or transit. It also influences the price and availability of parking. For example, a low-density center is poorly served by transit; parking is often easily obtainable and free. People who work there are far more likely to drive alone than take transit. In contrast, a high-density center is

effectively served by transit; parking is limited and very expensive. People who work there are far more likely to take transit or carpool to work.

The factors that influence mode choice may change for the same person if the circumstances change. For example, a branch manager of a bank located in Novato may choose to drive alone to work from his home in Novato. The distance is short and there is free employee parking. But if he gets promoted to the main office in San Francisco's financial district, he may choose to carpool or ride the bus. Not only is the travel time greater, but also the price of parking (if he gets a space at all) may be very high. He may not wish to spend his increased income on parking. The longer travel time may prompt him to seek others who are going to the same destination to share commuting costs.

F. VEHICLE OCCUPANCY

Vehicle occupancy, the result of a person's mode choice, is the number of persons riding in a given type of vehicle at one point in time. In practical usage, vehicle occupancy is given as a rate or average. For example, since 1995, vehicle occupancy rates have ranged from 1.5-1.6 persons per vehicle on Highway 101 during peak periods. This is an average representing the total number of people traveling on the highway divided by the total number of vehicles.

Vehicle occupancy is an important measure for studying the capacity of a road system. Roads are designed to carry a certain number of vehicles during the most heavily congested hour of the day. If the vehicle occupancy rate is high, the road can serve a greater number of trips (or people). Vehicle occupancy can directly affect congestion as well. If, because of more carpooling or transit usage, vehicle occupancy rates increase, congestion will decrease.

Vehicle occupancy information is collected manually by observers counting the number of people in a vehicle. Generally, the only vehicle observed is the automobile. Rarely are truck or van occupancies determined. Train, bus, and ferry occupancies are calculated via fare receipts. The sources of vehicle occupancy information available to the Countywide Plan update effort are the California Department of Transportation ("Caltrans") annual vehicle occupancy counts for the San Francisco Bay Area freeway system and Golden Gate Bridge District fare receipts. To obtain this information, Caltrans stationed observers at selected points along Highway 101 and its ramps. The observers counted the number of automobiles with one, two, or three or more people in them. They also counted the number of vans, motorcycles, buses, and trucks but not the number of people in them.

G. TRANSPORTATION DEMAND MANAGEMENT

As roads become more congested in urban areas and financial, physical, and political constraints make expanding the road network more difficult, if not impossible, engineers and planners are turning to Transportation Demand Management ("TDM") to encourage more efficient use of existing transportation resources. There are many different TDM strategies with a variety of impacts. Some improve the transportation options available to consumers, while others provide an incentive to choose more efficient travel patterns. Some reduce the need for physical travel through mobility substitutes or more efficient land use. TDM strategies can change travel timing, route, destination, or mode.

Travelers can, via their mode choice, reduce congestion substantially during peak periods. If travelers shift to higher occupancy vehicles (e.g., carpools, vanpools, buses, trains, and ferries), fewer vehicles will

be necessary to carry the same number of people. Fewer vehicles result in less congestion. In addition, if travelers shift their times of travel out of the most congested hour by telecommuting or alternative work schedules, fewer vehicles will be on the road during that hour. Another alternative is to limit the type of trip taken during the most congested period to those that are necessary. Discretionary trips may be taken before or after the period of greatest congestion.

Some major employers in Marin County, including the County government, are implementing TDM programs at their workplace for their employees. The programs are designed to help relieve traffic congestion and focus on providing incentives to employees for commute options other than the single-occupant vehicle. Typically, these programs are managed by a transportation coordinator who helps employees find prospective carpool passengers in the company, provides preferential free parking for carpools and vanpools, and provides financial assistance for offsetting the cost of vanpools or transit.

III. THE MARIN COUNTY TRANSPORTATION MODEL

A. OVERVIEW OF THE MODEL

The Marin County Transportation Model is sets of equations that simulate traffic and transit operations and a microcomputer-based software package, EMME/2 (the name EMME is a French/English acronym for "Multi-modal Equilibrium"). The software uses the model equations and other information as input to perform all calculations and then graphically represent traffic volumes on a road network.

The County's modeling process follows the standard methodology used in transportation modeling. The four steps of the process are trip generation, trip distribution, mode choice, and trip assignment. Trip generation is the number of trips produced and attracted by the land uses within traffic zones. These trips are then distributed to other traffic zones depending on the land use characteristics of other zones and the time of travel between zones. Mode choice is made according to the relative attractiveness of the alternatives and the income of the person making the trip. EMME/2 has an algorithm that assigns vehicles to the network according to specifications entered by the operator. The software can print out a copy of the network with the results printed along the road segments.

B. SETTING UP THE MODEL

Before modeling may begin, the operator must provide both graphic and numeric inputs. The graphic inputs are traffic zones, the street network, and transit routes. The numeric input includes values for the variables in the equations and parameters for the software's algorithms.

1. Graphic Input: Traffic Area Zones

The county has been divided into 117 small geographical areas called Traffic Area Zones. The zone boundaries have been drawn to contain individual neighborhoods, commercial areas, or office developments. Although the zones appear as areas on a paper map, in the EMME/2 software they are represented as points. Each point is called a centroid, and all information associated with the traffic zone is attached to the centroid. One or more road links connect the centroid to the road network. The centroid is defined by a code number, an x, y coordinate, and operator-supplied data. For

example, operator-supplied data for a residential area could be population, number of households, average household income, and average number of automobiles per household.

Traffic zones in San Francisco and Sonoma counties are for the most part, U. S. Census Tracts. Other counties in the Bay Area are represented by "super districts," a large area of many Census Tracts used by the MTC for their transportation modeling.

The Association of Bay Area Governments ("ABAG") has provided the data describing the traffic zones outside Marin.

2. Graphic Input: Street Network

EMME/2 represents the street network in an abstract fashion using links and nodes. A link is a line between two nodes. Road segments are links and intersections are nodes. For example, the portion of Sir Francis Drake Boulevard between College Avenue and Bon Air Road would be a link. The intersections at College Avenue and Bon Air Road would be nodes. In the software, a node is designated by a code number and an x, y coordinate. The computer uses the x, y coordinates to plot maps of the network. Each node has three user-defined bits of information associated with it. A link is defined by the numbers of the two nodes it connects. Each link has nine bits of information associated with it:

1) Modes allowed on link (e.g., cars, buses, trains);
2) Type of link (e.g., freeway, primary arterial, ramp);
3) Length of link, usually measured in miles;
4) Number of lanes;
5) Volume-delay function (a mathematical formula that describes how speeds decrease as the link becomes more congested);
6-9) User defined data, such as a.m. and p.m. peak-hour volumes or Average Daily Traffic volumes.

Relatively few of Marin's roads are in the model. Only roads that carry appreciable amounts of traffic are represented. They include freeways, ramps, primary and secondary arterials, and commercial collectors. The road network for other Bay Area counties is the same network used by the MTC for their transportation modeling.

3. Graphic Inputs: Transit Routes

Overlaying the road network are the transit routes. Transit routes may use the same link as automobiles or may run on their own link. Examples of separate links are high occupancy vehicle lanes, ferry lines, and train tracks. A variety of information about transit travel, such as type of vehicle and fare, is associated with the transit route.

4. Numeric Inputs: Trip Production and Attraction

The second phase of setting up the model consists of creating the equations that explain the relationships among land uses, population, employment, trip making and travel patterns. The equations designate a functional relationship between a "dependent variable" and one or more "independent variables." For example, the dependent variable, home-based work trips, is a function of the independent variables, number of households, workers per household, and household income.

Each traffic zone has land uses that either produce or attract trips. Residences produce the trips; job centers, retail and service centers, and recreational facilities attract trips. The concept of trip producers and attractors applies to home-based trips. Non-home-based trips occur between two attractors. For modeling those trips, one attractor is assigned the role of producer. For each traffic zone there will be ten calculations: five trip types each for producers and attractors. The independent variables used to calculate the number of trips produced and attracted from each traffic zone are listed below. The formal equations are listed in Appendix A.

Home-based work trips

Production: Number of households, workers per household, household income

Attraction: Number of jobs (may be disaggregrated by industry)

Home-based shopping trips

Production: Auto ownership, household income, persons per household

Attraction: Retail and service employment as a percentage of total employment, employment density (jobs per acre or square feet of buildings)

Home-based recreation trips

Production: Auto ownership, household income, persons per household, service employment density

Attraction: Retail and service employment, population, vacant land

Non-home school trips

Production: Number of households, persons per household, household income

Attraction: Population

Non-home-based trips

Production: Retail, service and other employment, number of households

Attraction: Retail, service and other employment, number of households

The values of the independent variables have been obtained from a variety of sources. For Marin traffic zones the primary sources are the Marin County Community Development Agency land use database and ABAG projections. For other counties, the data are from the MTC's regional transportation model (ABAG supplies MTC's land use and demographic information). The data sources for the Countywide Plan update effort are:

1) Land use data from the Marin County Community Development Agency's database;
2) Projections from ABAG;

3) The 1980, 1990, and 2000 Census;
4) Travel surveys from Caltrans and the MTC;
   Data from MTC's regional transportation model; and
   Actual traffic counts.

The independent variables used to calculate trip production include employed residents, number of workers per household, number of households, average persons per household, average household income, and average number of automobiles per household. The values of these variables were used in equations for trip generation, trip distribution, and mode choice. The source of information for each variable is as follows:

Employed Residents: The number of employed residents from ABAG's projections by census tract were allocated to traffic zones proportional to the number of housing units with employed residents.

Workers per Household: The number of employed residents divided by the number of households.

Households: The number of housing units from the Assessor's Property Files were summed by traffic zone. Vacancy rates from current surveys were applied to the zones according to the zip code of the zone (the vacancy rates are reported by zip code). This yielded the number of households (occupied housing units).

Average Persons per Household: Persons per household was taken from ABAG's projections by census tract and applied proportionally to the traffic zones.

Average Household Income: Income data were available from ABAG projections and were applied proportionally to traffic zones, or Census Tract data from the U.S. Census were applied proportionally to traffic zones.

Average Autos per Household: The average number of autos per household was obtained from the U.S. Census and MTC's regional transportation model. The county total was cross-checked with current automobile registration from the Division of Motor Vehicles. Projections of automobile ownership were obtained from MTC's regional transportation model.

On the attractions side, the variables used were retail, service, manufacturing and total employment, total employment density (jobs per acre of land) and service employment density. The values of these variables were used in equations for trip generation, trip distribution, and mode choice. The source of information for each variable is listed below.

Retail Employment: The square footage of retail space per traffic zone was drawn from two surveys of commercial parcels in Marin, the second of which consisted of phone calls to occupants of the parcel to obtain the exact number of employees. The number of employees was calculated according the average square feet of retail space per employee. For example, if a building has 3,500 square feet of space and there is an average of 500 square feet per employee, it is assumed that 7 employees work at the

site. Site information was summed to the traffic zone level and then summed to the census tract level. The results were cross-checked with ABAG's projections and the employer survey.

Service, Manufacturing and Total Employment: These were calculated using the same method described in "Retail Employment" above.

Service Employment Density: The number of service employees divided by acres per traffic zone.

Total Employment Density: The total number of employees divided by acres per traffic zone.

The trips generated from productions and attractions were distributed between traffic zones via a gravity model (described below). Data from origin-destination surveys were processed to create production-attraction matrices. These, in turn, were used to calibrate the model output.

5. Numeric Inputs: Mode Choice

The model determines mode choice by calculating the probability that a person will choose a particular mode over alternatives based on the "utility" he derives from that mode compared to the others. Utility is calculated by weighing the factors a person considers choosing between alternatives and then adding the factors. Although there may be subjective considerations such as comfort, convenience and prestige that influence a decision, the model is limited to using quantitative information to represent the factors. "Convenience," for example, is indirectly measured by travel time and employment density. Comfort and prestige are not modeled. The rationale for this is that when it comes to commuting, people put much more weight on time and cost. The mode split component of the model was developed by MTC. All local governments, which would like to receive State and Federal funds passed through MTC, are required to use this set of equations. The factors (independent variables) that determine the utility of each mode are listed below. The formal equations are listed in Appendix A.

Utility of transit: In-vehicle travel time, cost, out-of-vehicle travel time, requirement for automobile access, automobiles per household (when an automobile is required for transit access);

Utility of three-person carpool: Total employment density, automobiles per household, workers per household, household income, in-vehicle travel time, cost, out-of-vehicle travel time;

Utility of two-person carpool: The same factors as used for the three-person carpool above; and

Utility of driving alone: Same factors as used for carpools above plus number of persons per household who drive alone.

C. OPERATING THE MODEL

The Marin Transportation Model has four modules that correspond to the four steps of transportation modeling. The first step is calculating the number of trips produced by and attracted to a given traffic zone. Trips are then distributed among the zones. After a mode choice has been made, these trips are converted into numbers and types of vehicles. Then the vehicles are assigned to the road system according to the shortest travel time between traffic zones. The result is a count of vehicles on each road segment.

1. Trip Generation

The first step in operating the model is to calculate the productions and attractions for each of the four types of trips for each traffic zone. The equations used have been described in the preceding section on numeric inputs. The output is the number of person trips per day of each type per zone.

2. Trip Distribution

After the number of trip productions and attractions for each trip type has been calculated for each traffic zone, the model distributes traffic from productions to attractions using a "gravity" model. The hypothesis behind a gravity model is that trips between two zones are a function of the trips produced in one zone, the relative trip attraction in another zone, and the travel time between those zones. (Some gravity models also add a socioeconomic factor to account for travel characteristics unique to a given area. Examples of socioeconomic factors are household income, land values, and wage rates.)

The advantage of a gravity model is that it is sensitive to travel times. As the road system becomes more congested and travel times increase, the model will predict that fewer trips will be made to congested areas. Instead, people will travel to less congested areas. This is especially valuable for long-range planning: planners can get an idea of shifting travel patterns and what portions of the transportation system need to be improved to reduce travel times.

The gravity model equations are calibrated by comparing the trip exchanges from the model to the zonal exchange data developed by MTC, Caltrans, and the County of Marin (which show actual trip exchanges). Because travel times between zones are not known before the model is run, a gravity model assignment does not produce the same production-attraction matrix as that shown by surveys. The gravity model must be run several times until its distribution closely approximates that shown by the surveys. While running, the gravity model calculates "friction factors," how much time it takes to travel between zones. (To get the travel times, the model must go through the mode choice and assignment modules also.) This calibrated gravity model is used to distribute future trips.

The production and attraction matrices show the number of daily trips exchanged between zones. These daily trips are factored to represent evening peak-hour trips (a known percentage of daily trips occur in the evening peak hour). The source of the factors is the observed number of trips occurring between zones from the origin-destination surveys. In addition, a "directional split" must be calculated for the trips between each zone. Because any two traffic zones may have both trip producers and attractors, trips occur in both directions between the zones. The amount of travel in each direction is calculated according to the relative number of trip producers and attractors in each zone and compared to actual origin-destination surveys.

3. Mode Choice

After the distribution of trips has been set, the mode choice module is invoked. As explained above, the mode choice model calculates the probability that a person will choose a particular mode based on the utility he derives from it compared to other modes. The output is the number of trips in each of the following modes: single-occupant automobile, two-occupant automobile, three-occupant automobile, and transit (buses, trains, ferries).

Although the Marin County transportation model has a fully calibrated and validated mode choice module available, the coefficients of the variables have been adjusted because the County model has smaller traffic zones and a more refined road network. The Planning and Public Works Departments have used survey information from the MTC, Caltrans, the Golden Gate Bridge District, and their own studies to evaluate the mode choice module's output.

4. Network Assignment

After the mode choices have been made, the EMME/2 software assigns vehicle trips to the road network. Automobile and transit trips are assigned separately, but, if both share the same road, transit vehicles are assigned according to their headways (the elapsed time between consecutive vehicles).

On the first assignment, the model is programmed to assign automobiles along the shortest path to the zone of attraction. As vehicles are loaded onto the road network, the computer keeps a count of the number vehicles and calculates vehicle speeds as congestion worsens. After the first iteration, travel times are reported for all links. With each subsequent iteration, the program seeks the quickest route based on the current travel time associated with a link on the network. The hypothesis is that drivers try to reduce their travel time given several choices of routes. If there are alternate routes, the model pulls automobiles off "slow" links and assigns them to "faster" links to the same zone. If there is no alternative, vehicles remain assigned to the route. The EMME/2 model objective is to achieve equilibrium throughout the entire system: the travel time between each zone should be equal across all routes.

These vehicle counts are then compared to actual counts on road segments in the county. The purpose of comparison is to "validate" the model, that is, to make sure it accurately reflects the travel behavior of area residents. To the extent that there is a significant discrepancy, the representation of the network, road speed/time delay functions, land use/demographic inputs or coefficients of the model equations must be examined.

The counts used for comparison come from several sources. Local governments in Marin County take traffic counts on local streets as part of construction or traffic signalization programs. Counts from over 200 local street segments and interchanges covering the period from 1980 to 2001 have been gathered for the Countywide Plan update. Counts have also been gathered by consulting firms as part of the Environmental Impact Report ("EIR") for major developments. Counts for Highway 101 and its ramps have been made by Caltrans through 2001. The County's and Caltrans' counts are for road segments only; they do not include turning counts at intersections. (Some turning counts are available for specialized study areas such as downtown San Rafael and the Marinship area of Sausalito. These were obtained from EIRs of development projects and are also used as a check for the model.)

The counts taken by local governments include average weekday traffic, average weekday morning peak hour, and average weekday evening peak hour. The morning peak hour was between 7:30 a.m. and 8:30 a.m.; the evening peak was between 5:00 p.m. and 6:00 p.m. The counts provided by Caltrans include morning and evening peak *periods* plus some 24-hour counts. Counts were made at 15-minute intervals for both peaks. The morning peak period was between 6:00 a.m. and 9:00 a.m.; the evening peak period was between 4:00 p.m. and 7:00 p.m.

APPENDIX 1. MARIN TRANSPORTATION MODEL EQUATIONS

TRIP PRODUCTION AND ATTRACTION

Home-based work trips:

Trips produced per household = K + (c)household income + (c)number of households + (c)workers per household - 1

Trips attracted per job = (c)total employment or (c)retail employment + (c)service employment + (c)manufacturing employment + (c)other employment

Home-based shopping trips:

Trips produced per household = K - (c)variable for auto ownership + (c)household income + (c)persons per household

Trips attracted per job = K + (c)ratio of retail employment to total employment + (c)ratio of service employment to total employment - (c)constrained natural logarithm of employment density

Home-based recreation trips:

Trips produced per household = K + (c)persons per household + (c)household income - (c)variable for automobile ownership - (c)service employment density

Trips attracted per facility = (c)retail employment + (c)service employment + (c)population + (c)vacant land

Home-based school trips:

Trips produced per household = K + (c)household income + (c)number of households + (c)persons per household

Trips attracted per facility = (c)total population

Non-home-based trips:

Trips produced or attracted = (c)retail employment + (c)service employment + (c)other employment + (c)households

NOTE: K is a constant used to calibrate the set of independent variables with the resulting value of the dependent variable; (c) is a coefficient or weight for each variable. It is calculated when the model is calibrated.

TRIP DISTRIBUTION (GRAVITY MODEL)

[(Productions in zone i multiplied by Attractions in zone j) divided by travel Time between i and j] divided by (sum of attractions in all zones divided by travel time between zone i and all other zones

Symbolically:

$$\frac{PiAj/Tij}{\text{sum } \underline{Ax}}$$
$$Tix$$

where x is all zones 1 through 293

MODE CHOICE

P[M,i,j] = Exp [u (M,i,j)] / Exp [u (M,i,j)] summed over K

P is the probability that mode M is chosen from a set of K modes by workers living in zone i and working in zone j. Exp is the exponent used to calibrate the relationship between the independent variables. U is the utility derived from choosing mode M to travel from i to j. The utilities are linear functions of household and modal characteristics as follows:

Utility of transit = (c)in-vehicle travel time + (c)fare + (c)out-of-vehicle travel time + (c)variable for transit trips requiring auto access + (c)number of automobiles per household for transit trips requiring automobile access

Utility of three-person carpool = (c)variable for three-person carpool (note: it equals 1 for a three-person carpool, 0 for other modes) + (c)natural logarithm of employment density + (c)number of automobiles per household + (c)number of workers per household + (c)household income + (c)in-vehicle travel time + (c)cost + (c)out-of-vehicle travel time + (c)aggregate validation adjustment constant (note: used when summing the results of traffic zones to larger areas)

Utility of two-person carpool = (c)variable for two-person carpool (note: it equals 1 for a two-person carpool, 0 for other modes) + (c)natural logarithm of employment density + (c)number of automobiles per household + (c)number of workers per household + (c)household income + (c)in-vehicle travel time + (c)cost + (c)out-of-vehicle travel time + (c)aggregate validation adjustment constant (note: used when summing the results of traffic zones to larger areas)

Utility of driving alone = (c)variable for drive alone mode (note: it equals 1 for drive alone mode, 0 for other modes) + (c)natural logarithm of employment density + (c)number of automobiles owner per household + (c)number of workers per household + (c)number of persons per household + (c)household income + (c)in-vehicle travel time + (c)cost + (c)out-of-vehicle travel time + (c)aggregate validation adjustment constant (note: used when summing the results of traffic zones to larger areas)

NOTE: (c) is a coefficient or weight for each variable; it is calculated when the model is calibrated.

APPENDIX 2. TRANSPORTATION SYSTEM ROAD LINKS

List of Streets by Class

Freeway:

Highway 101 between the Golden Gate Bridge and Atherton Avenue exit, Novato
Highway 37 between Highway 101 at Novato and Sonoma County
Highway 580 between the Richmond Bridge and Highway 101 in San Rafael

Freeway Ramps:

Sausalito Lateral, all directions
Wolfback Ridge Road/Spencer Avenue
Monte Mar Drive, Sausalito
Rodeo Avenue, Sausalito
Bridgeway/Donahue Street, Sausalito
Shoreline Highway (State Route 1)
Redwood Highway Frontage Road, Strawberry
Tiburon Boulevard/Blithedale Avenue, Tiburon/Mill Valley
Tamalpais Drive/Paradise Drive, Corte Madera
Tamal Vista Boulevard, Corte Madera
Fifer Avenue/Paradise Drive, Corte Madera
Sir Francis Drake Boulevard
Highway 580/Francisco Boulevard
Irwin/Hetherton at Second Street, San Rafael
Irwin/Hetherton at Mission Street, San Rafael
Los Ranchitos/Lincoln Avenue, San Rafael
San Pedro Road, San Rafael
Manuel T. Freitas Parkway/Civic Center Drive, San Rafael
Lucas Valley Road/Smith Ranch Road, San Rafael
Miller Creek Road/St. Vincent's Drive, San Rafael
Alameda del Prado/Nave Drive, Novato
Ignacio Boulevard, Novato
South Novato Boulevard/Highway 37, Novato
Atherton Avenue on Highway 37, Novato
Rowland Boulevard, Novato
De Long Avenue, Novato
San Marin Drive/Atherton Avenue, Novato

Primary Arterials:

Bridgeway Avenue, Sausalito
Shoreline Highway (State Route 1), Tamalpais Valley
Miller Avenue between Almonte Boulevard and Miller Lane, Mill Valley
Camino Alto between Miller Avenue and East Blithedale, Mill Valley
East Blithedale Avenue between Camino Alto and Highway 101
Tiburon Boulevard between Highway 101 and Cove Road, Tiburon
Tamalpais Drive between Redwood Avenue and Paradise Drive, Corte Madera
Bon Air Road between Magnolia Avenue and Sir Francis Drake, Larkspur/Greenbrae
Sir Francis Drake Boulevard
Bellam Boulevard, San Rafael
Point San Pedro Road from Third Street to Riviera Drive, San Rafael
Second and Third Streets, San Rafael
Fourth Street between Second Street and San Anselmo border
Red Hill Avenue between San Anselmo border and Sir Francis Drake Boulevard
North San Pedro Road between Los Ranchitos Road and Golf Drive
Manuel T. Freitas Parkway
Smith Ranch Road
Lucas Valley Road between Highway 101 and Las Gallinas Avenue
Miller Creek Road to Las Gallinas Avenue
Ignacio Boulevard to Young Court
Bel Marin Keyes Boulevard to Frosty Lane
Novato Boulevard to Simmons Way
Redwood Boulevard between Rowland Boulevard and San Marin Drive
De Long Avenue
Highway 101 from Atherton Avenue to Sonoma County border

Secondary Arterials:

Tiburon Boulevard between Cove Road and Mar West Street, downtown Tiburon
San Rafael Avenue between Tiburon Boulevard and Golden Gate Avenue, Belvedere
Trestle Glen Drive between Tiburon Boulevard and Paradise Drive, Tiburon
Paradise Drive between Trestle Glen Drive and Highway 101
East Blithedale Avenue between Camino Alto and Throckmorton, Mill Valley
Camino Alto between East Blithedale and Corte Madera border, Mill Valley
Corte Madera Avenue between Corte Madera border and Doherty Drive, Corte Madera
Madera Boulevard, Corte Madera
Tamal Vista Boulevard, Corte Madera
Doherty Drive, Corte Madera
Magnolia Avenue, Larkspur
College Avenue, Kentfield
Wolfe Grade, Greenbrae
D Street, San Rafael
Andersen Drive, San Rafael
East Francisco Boulevard, San Rafael

East Kerner Boulevard on east side of Bellam to dead end, San Rafael
Fourth Street between Second Street and Lincoln Avenue, San Rafael
Grand Avenue, San Rafael
Lincoln Avenue between Fourth Street and Highway 101, San Rafael
Center Boulevard San Anselmo
Broadway Avenue, Fairfax
Bolinas-Fairfax Road to Meadow Country Club
Butterfield Road, Sleepy Hollow
Point San Pedro Road between Riviera and North San Pedro
North San Pedro Road between Point San Pedro and Golf Avenue
Civic Center Drive between North San Pedro and Redwood Road
Redwood Road between Civic Center Drive and Smith Ranch Road
Los Ranchitos Road
Las Gallinas Avenue
Northgate Drive
Lucas Valley Road between Las Gallinas and McKinley Road
Alameda del Prado
Nave Drive, Novato
Sunset Parkway, Novato
Center Road between South Novato Boulevard and Gregor Lane, Novato
Tamalpais Avenue between Center Road and Vallejo Avenue, Novato
Hicks Valley Road between Stafford Lake and Novato Boulevard, Novato
Grant Avenue, Novato
Olive Avenue, Novato
San Marin Drive, Novato
Atherton Avenue, Novato
Seventh Street between Vallejo Avenue and San Marin Drive, Novato

Commercial Collectors:

Caledonia Street, Sausalito
Harbor Drive, Sausalito
Strawberry Drive, Strawberry
Millwood Street, Mill Valley
Grove Street, Mill Valley
Hill Street, Mill Valley
Forrest Street, Mill Valley
Parkwood Avenue, Mill Valley
Laurelwood Street, Mill Valley
Ross Common, Ross
San Anselmo Avenue, San Anselmo
Golden Gate Drive, San Rafael
Dodie Street, San Rafael
Jacoby Street, San Rafael
Irene Street, San Rafael
Belvedere Street, San Rafael

Lisbon Street, San Rafael
Castro Avenue, San Rafael
Louise Street, San Rafael
Vivian Street, San Rafael
Medway Road, San Rafael
Hoag Avenue, San Rafael
Harbor Street, San Rafael
Front Street, San Rafael
Mill Street, San Rafael
Bay Street, San Rafael
Beach Park Road, San Rafael
Francisco Boulevard West, San Rafael
DuBois Street, San Rafael
Irwin Street, San Rafael
Lovell Avenue, San Rafael
Jordan Street, San Rafael
Lindaro Street, San Rafael
Tamalpais Avenue, San Rafael
A Street, San Rafael
Portions of B, C, and D Streets
Loch Lomond Drive, San Rafael
Redwood Frontage Road, San Rafael
Joseph Court, San Rafael
Mitchell Boulevard, San Rafael
Mark Drive, San Rafael
Carlos Drive, San Rafael
Paul Drive, San Rafael
Hamilton Drive, Novato
Galli Drive, Novato
Pimentel Court, Novato
Commerce Way, Novato
Scott Avenue, Novato
Blodgett Avenue, Novato
Machin Avenue, Novato
Sweetser Avenue, Novato
Nugent Lane, Novato
Vallejo Avenue, Novato
Orange Avenue, Novato
Madrone Avenue, Novato
Rose Street, Novato

APPENDIX 1-E

COMMUNITY DEVELOPMENT ELEMENT TECHNICAL REPORT #1, LAND USE MODELING AND BUILDOUT, OCTOBER 2006

MARIN COUNTYWIDE PLAN

Community Development Element
Technical Report #1

Land Use Modeling and Buildout

October 2006

The Marin County Community Development Agency, Planning Division
3501 Civic Center Drive, San Rafael, CA 94903

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Background and Summary

Understanding the effects of land development on Marin communities and complying with State of California standards for local general plans necessitates detailed land use information. Recognizing this, the Marin County Board of Supervisors directed the County Planning Department to prepare detailed records of land use and development activity by adopting the Economic Element of the Countywide Plan in 1985 and endorsing the update of the Marin Countywide Plan in 1986. In cooperation with other agencies, the Marin County Planning Department created a parcel database that serves planning purposes and provides information in support of the Marin Countywide Plan. This technical report describes the database and the processes developed for ongoing Marin County planning efforts.

The Marin County Planning Department tracks land use changes at a parcel level on a countywide basis semi-annually in cooperation with local governments. The primary data table, "Landuse" stores information about existing and potential land use and development density. Potential land use is defined as the possible build out of a parcel based on local General Plan, zoning and development policies as interpreted by planners. A second table, "Geocodes" assigns location designators to parcels to denote what kind of geographical area they are in (e.g. city, traffic zone, and water district).

Of note about the data and collection process:

- There is no implicit or explicit time horizon associated with this "build out" estimate. Therefore, calculated "build out" is *not* a projection. Buildout under this analysis would be if every parcel were developed to the maximum permitted, factoring in environmental and other constraints under the policies contained herein and therefore does not have a date certain attached. While particular sites may develop at their respective buildout assumptions by a certain time, the date at which there would be countywide buildout cannot be foreseen.
- This estimate does not involve the detailed environmental or site analysis that would accompany an actual development application submitted by a property owner. It therefore may differ from a subsequent allowable amount of development granted in an application approval.
- This estimate does not grant or remove a property right, nor constitutes a development entitlement of any kind, nor establishes a land use restriction on anyone's property. This estimate is used for large scale modeling purposes only (i.e. data are aggregated to larger geographic regions such as traffic zones, census tracts, communities and cities).
- County of Marin makes a reasonable effort to obtain current, accurate information from local governments on a semi-annual basis but has no authority to compel local governments to submit their data. The countywide data are no more or less accurate than that submitted by each city. The County of Marin assumes neither responsibility for nor liability for the accuracy, currency or completeness of data associated with parcels within city boundaries.

Aggregated parcel data are converted into household, population and employment data via factors contained in ancillary data tables and equations within a computer program. These data are primarily used as inputs for transportation modeling.

State of California General Plan Standards and County of Marin Land Use Data

The State of California general plan requirements can only be met with detailed information about demographic, land use, and transportation information. California Government Code Section 65302 (a) requires localities to describe and map standards of population density and building intensity in the land use element of their general plans. General plans must also identify certain areas including flood plains, timber production zones, solid and hazardous waste storage facilities, open space, agricultural resources, mineral resources, parks, school, public buildings, and all residential, commercial, and industrial land. In order to meet these State requirements, the State Office of Planning and Research recommends that local governments produce a parcel by parcel catalogue of land uses (Office of Planning and Research "General Plan Guidelines", 1987). The Marin County Planning Department has created the technical infrastructure to support these requirements.

A parcel-based method of estimating population, households and employment for the Countywide Plan

The Marin County Planning Department's parcel database and computer programs offer the opportunity to estimate “build out”, an estimate of the scale and intensity of development of parcels under current zoning and development policies as various levels of geography. By varying the amount of residential and commercial development on parcels, planners can create alternate scenarios of future states as manifested in volume of development. Scenarios generated from these modeling exercises can be analyzed for their impact on the environment, public services and infrastructure (such as the transportation system).

Parcel-based data describing land use conditions allow County planners to provide input to the projections produced by the Association of Bay Area Governments (ABAG). ABAG is the regional planning agency that has responsibility for producing projections for the nine-county Bay Area Region. ABAG projections are generally accepted by State and local governments as valid for modeling and environmental impact analysis purposes. The ABAG projections are time-related based on ABAG’s estimation of how quickly various land uses will economically be able to develop and be absorbed into the Bay Area economy. The Federal Highway Administration (FHWA) requires any federal grants for highway and interchange projects to provide capacity for growth projected in ABAG’s projections. The County of Marin submits its parcel-based data to ABAG for ABAG’s use in creating the regional projection series. The benefit to Marin County is that ABAG takes into consideration available land and local policies as reflected in the land use data when creating their projections. All local governments use ABAG projections in support of planning, especially transportation infrastructure planning (State law requires that local government projections be congruent with ABAG projections in order to receive transportation funds).

The Marin Transportation Model (MTM) uses data input from land use and demographic characteristics to model transportation impacts of land development on highways and major streets. The model contains information about the existing transportation system (as well as possible future systems) and simulates how people make decisions about transportation and how traffic "behaves" on major roads under various land use scenarios. The model relies on information summarized by Marin traffic zones, a unit of analysis for which no published data sources exist. Accurate information at the parcel level that can be easily aggregated by traffic zone is essential for the operation of the model.

The Land Use Database

The Marin County parcel database has several tables that contribute the transportation model data input table. The land use table shows existing and "build out" land use for the 96,000 plus parcels in Marin County cities, towns, and unincorporated areas. Table 5 lists the field names of the land use table. The "Geocodes" table has numeric codes representing various geographical designations for parcels. Field names are shown in Table 6. The land use codes common to the database are shown in Table 7. Table 8 contains data from ABAG (as distributed by the Metropolitan Transportation Commission for local government transportation modeling) that are used in conjunction with local land use data. Some factors that assist in converting land use data into households, population, employment and employed residents are shown in Table 9.

The Modeling Process

A computer query aggregates either existing or "build out" land use information (number of housing units and commercial square feet) by land use code and a given level of geography: Countywide Plan planning area, community, city, census tract, or traffic zone. A second computer program provides estimates of households, population, employment by general category (e.g. retail) and employed residents by geographic area. The model uses vacancy rates to calculate occupied commercial space and households, which are then multiplied by factors to determine employment and household size.

Here is an example of an employment calculation. Say a census tract has 300,000 square feet of commercial office space that is 90% occupied. Space utilization is one employee for every 300 square feet of occupied office space. Say for this particular tract, ABAG projections show that 60% of the employees work in service industries and 40% work in finance, insurance, and real estate industries. Multiply 300,000 commercial square feet by the 90% occupancy rate to yield 270,000 occupied commercial square feet. Divide the 270,000 square feet of occupied space by 300 square feet per employee to yield 900 employees (jobs) in the census tract. Multiply the 900 jobs by 60% to produce 540 service industry jobs and by 40% to produce 360 finance, insurance, and real estate industry jobs.

An example of population and household calculations in a census tract with 1,000 housing units as follows. ABAG projections show 2.4 persons per household. Multiply the 1,000 homes in the census tract by 95% to calculate occupied housing units to yield 950 occupied units (a 5% vacancy rate). Multiply 950 occupied units by 2.4 to yield 2,280 persons per tract. Add any population described as "institutionalized" or living in group quarters as published by the Census Bureau.

These examples illustrate the importance of the survey data and assumptions used to generate employment and population from housing units and commercial space. A computer model can use any set of assumptions provided by planners so that factors can be modified and improved as often as necessary.

Creating Visions for the Future

The primary purpose of any planning effort is to create a vision of the future that most stakeholders can reasonably agree upon. Usually the process begins by analyzing existing conditions and projecting those conditions into the future. Various stakeholders have different preferences as to what the future should be. They discover these preferences and compile them into a coherent vision that can be modeled, planners conduct public workshops with stakeholders to help them articulate the vision in terms of land use and public policies. Stakeholders tend to group themselves with like-mind individuals in order to advance their preferences in the political arena. In Marin County, these groups are well organized and articulate as to their preferences.

Recognizing key areas of interest in the county, each of which have several local organizations to advocate for those interests, the Countywide Plan visioning process employed four themes to encourage brainstorming and policy discussion among stakeholder groups. The four themes are Economic Vitality, Environmental Preservation, Housing, and Transportation. For each of the four themes, separate workshops were held with associated constituency groups and interested members of the public at which they were asked, if they were king or queen for a day and regardless of any real or perceived constraints, what would their vision for the county be and what specific desired outcomes would they like to see. The concepts for each of the groups were converted to policy statements which were then computer modeled as a scenario to compare the outputs to existing conditions, current policy direction of the Countywide Plan, and the other three scenarios. Many of the recommendations from this process were included in a Preferred scenario which took many ideas from each group and incorporated common interests. The policy statements in the Preferred scenario were ultimately factored into what is being modeled as the Project. Tables 1 and 2, following the Project discussion, compare the outcomes of each of the scenarios and the Project by housing units and commercial floor area, respectively.

Countywide Plan Scenario: "Economic Vitality"

The Vision:

The Economic Vitality scenario will maintain a healthy and vibrant economy while maintaining the quality of life that attracts businesses and residents to Marin.

Spiraling housing costs and the attendant transportation problems created because of increased commuting distances have been contained. Well-suited businesses are encouraged to locate in Marin and expand here. Continued progress has been made to improve challenging permit processes, limited space availability, and difficulty in recruiting and retaining workers. Key to ensuring a vibrant economy is that there are sufficient housing units affordable to the workforce of Marin.

What are the desired outcomes?

- All commercial areas, excluding industrial areas have been rezoned to mixed-use to allow maximum flexibility in use/reuse of the site.
- Allowable floor area ratios and building heights have been increased in central business districts and for targeted transit sites to result in an effective FAR of .35 instead of .3.
- New housing construction has been focused on higher-density, infill areas rather than single-family to make the most efficient use of land and maximize the potential for affordability. Allowable density has not been decreased on any single-family parcel but infill densities are assumed at one unit per 1,000 square feet of lot area above and beyond any commercial FAR allowance.
- Publicly-owned land (aside from parks and open space lands) has been used to provide additional housing.
- Retail centers have had housing added when being modernized or reconstructed at a rate of one unit per 1,000 square feet of building area.
- All new non-residential developments have been required to provide housing at a rate of one unit per 1,000 square feet of building area.
- Housing need for agricultural workers has been provided (520 units)
- Tax measures have been passed to fund transportation and housing as well as leverage outside funding.
- Public transportation has been improved to reduce single-occupant vehicle trips.
- Parking requirements have been reduced for non-residential projects to encourage the marketplace to determine appropriate amounts of parking.
- Airspace above parking lots has been used for additional housing.
- Second units are assumed to be on one of every ten single-family lots.
- The following specific sites have development as follows:
  1 St. Vincent's/Silveira – 1,500 clustered moderate- to high-density housing units, 246,000 square feet of resident-supporting retail space, exclusive of the St. Vincent's School and existing on-site facilities.
  2. San Rafael Rock Quarry – 350 residential units

Countywide Plan Scenario: "Environmental Preservation"

The Vision:

The environmental preservation scenario will maximize protection of environmentally sensitive lands. Using concepts from Community Marin, a consortium of interest groups focused on environmental issues, this scenario creates a Bayfront Protection Corridor. Countywide, it removes, through public and/or private acquisition, development potential in areas with environmental significance including wetlands, associated upland areas, sub-tidal areas, undeveloped 100-year flood plains and other areas subject to inundation, steep slopes, riparian corridors, and other geologically sensitive areas. Commercial development potential has been reduced. Existing policy related to ridgelines has been retained, including restrictions on ridgeline development, reduced densities on hillside areas, and clustering of development that is permitted to lower portions of the site. Planning decisions and land use designations are based on sound ecological principles and direct development away from sensitive habitats. Expansion of existing development and uses into sensitive habitats is not permitted. New development uses green-building techniques and is concentrated in already-developed areas proximate to transit service while home sizes have been capped to minimize resource consumption. Parking lots have been targeted for infill development instead of new development in "greenfields" such as undeveloped lands without urban services available or on the periphery of urbanized areas.

In West Marin, Coastal Corridor and Local Coastal Plan policies continue to direct development into existing villages rather than onto surrounding undeveloped lands. Environmentally sound agricultural operations have been encouraged along with allowances for agricultural-worker housing. Streamside and wetland policies protect creek habitat from development as well as agricultural runoff while hillside guidelines preclude inappropriate development along Bolinas Ridge. New development potential along the shore of Tomales Bay has been eliminated.

What are the desired outcomes?

- Additional development potential has been reduced to existing levels for parcels meeting any of the following criteria:
  1. Within a ridge and upland greenbelt
  2. Within a 100-year floodplain
  3. Contain diked baylands and associated uplands
  4. Below sea level
  5. Containing wetland habitat
  6. Within 100 feet of a perennial, intermittent, or ephemeral stream, or man-made channel
- For the Inland Rural and Coastal Corridor, overall additional development potential has been halved.
- Second units are assumed to be on one of every ten lots with an existing single-family home.
- Existing policies in the Coastal Corridor continue as they exist today and have also been applied to parcels within the Inland Rural Corridor.
- The following specific sites have development potential designated as follows:
  1. St. Vincent's/Silveira – 63 units
  2. Gnoss Field area – one unit per parcel
  3. Tomales Bay Shoreline (inboard of Highway 1 and Sir Francis Drake – No development

4. San Quentin Prison property – 506 residential units (based on current land use designations)
5. Novato Narrows – no additional development above what is currently permitted (agriculture).
6. Tiburon Peninsula – existing development levels but not less than one unit per parcel.
7. Strawberry and Marin City Shopping Centers – one residential unit per 1,000 square feet of nonresidential floor area in addition to current development.

- For nonresidential parcels not affected by any of the above criteria, remove half the potential additional development and convert to residential at the rate of one unit per every 1,000 square feet of nonresidential development removed.

Countywide Plan Scenario: "Housing"

The Vision:

The Housing scenario will provide sufficient housing for Marin residents with a special emphasis towards providing units affordable to lower-income members of the workforce, large families, the elderly, and the disabled.

Primary actions include development of policy actions and funding mechanisms to construct affordable ownership and rental housing including establishment of minimum densities, maximum home sizes, encouraging mixed-use developments, reducing parking requirements, establishing a countywide housing trust fund, and forming public-private partnerships to acquire land and leverage funding opportunities.

What are the desired outcomes?

- New housing construction has been focused on higher-density, infill areas rather than single-family to make the most efficient use of land and maximize the potential for affordability. Allowable density has not been decreased on any single-family parcel but infill densities are assumed at one unit per 1,000 square feet of lot area above and beyond any commercial FAR allowance.
- Targeted lots in single-family neighborhoods, such as corner lots, provide opportunities for duplex and other medium-density multifamily housing.
- Inclusionary programs have been applied to all development proposals.
- An affordable housing overlay zone has been established in transit-rich areas to facilitate financing and construction of affordable units.
- Retail centers have had housing added when being modernized or reconstructed at a rate of one unit per 1,000 square feet of building area.
- All new non-residential developments have been required to provide housing at a rate of one unit per 1,000 square feet of building area.
- Housing need for agricultural workers has been provided (520 units)
- 50% of new multifamily units are deed-restricted to be affordable to extremely low, very low and low-income households.
- Public transportation has been improved to reduce single-occupant vehicle trips.
- Airspace above parking lots has been used for additional housing.
- Second units are assumed to be on one of every ten single-family lots.
- Minimum densities have been established and single-family homes prohibited on multifamily-zoned properties.
- The following specific sites have development as follows:
  1. St. Vincent's/Silveira – 1,200 clustered moderate- to high-density housing units, 50,000 square feet of resident-supporting retail space, exclusive of the St. Vincent's School and existing on-site facilities.
  2. San Quentin – 3,585 residential units clustered in a European village-like community with 500,000 square feet of nonresidential space (inclusive of existing structures that would be preserved and/or reused).
  3. San Rafael Rock Quarry – 400 residential units

Countywide Plan Scenario: "Transportation"

The Vision:

The Transportation scenario will provide for land use patterns that support multi-modal, connected, and seamless mobility choices for Marin's residents.

Key to addressing concerns about excessive single-occupant vehicle trips and limited road infrastructure is to focus future growth towards places that are already developed and can be adequate served with transportation modes other that the automobile. This results in compact communities that emphasize transit-oriented development patterns that also enable easy bicycle and pedestrian circulation. A mixture of land uses within walking distance to serve basic needs is an essential characteristic of these communities. Transportation linkages and transit service will be regular and frequent and serve activity nodes such as schools, employment centers, and public facilities. An off-street circulation network is critical to encouraging pedestrian and non-motorized trips.

What are the desired outcomes?

- Programs identified in the Transportation Vision Plan have been implemented.
- Motorized transportation is primarily alternative-fuel based.
- All commercial areas, excluding industrial areas, have been rezoned to mixed-use to allow maximum flexibility in use/reuse of the site.
- Targeted transit areas have been defined as land within ¾ mile of a train station or ferry terminal, ½ mile of a bus terminal and the 101 bus pads, and ¼ mile of selected bus routes.
- Allowable floor area ratios and building heights have been increased in central business districts and for targeted transit sites to result in an effective FAR of .35 instead of .3.
- New housing construction has been focused on higher-density, infill areas rather than single-family to make the most efficient use of land and maximize the potential for affordability. Half of the remaining development potential in the Inland Rural and Coastal corridors has been allocated to a transfer of development rights "pool" which may be used in targeted communities to provide additional affordable units above what is permitted by current policy.
- Retail centers have had housing added when being modernized or reconstructed at a rate of one unit per 1,000 square feet of building area.
- All new non-residential developments have been required to provide housing at a rate of one unit per 1,000 square feet of building area.
- Tax measures have been passed to fund transportation as well as leverage outside funding.
- The Transportation Authority of Marin has been established to oversee transportation improvements and manage transportation programs.
- A network of bicycle and pedestrian pathways has been constructed, and bike routes added to roadways as designated on the bicycle master plan.
- Barriers to pedestrian and bicycle access have been removed and sufficient parking areas for bicycles have been provided at activity nodes.
- Parking maximums have been established for areas served by transit.
- Airspace above parking lots in targeted transit areas has been used for additional housing.
- Second units are assumed to be on one of every ten single-family lots.
- The following specific sites have development as follows:

1. St. Vincent's/Silveira – Assumes no large-scale development
2. San Quentin – 2,100 residential units clustered in a European village-like community with 285,000 square feet of nonresidential space (inclusive of existing structures that would be preserved and/or reused).
3. Strawberry Shopping Center – 169 units
4. Marin City Shopping Center – 170 units

The Marin Countywide Plan: "Project"

In response to the guiding principles of the Countywide Plan update, it was recognized that currently-assumed potential levels of development could result in substantial, potentially negative impacts to areas of the county identified as environmentally sensitive or otherwise inappropriate for the levels of potential development assumed. At the same time, areas that have been identified as suitable locations for additional housing because of their proximity to transit, services, and infrastructure do not necessarily have sufficient potential densities assigned to make such projects viable. Given the significant concerns about a lack of affordable housing in Marin, the key policy objective was to have no net loss in potential housing units countywide.

Therefore, in order to protect agriculture and reduce the environmental impacts of residential development in sensitive locations, residential development potential has been reduced in those locations and transferred to potential suitable locations almost entirely in the City-Centered Corridor. A "Housing Bank" has been created to retain and reallocate units transferred off of sensitive sites. The Countywide Plan establishes a "Housing Overlay" designation to identify specific sites where units from the Housing Bank can be reallocated and establishes criteria under which those units can be constructed within the overlay area. The Housing Overlay is discussed in greater detail later in this document.

There are three Options which assume varying degrees of development on St. Vincent's Silveira and the Rock Quarry. For each of the Options, to the extent that development assumptions deviate from Current Policy on those sites, net changes in units affect the total number of units to be allocated through the Housing Overlay Zone program. As a result, even though the countywide figures do not vary between the three options, figures for planning areas do vary because of the degree of shift of units from one area to another depending on the criteria of the Option.

Basic assumptions were made for the Project that are reflected in all three options. As noted above, the three options reflect varying degrees of development for specific sites. For all of the specifications listed below, if there is a conflict, the more site-specific specification takes precedence over the more global.

Global Changes that Reduced Assumed Development Potential:

1. For **Gnoss Field area** – Using the Airport Master Plan, Stage 3 (1998-2007), apply 200,000 square feet for new hangars or industrial land uses to four parcels, based on prevalence of wetlands and remaining suitable buildable area.

Parcel	Square Footage
125-190-74	100,000
125-190-41	60,000
125-190-29	20,000
125-190-56	20,000

All publicly owned parcels reduce density to existing or zero.

2. **Inland Rural or Coastal Corridor parcels (except for parcels zoned C-RA-B2 of less than 5,000 square feet in Bolinas)**: For conforming lots assume the lower end of the density range due to environmental constraints and a lack of urban servies. For non-conforming lots (substandard) and all parcels along Tomales Bay, assume a maximum of one unit or existing (i.e. no further land divisions).
3. **Bolinas:** Only for Bolinas, C-RA-B2 zoned parcels less than 5,000 square feet (substandard lots with no septic system): no units
4. Countywide, in areas lacking public **sewer or water** calculate build-out at the low end of the density range.
5. In the **Ridge & Upland Greenbelt** areas and parcels immediately adjacent to the Greenbelt ignore zoning and calculate build-out at the lower end of the General Plan density range (one unit per 1-10 acres).
6. Parcels that are **below sea level:** remove development potential.
7. Apply the low-end of the general plan density range to the properties located in the Sphere of Influence but outside city boundaries.

Global Changes that Increased Assumed Development Potential:

1. **Marin City** (Gateway Shopping Center) 186 additional residential units (one unit per 1,000 s.f. of allowable commercial floor area) from Housing Bank.
2. **West Fairfax:** at Oak Manor increase to 21 units on the following parcels: 174-011-32 – 7 units, 174-011-33 – 14 units, from Housing Bank.
3. **Strawberry Shopping Center:** 169 additional residential units (one unit per 1,000 s.f. of allowable commercial floor area) from Housing Bank.
4. **Marinwood Shopping Center:** 90 additional residential units from Housing Bank
5. **San Quentin Prison:** For impact analysis, assume continuation of the prison with the Condemned Inmate Complex or a redevelopment of the site occurs with development intensity and impacts equivalent to a correctional facility with inmate population of 7,380 (using site employment data and calculated increase) .

Changes that Did Not Factor Into Model Calculations:

1. **Second Units:** In response to State legislation encouraging second unit construction and assuming a significant number of potential units as a result, apply one second dwelling unit for every 10 single family dwellings for build-out. This figure was also added to the existing buildout assumptions (Current Policy) so it does not result in a net unit change.
2. **Ag Worker Units:** Up to 520 agricultural worker units are assumed countywide. This figure was also added to the existing buildout assumptions (Current Policy) so it does not result in a net unit change.

Changes Reflected in the Three Options

1. **San Rafael Rock Quarry:** Option 1 – continued use as a quarry, modeled using existing traffic volumes and truck trips. Options 2 and 3 – 350 residential units, no change to non-residential floor area.

2. **St. Vincent's/Silveria:** Option 1 – Base density of one unit per 10 acres, plus up to 100 affordable units (yield at 1,210 acres is 121+100 affordable is 221). Option 2 – 350 residential units. Option 3 – 500 residential units.

Tables 1 and 2, on the following pages, show the residential unit and commercial floor area modeled outcomes, respectively. Modeled figures are provided for what currently exists, what is assumed based on the currently-adopted policies and programs in the 1994 Countywide Plan, the three Project options for the current Countywide Plan update, and the four thematic scenarios.

Defining the Housing Overlay

The draft Countywide Plan establishes the Housing Overlay designation and includes programs to implement a Housing Overlay Designation (HOD) through the Development Code. In determining the boundaries of the Housing Overlay, parcels must meet all of the following criteria:

- Located within the unincorporated portion of the City-Centered Corridor
- Has a Countywide Plan land use designation of PD (Planned Designation), MF (Multifamily), GC (General Commercial), NC (Neighborhood Commercial), OC (Office Commercial), RC (Recreation Commercial), or PF (Public Facility)
- Located within one-half mile of a transit node or route with daily, regularly scheduled service
- Located within one mile of a medical facility, library, post office, or commercial center
- Site does not exceed an average 20% slope and is not within the Ridge and Upland Greenbelt
- Portions of parcels within a Wetlands Conservation Area or Streamside Conservation Area are not eligible for Housing Overlay units.

The objective of having a defined Housing Overlay designation is to provide viable locations in which to locate units transferred from environmentally sensitive areas, provide for these units in locations where they can be best provided services with reduced impacts, and define a large enough area with enough flexibility that speculative price increases on designated lands can be avoided. Using the criteria above, the defined Housing Overlay includes parcels in a variety of areas and is not a contiguous units. Rather, it is clustered around existing activity areas and includes a variety of parcel sizes. The Housing Bank is a repository for these units and would be drawn down as projects including qualifying HOD units are constructed. From a mathematical standpoint, there are far more sites and potential for additional housing units within the Housing Overlay than there are units in the Housing Bank. This is in recognition that to avoid land speculation, provide flexibility, and account for not all sites within the overlay ultimately being suitable for additional housing, that sufficient area needs to be designated above a one-to-one correlation.

The Housing Bank includes 1,694 "basic" units which have been transferred from various environmentally sensitive areas countywide. The three options include varying degrees of additional units depending on the assumptions for St. Vincent's-Silveira and the San Rafael Rock Quarry. The resulting Housing Bank totals range from a high of 1,974 units under Option 1 to 1,694 units under Option 3. Of these figures, 466 units have been assumed at specific sites under Option 1 (Rock Quarry remains in operation) and 816 units for Options 2 and 3 (Rock Quarry redeveloped with 350 housing units) for modeling purposes. While there may be more or fewer units at these sites than the number assumed, policy language in the Plan encourages and/or requires residential units to be provided at

commercial sites upon development or redevelopment. The units assigned to these sites are not included in the unit assignments by community through the "Residual Assigned to Housing Overlay" unit allocation. Excluding the quarry, the specific-site assumptions are existing shopping centers or other retail areas and all are part of the Housing Overlay.

Assignment of the residual Housing Overlay units was based on the criteria defining the boundaries of the Housing Overlay, the amount of land area designated for the Housing Overlay within a given community, and, to a lesser degree, its current and projected population. The result is a percentage assignment for each community area affected by the Overlay to fully assign the residual HO units. For modeling purposes, the community unit assignments were further broken down into weighted figures for traffic zones (TAZ) within each of the community areas based on the area of the Overlay in that community in relation to the area of the traffic zone.

Tables 3 and 4 below show the allocation of the residual units. The residual unit figure is derived from the variable Banked Units figure (which is affected by unit allocations St. Vincent's/Silveira), less the 466 to 816 units assigned to specific sites (affected by reuse of the quarry). The Residual Unit Distribution outlines the percentages by which the residual units were allocated to each community while the Unit Allocation by Community/TAZ shows how units were further allocated by traffic zone for each of the community areas. For communities with only one traffic zone, the figures between the first and second sections is identical. For communities with multiple traffic zones, the units for that community were further broken out using the multipliers indicated. The general basis of the multipliers is the amount of land area within each of the traffic zones that is also in the Overlay. Table 4 illustrates the same information but is instead aggregated by Option and indicates the number of units in each community assigned to specific sites or to the broader Housing Overlay.

Marin Countywide Plan Update
Land Use Alternatives by Planning Area
-- Nonresidential Floor Area --

					PROJECT	SCENARIOS			
Planning Area	**Location**	**Acres**	**Existing SQ FT**	**Current Policy SQ FT**	**All Options**	**Economic Vitality**	**Environmental Preservation**	**Housing**	**Transportation**
1	Novato Environs	36,271	306,575	1,177,526	507,189	511,729	308,719	1,177,526	1,177,526
2	Las Gallinas	20,492	253,644	862,233	862,233	1,108,233	717,007	885,507	878,735
3	Central San Rafael	2,808	25,481	25,481	25,481	25,481	25,481	10,977	83,427
4	Upper Ross Valley	5,150	41,364	46,817	46,817	46,817	44,091	46,817	54,608
5	Lower Ross Valley	3,424	236,429	457,094	449,980	457,094	385,744	457,094	479,729
6	Southern Marin	5,856	1,095,980	1,296,421	1,234,987	1,324,050	1,171,693	1,273,692	1,466,450
7	West Marin	249,128	1,245,076	1,406,616	1,314,643	1,396,092	1,294,404	1,406,616	1,367,407
Unincorporated Area Total		**323,131**	**3,204,549**	**5,272,188**	**4,441,330**	**4,869,496**	**3,947,139**	**5,258,229**	**5,507,882**
Incorporated Cities and Towns		47,381	36,005,945	45,431,753	45,431,753	45,431,753	45,431,753	45,431,753	45,431,753
Countywide Total		**370,512**	**39,210,494**	**50,703,941**	**49,873,083**	**50,301,249**	**49,378,892**	**50,689,982**	**50,939,635**
Change from Existing (Unincorporated Only)				**2,067,639**	**1,236,781**	**1,664,947**	**742,590**	**2,053,680**	**2,303,333**
Change from Current Policy (Unincorporated Only)					**-830,858**	**-402,692**	**-1,325,049**	**-13,959**	**235,694**

Note: 'SQFT' refers to the floor area of any nonresidential use including retail, office, warehouses, hotels, and group quarters.

v8.1 1/4/06F

Marin Countywide Plan Update
Land Use Alternatives by Planning Area
-- Housing Units --

						PROJECT			SCENARIOS			
Planning Area	**Location**	**Acres**	**Existing Units**	**Current Policy**	**Current Policy "Alt."**	**Option 1**	**Option 2**	**Option 3**	**Economic Vitality**	**Environmental Preservation**	**Housing**	**Transportation**
1	Novato Environs	36,271	2,854	3,587	3,587	3,413	3,413	3,413	3,413	3,386	4,711	3,591
2	Las Gallinas	20,492	4,234	5,656	5,166	5,863	5,850	5,956	6,686	5,115	7,029	5,487
3	Central San Rafael	2,808	645	825	825	823	1,171	1,171	1,171	801	1,471	1,071
4	Upper Ross Valley	5,150	1,358	1,617	1,617	1,606	1,606	1,606	1,606	1,570	1,709	1,675
5	Lower Ross Valley	3,424	2,828	3,255	3,255	3,507	3,420	3,393	3,237	3,267	4,042	3,692
6	Southern Marin	5,856	9,565	11,495	11,495	12,387	12,139	12,060	11,602	11,625	13,003	12,407
7	West Marin	249,128	5,839	9,579	9,579	8,416	8,416	8,416	8,416	9,222	10,771	8,310
Unincorporated Area Total		**323,131**	**27,323**	**36,014**	**35,524**	**36,015**	**36,015**	**36,015**	**36,131**	**34,986**	**42,736**	**36,233**
Incorporated Cities and Towns		47,381	80,670	89,132	84,023	89,132	89,132	89,132	89,132	89,132	89,132	89,132
Countywide Total		**370,512**	**107,993**	**121,846**	**119,547**	**125,147**	**125,147**	**125,147**	**125,263**	**124,118**	**131,868**	**125,365**
Change from Existing (Unincorporated Only)				**8,691**	**8,201**	**8,692**	**8,692**	**8,692**	**8,808**	**7,663**	**15,413**	**8,910**
Change from Current Policy (Unincorporated Only)						**1**	**1**	**1**	**117**	**-1,028**	**6,722**	**219**

Note: A 'Unit' is any self-contained dwelling units such as a house, townhome, or apartment but excluding group quarters.

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Option 1 assumes 221 units at St. Vincent's/Silveira and no change at the quarry
Option 2 assumes 350 units at St. Vincent's/Silveira and 350 units at the quarry
Option 3 assumes 500 units at St. Vincent's/Silveira and 350 units at the quarry

Table 3. Allocation of Housing Units in the Housing Overlay

		Project Options		
		Option 1	Option 2	Option3
Units Transferred From Sites Countywide		**1,694**	**1,694**	**1,694**
Units Transferred from St. Vincent's/Silveira		280	151	0
Total Units to Housing Overlay		**1,974**	**1,845**	**1,694**
Less Allocation Assumptions to Specific Sites		466	816	816
Residual Assigned to Housing Overlay		**1,508**	**1,029**	**878**
Residual Unit Distribution				
Community	*Share*			
Marin City	17.0%	256	175	149
Tam Valley/Almonte	20.2%	305	208	177
Strawberry	14.9%	225	153	131
Kentfield	17.9%	270	184	157
Santa Venetia	12.1%	182	125	106
Marinwood	17.9%	270	184	157
Total *(may not add due to rounding)*		**1,508**	**1,029**	**878**
Residual Unit Allocation by Community/TAZ (Traffic Zone)				
Community	*TAZ*			
Marin City	86	256	175	149
Tam Valley (.6)	87	183	125	106
Almonte (.3)	88	91	62	53
Almonte (.1)	98	30	21	18
Strawberry	99	225	153	131
Kentfield (1/3)	126	90	61	52
Kentfield (1/3)	127	90	61	52
Kentfield (1/3)	128	90	61	52
Santa Venetia	154	182	125	106
Marinwood (.25)	170	67	46	39
Marinwood (.5)	171	135	92	79
Marinwood (.25)	173	67	46	39
Total *(may not add due to rounding)*		**1,508**	**1,029**	**878**

Table 4. Allocation of Housing Bank Units by Option, Type, and Location

Option 1

Area	Specific Site Units	Housing Overlay Units	Total Units
Marin City	186	256	442
Tam Valley	0	305	305
Strawberry	169	225	394
Kentfield	0	270	270
Santa Venetia	0	182	182
San Rafael Rock Quarry	0	0	0
Fairfax/Oak Manor	21	0	21
Marinwood	90	270	360
Totals *(may not add due to rounding)*	**466**	**1,508**	**1,974**

Option 2

Area	Specific Site Units	Housing Overlay Units	Total Units
Marin City	186	175	361
Tam Valley	0	208	208
Strawberry	169	153	322
Kentfield	0	184	184
Santa Venetia	0	125	125
San Rafael Rock Quarry	350	0	350
Fairfax/Oak Manor	21	0	21
Marinwood	90	184	274
Totals *(may not add due to rounding)*	**816**	**1,029**	**1,845**

Option 3

Area	Specific Site Units	Housing Overlay Units	Total Units
Marin City	186	149	335
Tam Valley	0	177	177
Strawberry	169	131	300
Kentfield	0	157	157
Santa Venetia	0	106	106
San Rafael Rock Quarry	350	0	350
Fairfax/Oak Manor	21	0	21
Marinwood	90	157	247
Totals *(may not add due to rounding)*	**816**	**878**	**1,694**

Table 5.
Land Use Table Data Dictionary

PROPERTY_ID	10-character parcel number (dashes included: xxx-xxx-xx)
ZONING	Official zoning designation as assigned by local government Planning Department
ORDINANCE	Ordinance number which specified the zoning for the parcel
GENERAL_PLAN	Official local General Plan designation as assigned by local government Planning Department
EXISTING_LAND_USE_CODE	A numeric code assigned to indicate an existing general land use type such as "single family house".
EXISTING_UNITS	Number of existing housing units on the parcel.
EXISTING_COMM_SQFT	Number (volume) of existing commercial square footage on the parcel (i.e. the size of all commercial buildings on the parcel).
BUILDOUT_LAND_USE_CODE	A numeric code assigned to indicate a general land use type such as "single family house" that could be built under local government General Plan and zoning ordinance.
BUILDOUT_UNITS	Number of housing units that could be built under local government General Plan and zoning ordinance.
BUILDOUT_COMM_SQFT	Number (volume) of commercial square footage that could be built under local government General Plan and zoning ordinance.
PARCEL_SQFT	Parcel size in square feet as calculated by County Assessor's Office.
AGRICULTURAL_USE_FL	A "Y" or "N" indicating whether a parcel is used for agricultural purposes.
PARCEL	8-character parcel number (no dashes within the number)
CITY_NAME	Name of local government (without official prefix "Town of" or "City of").
UPDATE_DATE	Date of most recent update
UPDATE_USER_NAME	Name of person who most recently updated this parcel information.

Table 6
Geocodes Table Data Dictionary

PROPERTY_ID	10-character parcel number (dashes included: xxx-xxx-xx)
COMMUNITY_PLAN	The name of an unincorporated community that has a County-approved Community Plan (a local, more specific version of a General Plan).
COMMUNITY	The name of an unincorporated community.
CLUBLIST	The names of a mailing list to which this parcel belongs. Used to notify residents of an area about proposed land use changes within the area.
CENSUS_TRACT	US Census Bureau tract number (a geographic subdivision of a county).
CENSUS_BLOCK	US Census Bureau block number (a geographic subdivision of a tract).
TRAFFIC_ZONE	A number used by Countywide Planning Agency and Transportation Authority of Marin to denote a contiguous geographic area for which land use an transportation impacts are modeled.
CWP_AREA	A contiguous subdivision of Marin County used by the Countywide Plan for purposes of land use analysis. Each are is approximately an aggregation of Census Tracts.
CWP_CORRIDOR	A contiguous subdivision of Marin County used by the Countywide Plan for purposes of broad land use policy application.
CWP_MAP_NUMBER	The number of the land use map in the Countywide Plan in which this parcel resides.
URBAN_SERVICE_AREA	The name of the City or Town that provides or may provide services to this parcel.
SPHERE_OF_INFLUENCE	The name of the City or Town that asserts some authority to review land use changes on this parcel.
PARK	An alphanumeric code denoting what Federal, State or local park or Open Space Preserve this parcel belongs to.
LOCAL_COASTAL_PLAN	An alphanumeric code denoting that land use changes on this parcel are subject to discretionary review by the State of California Coastal Commission.
SUPERVISOR_DISTRICT	An alphanumeric code denoting the Marin County board of Supervisor District, a contiguous geographic area with political representation by one elected official.
BFC_ZONE	An alphanumeric code denoting that land use changes on this parcel are subject to land use regulation specific to property near the bay.
DAM_FAILURE_AREA	An alphanumeric code denoting that parcel within this area are possibly subject to flooding if the upstream dam

	breaks.
ALQUIST_PRIOLO_ZONE	An alphanumeric code denoting that this parcel is within 1000 feet of an earthquake fault. Prospective owners are required to be notified that they are within this hazard zone.
VOTER_PRECINCT	The County Elections Office voting precinct number in which this parcel resides.
ANADROMOUS	A "Y" or "N" flag to denote that this parcel is within or touches a buffer boundary around streams that have fish species deemed worthy of protection. Additional land use regulations apply.
STREAM_CONSERVATION_AREA	A "Y" or "N" flag to denote that this parcel is within or touches a buffer boundary around streams that are subject to an ordinance protecting stream habitats. Additional land use regulations apply.

Table 7.
Land Use Codes

11	Single Family Residential
21	Multifamily Residential
31	Agriculture
32	Open Space
41	Industrial
51	General Commercial
52	Office
53	Retail
54	Mixed Use
55	Commercial Recreation
81	Privately Owned Non-taxable
82	Publicly Owned Non-taxable
91	Vacant

Table 8 Metropolitan Transportation Commission Data for Marin County, Year 2020

MTC ZONE	Total Households	Household Population	Total Pop.	Employed Residents	Average Household Income	Total Employ-ment	Retail Employ-ment	Service Employ-ment	Other Employ-ment
1404	1129	2948	2948	1826	109916	1698	209	844	393
1405	1224	3187	3187	2018	68741	3370	728	1284	1223
1406	1077	2418	2423	1061	102341	3422	712	1309	826
1407	3097	7571	7696	4757	63972	9298	1120	5576	1640
1408	2874	6894	6918	4633	83542	3384	506	2227	445
1409	3144	8000	8034	4971	73652	3501	504	1986	403
1410	2487	5805	5829	4083	53310	1641	144	1199	28
1411	2943	7057	7754	4504	68671	2601	103	1287	1176
1412	4801	12251	12382	7715	65585	6764	1155	2867	2540
1413	1209	3129	3131	2056	92310	6708	500	4635	1057
1414	3190	8941	9004	5177	97220	833	82	527	207
1415	1540	3704	3794	1808	78632	2883	458	1785	508
1416	1007	2253	2503	1178	55624	1573	297	353	476
1417	144	330	330	223	78912	144	49	62	27
1418	1600	4000	4132	2063	68952	1082	306	333	426
1419	1450	3220	3220	2158	72038	567	108	319	118
1420	2915	7364	7437	4631	105427	2336	335	709	1233
1421	3109	6745	7204	3755	75756	6221	1303	2246	2488
1422	2908	7092	7188	4199	86207	4192	432	1812	1786
1423	2695	7099	7215	4017	97921	1219	95	914	162
1424	2459	4533	4903	3269	64673	7585	1343	3147	1824
1425	2542	6181	6750	4015	85225	5596	590	3015	1821
1426	2395	6009	6009	3344	154177	1236	183	505	414
1427	2692	6007	6465	4228	114405	3977	735	1859	1177
1428	3504	13254	13401	6488	51837	13046	1609	4587	4060
1429	2204	4801	4810	3524	73652	4116	769	1739	1162
1430	2895	6035	6345	4935	68321	8607	1703	4568	1755
1431	4059	8669	8737	6309	79263	2640	604	1309	518
1432	2137	4676	4883	3515	87680	3115	1387	1051	593
1433	1340	3141	3161	2482	87751	665	123	165	335
1434	2400	5355	5355	4021	73652	1612	577	705	285
1435	820	2450	2550	1210	158666	960	63	859	38
1436	2079	5133	5164	3461	186584	2880	617	1895	322
1437	3639	7135	7290	5214	106549	4743	524	3416	686
1438	3425	7953	7953	5732	97080	10872	2714	3364	3441
1439	172	372	6768	355	68110	1036	126	395	405
1440	3496	7183	7202	6391	111529	3114	1139	1204	695
1441	2500	5524	5524	3846	96028	4358	2088	1272	724
1442	2573	5985	6015	3977	138535	2726	696	1183	595
1443	2242	4536	4606	2788	109355	3827	1078	1892	734
1444	1972	4024	4255	2680	99114	1671	484	665	428
1445	2359	5448	5459	3470	170170	1320	363	494	402
1446	2575	5488	5677	3545	165330	2654	830	1049	682
1447	1009	2231	2231	1093	223901	1150	18	536	596
1448	4546	7799	7799	7467	120157	7831	2346	2779	1631
1449	1151	2664	2664	1662	51486	1175	192	537	358

MTC ZONE	Total Households	Household Population	Total Pop.	Employed Residents	Average Household Income	Total Employ-ment	Retail Employ-ment	Service Employ-ment	Other Employ-ment
1450	2865	6647	6660	4586	140289	1640	470	663	366
1451	2018	4739	4778	3597	124717	1319	399	548	244
1452	2237	4967	4967	3483	138886	2784	861	996	750
1453	272	604	684	354	112441	677	43	308	134
1454	1080	2446	2606	1226	84103	1212	435	590	177

Table 9 Factors used in Transportation Model (year 2030)

Area	Building Occupancy in 2030	Housing Occupancy in 2030	Households in 2000	Work at home 2000	Work at home percentage	Persons per household 2030	Group quarters population
Traffic Zone 84	1.00	0.95	1280	195	0.11	1.72	0
Traffic Zone 85	1.00	0.95	3235	320	0.11	1.72	12
Traffic Zone 86	1.00	0.95	1090	42	0.11	2.29	0
Traffic Zone 87	1.00	0.98	2663	485	0.11	2.32	14
Traffic Zone 88	1.00	0.96	777	96	0.11	2.36	41
Traffic Zone 89	1.00	0.96	1120	172	0.11	2.36	0
Traffic Zone 90	1.00	0.98	1024	199	0.11	2.34	27
Traffic Zone 91	1.00	0.97	216	95	0.11	2.22	0
Traffic Zone 92	1.00	0.98	1316	223	0.11	2.34	0
Traffic Zone 93	1.00	0.97	880	164	0.11	2.22	0
Traffic Zone 94	1.00	0.97	891	249	0.11	2.22	0
Traffic Zone 95	1.00	0.73	245	48	0.11	2.24	84
Traffic Zone 96	1.00	0.67	992	126	0.11	2.21	168
Traffic Zone 97	1.00	0.97	753	129	0.11	2.03	0
Traffic Zone 98	1.00	0.97	1358	140	0.11	2.03	64
Traffic Zone 99	1.00	0.96	1816	146	0.11	2.03	243
Traffic Zone 100	1.00	0.96	2283	253	0.11	2.36	6
Traffic Zone 101	1.00	0.97	558	126	0.11	2.16	20
Traffic Zone 102	1.00	0.97	1909	284	0.11	2.16	86
Traffic Zone 103	1.00	0.90	945	124	0.11	2.23	0
Traffic Zone 104	1.00	0.96	1392	138	0.11	2.33	0
Traffic Zone 105	1.00	0.96	121	13	0.11	2.33	0
Traffic Zone 106	1.00	0.96	0	0	0.11	2.33	0
Traffic Zone 107	1.00	0.97	1029	172	0.11	2.24	0
Traffic Zone 108	1.00	0.97	343	63	0.11	2.24	0
Traffic Zone 109	1.00	0.97	297	22	0.11	2.24	0
Traffic Zone 110	1.00	0.97	504	97	0.11	2.24	0
Traffic Zone 111	1.00	0.96	164	16	0.11	2.33	0
Traffic Zone 112	1.00	0.97	238	31	0.11	2.16	0
Traffic Zone 113	1.00	0.97	352	106	0.11	2.16	0
Traffic Zone 114	1.00	0.97	1292	198	0.11	2.16	18
Traffic Zone 115	1.00	0.97	359	46	0.11	2.16	0
Traffic Zone 116	1.00	0.98	1966	95	0.11	1.98	142
Traffic Zone 117	1.00	0.96	708	68	0.11	2.33	6212
Traffic Zone 118	1.00	0.95	2	0	0.11	3.9	0
Traffic Zone 119	1.00	0.95	1	0	0.11	3.9	0

Area	Building Occupancy in 2030	Housing Occupancy in 2030	Households in 2000	Work at home 2000	Work at home percentage	Persons per household 2030	Group quarters population
Traffic Zone 120	1.00	0.95	2391	66	0.11	3.9	31
Traffic Zone 121	1.00	0.95	603	11	0.11	3.9	106
Traffic Zone 122	1.00	0.98	837	62	0.11	2.19	0
Traffic Zone 123	1.00	0.98	1262	36	0.11	1.98	0
Traffic Zone 124	1.00	0.97	758	61	0.11	2.16	0
Traffic Zone 125	1.00	0.94	751	88	0.11	2.49	0
Traffic Zone 126	1.00	0.97	99	10	0.11	2.49	5
Traffic Zone 127	1.00	0.97	232	24	0.11	2.49	13
Traffic Zone 128	1.00	0.97	675	57	0.11	2.49	12
Traffic Zone 129	1.00	0.98	994	65	0.11	2.19	9
Traffic Zone 130	1.00	0.97	2163	310	0.11	2.53	0
Traffic Zone 131	1.00	0.97	2337	250	0.11	2.24	428
Traffic Zone 132	1.00	0.96	312	18	0.11	2.08	86
Traffic Zone 133	1.00	0.96	41	2	0.11	2.08	10
Traffic Zone 134	1.00	0.96	321	17	0.11	2.08	100
Traffic Zone 135	1.00	0.96	1637	190	0.11	2.08	59
Traffic Zone 136	1.00	0.98	3620	263	0.11	2.15	63
Traffic Zone 137	1.00	0.96	183	13	0.11	2.08	28
Traffic Zone 138	1.00	0.95	755	109	0.11	2.94	94
Traffic Zone 139	1.00	0.96	298	49	0.11	2.2	0
Traffic Zone 140	1.00	0.96	1182	155	0.11	2.2	178
Traffic Zone 141	1.00	0.96	563	96	0.11	2.2	4
Traffic Zone 142	1.00	0.98	1554	229	0.11	2.53	39
Traffic Zone 143	1.00	0.95	690	110	0.11	2.36	0
Traffic Zone 144	1.00	0.95	595	93	0.11	2.36	18
Traffic Zone 145	1.00	0.95	890	91	0.11	2.25	11
Traffic Zone 146	1.00	0.95	1515	156	0.11	2.25	0
Traffic Zone 147	1.00	0.98	1377	145	0.11	2.23	19
Traffic Zone 148	1.00	0.98	680	117	0.11	2.53	19
Traffic Zone 149	1.00	0.98	522	95	0.11	2.53	6
Traffic Zone 150	1.00	0.96	1480	207	0.11	2.5	139
Traffic Zone 151	1.00	0.73	938	145	0.11	2.24	262
Traffic Zone 152	1.00	0.76	1299	191	0.11	2.44	94
Traffic Zone 153	1.00	0.97	240	25	0.11	2.46	62
Traffic Zone 154	1.00	0.97	1631	234	0.11	2.46	349
Traffic Zone 155	1.00	0.97	219	43	0.11	1.82	109
Traffic Zone 156	1.00	0.99	866	0	0.11	2.18	19
Traffic Zone 157	1.00	0.99	872	123	0.11	2.18	195
Traffic Zone 158	1.00	0.99	1067	92	0.11	2.18	218
Traffic Zone 159	1.00	0.99	33	0	0.11	2.18	0
Traffic Zone 160	1.00	0.97	91	5	0.11	1.82	0
Traffic Zone 161	1.00	0.97	0	0	0.11	1.82	0
Traffic Zone 162	1.00	0.97	537	29	0.11	1.82	111
Traffic Zone 163	1.00	0.98	299	39	0.11	2.47	22
Traffic Zone 164	1.00	0.98	1782	220	0.11	2.47	43
Traffic Zone 165	1.00	0.98	523	70	0.11	2.47	24
Traffic Zone 166	1.00	0.98	0	0	0.11	2.47	0
Traffic Zone 167	1.00	0.97	447	17	0.11	1.82	38

Area	Building Occupancy in 2030	Housing Occupancy in 2030	Households in 2000	Work at home 2000	Work at home percentage	Persons per household 2030	Group quarters population
Traffic Zone 168	1.00	0.97	873	48	0.11	1.82	180
Traffic Zone 169	1.00	0.97	2	0	0.11	1.82	0
Traffic Zone 170	1.00	0.98	339	42	0.11	2.65	13
Traffic Zone 171	1.00	0.98	601	54	0.11	2.65	47
Traffic Zone 172	1.00	0.98	804	140	0.11	2.65	25
Traffic Zone 173	1.00	0.98	641	80	0.11	2.65	24
Traffic Zone 174	1.00	0.97	0	0	0.11	1.82	0
Traffic Zone 175	1.00	0.98	641	81	0.11	2.47	6
Traffic Zone 176	1.00	0.98	879	33	0.11	2.37	64
Traffic Zone 177	1.00	0.98	663	25	0.11	2.37	48
Traffic Zone 178	1.00	0.98	1732	218	0.11	2.47	16
Traffic Zone 179	1.00	0.98	165	17	0.11	2.45	1
Traffic Zone 180	1.00	0.98	522	54	0.11	2.45	4
Traffic Zone 181	1.00	0.98	124	10	0.11	2.47	0
Traffic Zone 182	1.00	0.98	760	68	0.11	2.47	3
Traffic Zone 183	1.00	0.95	255	34	0.11	2.6	0
Traffic Zone 184	1.00	0.96	1640	99	0.11	2.36	17
Traffic Zone 185	1.00	0.96	498	43	0.11	2.58	2
Traffic Zone 186	1.00	0.96	1200	86	0.11	2.58	25
Traffic Zone 187	1.00	0.96	463	28	0.11	2.36	5
Traffic Zone 188	1.00	0.96	287	17	0.11	2.57	11
Traffic Zone 189	1.00	0.96	100	7	0.11	2.61	0
Traffic Zone 190	1.00	0.96	896	67	0.11	2.61	0
Traffic Zone 191	1.00	0.95	726	95	0.11	2.6	0
Traffic Zone 192	1.00	0.96	287	0	0.11	2.57	11
Traffic Zone 193	1.00	0.96	1304	120	0.11	2.57	54
Traffic Zone 194	1.00	0.98	2474	245	0.11	2.42	623
Traffic Zone 195	1.00	0.98	2699	168	0.11	2.84	56
Traffic Zone 196	1.00	0.96	1726	107	0.11	2.57	24
Traffic Zone 197	1.00	0.97	890	86	0.11	2.62	2
Traffic Zone 198	1.00	0.96	0	0	0.11	2.61	0
Traffic Zone 199	1.00	0.96	0	0	0.11	2.61	0
Traffic Zone 200	1.00	0.96	0	0	0.11	2.61	0

APPENDIX 1-F

COMMUNITY FACILITIES ELEMENT TECHNICAL BACKGROUND REPORT, FEBRUARY 7, 2003

MARIN COUNTYWIDE PLAN

Community Facilities Element
Technical Background Report

Provision of Services in Marin County

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EXECUTIVE SUMMARY

The Community Facilities Element is an optional general plan element that was added in 1994. This technical report presents information about provision of four major community services and facilities: police, fire, water and sewer. In addition, other community facilities are described: school facilities, hospital care, solid and hazardous waste disposal, child care, libraries, gas and electric services, jails, and telecommunications.

Two water districts serve the City Centered Corridor: the Marin Municipal Water District (MMWD) and the North Marin Water District (NMWD). MMWD identified a supply deficiency in the early 1990's. It secured sources of supply and a bond measure was passed that could provide funding to accommodate the projected growth within its system. This additional supply is incremental in nature with additional phases developed as needed.

The NMWD estimates that it will need an additional 8.7 million gallons per day of peak month service capacity by the year 2025. A new Master Water Supply Agreement (Amendment 11) has been negotiated with the Sonoma County Water Agency to obtain this capacity. Sufficient water to meet the District's needs already exists in storage reservoirs on the Russian River (Lake Mendocino and Lake Sonoma). The District is working cooperatively with Sonoma County Water Agency and the cities and districts served by the Agency to bring additional aqueduct capacity on-line as soon as possible.

In West Marin, the Bolinas Community Public Utility District (BCPUD) has a moratorium in place because the current water capacity is insufficient to meet existing demand without voluntary rationing by consumers. The District will be constructing improvements to the system in order to alleviate this problem. The other West Marin water service agencies appear to have sufficient water supply to serve existing and projected population, although capacity may be restricted in peak demand periods.

Many of the sewer systems have been upgraded in recent years, though problems persist with infiltration in some of the older systems. Storm water and seawater intrusion often overwhelms the BCPUD's sewage treatment facility during winters of above average rainfall. Similarly, high periods of rainfall can sometimes overload the sewers and pumping facilities of the San Rafael Sanitation District. Other districts have modified their treatment plants to handle additional wet weather flows.

Some sanitary districts will need to undertake major plant expansion projects in order to accommodate development potential. In particular, the Las Gallinas Sanitary District will need to expand in order to serve potential development of the St. Vincent's/Silveira property, while Sanitary District #5 would require major improvements of the small secondary treatment plant near Paradise Cove to handle future development of the Trestle Glen area. Demands placed on the BCPUD's system from the summer tourist population and the waste from resident's septic systems, which are pumped and hauled to the treatment plant for disposal, reduces the plant's available capacity to serve present and future sewer service connections. On the other hand, while the majority of the districts have performed improvements to improve capacity, development potential is limited as many areas are built out.

Fire protection services are generally adequate; however, in some areas the narrow winding roads make access difficult. Fire sprinklers are required in all new construction and substantial remodels uniformly across all fire jurisdictions in Marin. Police protection services are also adequate and can be expanded as the population grows. Several of the fire and police departments have signed on to the Marin Emergency Radio Authority (MERA) which will come online in three phases over the next two years.

School facilities are adequate and have been expanded as the need has arisen. However, child care facilities such as day care have not kept pace with the increase in demand that has occurred since 1990.

Other community services such as the library system, solid and hazardous waste collection, hospital, and communication are adequate and can be expanded as the population grows. This technical report examines the availability of community facilities in Marin County.

I. PURPOSE

Although a community facilities element is not required under State law, a local government may emphasize its interest in the provision of services by adopting a community facilities element. It is particularly important to include this element in the Countywide Plan because the availability of facilities and services may influence future levels and locations of development. This technical report examines current supply and demand and also estimates the future availability of service. The Community Facilities Element is based on the information contained in this technical report.

II. AUTHORITY FOR COMMUNITY FACILITY PLANNING

The authority for including optional elements in a general plan is found in the California Government Code, Section 65303, which states:

> The general plan may include any other elements or address any other subjects which, in the judgment of the legislative body, relate to the physical development of the county or city.

In addition, the California Government Code, Section 65302(a), requires that all public buildings be shown in the general plan. The Code states:

> A land use element which designates the proposed general distribution and general location and extent of the uses of the land for housing, business, industry, open space including agriculture, natural resources, recreation, and enjoyment of scenic beauty, education, public buildings and grounds, solid and liquid waste disposal facilities, and other categories of public and private uses of land.

Although the location of public buildings and grounds is often included in the land use element, Marin County has chosen to include this information as part of the Community Facilities Element.

III. MARIN COUNTY WATER SERVICES

Table 1 summarizes water availability in Marin County.

Table 1. Water Availability

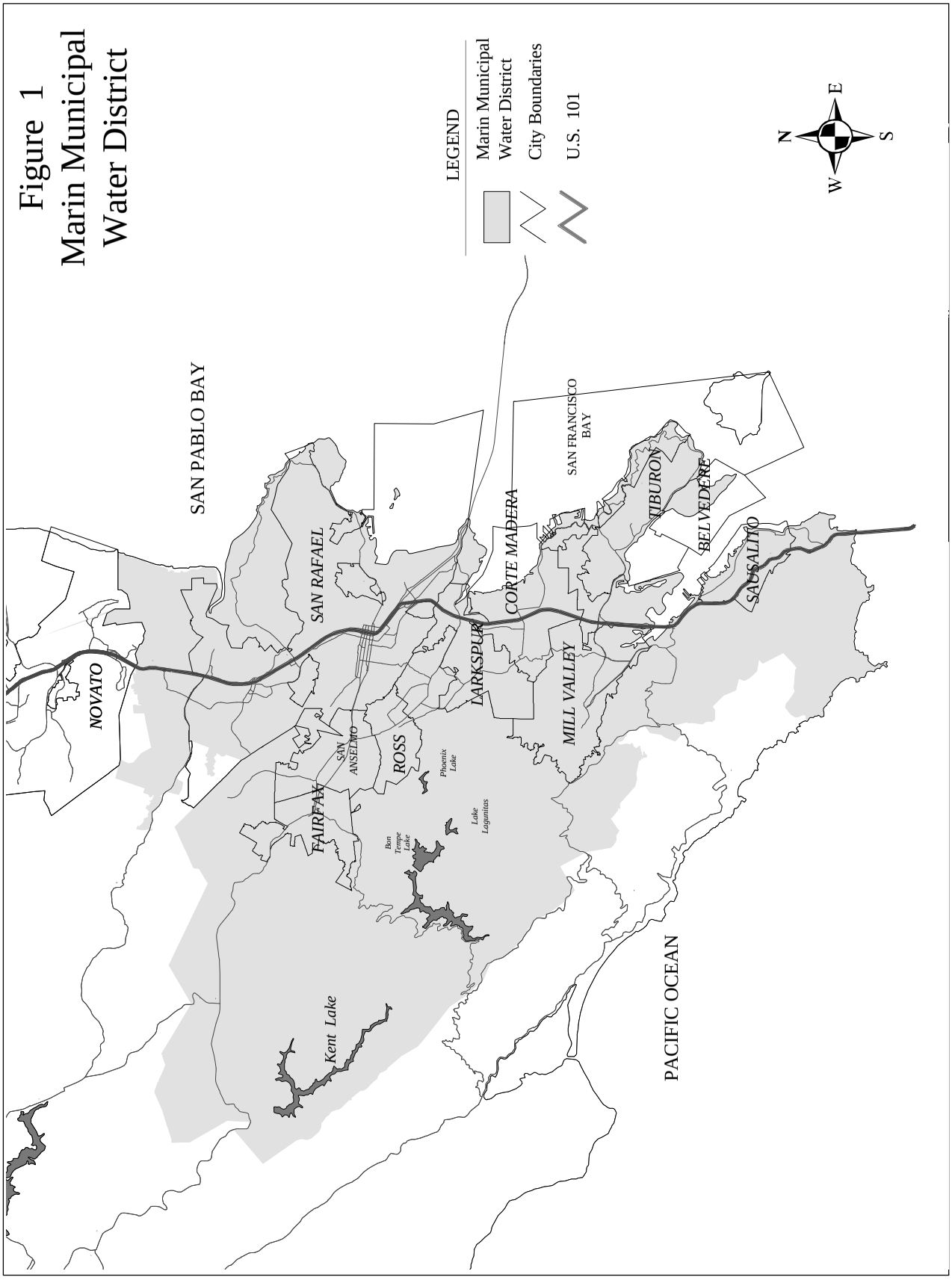
Water District	1987 Supply (Acre-Feet/Year)	1987 Demand (Acre-Feet/Year)	2000 Supply (Acre-Feet/Year)	2000 Demand (Acre-Feet/Year)
Marin Municipal Water District	30,000	33,000	29,300	30,425
North Marin Water District	12,000	9,803	16,100	10,784
Stinson Beach County Water District	323	184	323	185
Bolinas Public Utility District	175	175	150	175
Inverness Public Utility District	392	95	124	95

A. MARIN MUNICIPAL WATER DISTRICT

1. Water Demand

The Marin Municipal Water District (MMWD), in operation since 1912, serves a population that was 185,000 in the year 2000. The District has 59,180 service connections within a 146 square mile area in southern and central Marin County (see Figure 1).

Although annual water production dropped precipitously during the 1976-77 drought when rationing was imposed, it rebounded and then gradually rose to exceed pre-drought levels by 1986. Consumption dropped with the onset of the drought of the late 1980s and early 1990s but slowly rebounded during the 1990s. Water conservation has played a key role in keeping demand below the levels experienced in the early 1970s and the mid 1980s in spite of a continued slow growth in the number of services and population. Table 2 illustrates the annual water production for the MMWD during the 1970s and 1980s.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Water District
LEGEND
Marin Municipal
Water District
City Boundaries
U.S. 101
N
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BAY
PACIFIC OCEAN
NOVATO
SAN RAFAEL
CORTE MADERA
TIBURON
BELVEDERE
SAUSALITO
LARKSPUR
MILL VALLEY
ROSS
SAN
ANSELMO
FAIRFAX
Phoenix
Lake
Lake
Lagunitas
Bon
Tempe
Lake
Kent Lake

Table 2. Marin Municipal Water District:
Annual Water Production

Fiscal Year	Acre-Feet	Fiscal Year	Acre-Feet
1974-75	32,275	1987-88	32,845
1975-76	29,066	1988-89	28,555
1976-77	17,663	1989-90	29,392
1977-78	15,042	1990-91	25,210
1978-79	24,363	1991-92	23,078
1979-80	26,604	1992-93	23,459
1980-81	28,577	1993-94	26,951
1981-82	28,255	1994-95	26,261
1982-83	28,357	1995-96	28,194
1983-84	31,295	1996-97	29,736
1984-85	31,989	1997-98	27,401
1985-86	32,566	1998-99	29,718
1986-87	33,056	1999-00	30,425

The MMWD estimates that the population of 185,000 that it served in the year 2000 will grow to 198,846 by the year 2020 (ABAG Projections 2000). This population has a potential non-conserving annual water demand of 41,400 acre-feet. The District's potable water demand totals in the year 2000 have decreased to approximately 31,000 acre feet, because of the increased use of recycled water. In addition, there has been a reduction in water use of about 25 percent due to combined conservation efforts.

2. Water Supply

The MMWD obtains its water from seven reservoirs on four watersheds and from an intertie line to the Russian River. The storage reservoirs have a combined capacity of 79,885 acre-feet and are replenished with runoff from the watershed lands.

The MMWD uses local surface water for about 75 percent its supply. Its local watershed includes the headwaters of the Lagunitas Creek watershed at Mount Tamalpais as well as the watershed surrounding Nicasio Reservoir. Nicasio Creek eventually joins Lagunitas Creek, which empties into Tomales Bay. Outlying watersheds are also located on Walker Creek in West Marin, which supplies Soulajule Reservoir. Phoenix Lake is supplied by Ross Creek, which drains through Corte Madera Creek and into San Pablo Bay. Some additional facts on the District's reservoirs:

- Lagunitas Lake was built in 1873 and is the district's oldest reservoir. It has a capacity of 390 acre-feet. This is not an active supply and is held in storage for emergency purposes.

- Phoenix Lake was built in 1905 and has a capacity of 527 acre-feet. This is not an active supply and is also used as storage for emergency purposes.
- Alpine Lake was constructed in 1918. The dam has been raised twice since then. It has a capacity of 8,900 acre-feet.
- Bon Tempe Reservoir was constructed in 1948 and has a capacity of 4,300 acre-feet.
- Nicasio Reservoir was constructed in 1960 and has a capacity of 22,000 acre-feet.
- Kent Lake was first constructed in 1953 and enlarged in 1983. It presently has a capacity of 32,900 acre-feet.
- Soulajule Reservoir was finished in 1979 and has a capacity of 10,700 acre-feet.

The MMWD has a total of 79,566 acre-feet of storage, with approximately 70,000 acre-feet accessible for use.

The more recent additions to the MMWD water supply are provided by the Sonoma County Water Agency (SCWA). This source is piped from the deep well pumps located on the Russian River at Wohler and Mirabel. The MMWD / SCWA water supply agreement gives the MMWD 10,000 acre-feet of firm supply in addition to its initial contract of 4,300 acre-feet. In 2000 the MMWD received 7,907 acre-feet from the Russian River intertie.

The MMWD can currently safely supply 29,300 acre-feet annually from its reservoirs and the Russian River intertie. This "operational yield" is the water demand which can be met with a 25 percent overall reduction in use during a period of drought equal to that of the 1970's with 10,000 acre-feet maintained in storage at the end of the drought.

The MMWD secured 10,000 acre-feet of water from the Sonoma County Water Agency (SCWA) in 1992. The MMWD has incrementally increased its annual take from this supply which is delivered on an "as available basis" through a pipeline that is owned by the North Marin Water District (NMWD). During high demand periods this pipeline is not large enough to deliver the necessary amount for both agencies and it is projected that the MMWD must reduce its supply from existing facilities in future years. This amount of reduction is presently calculated to be approximately 1,500 acre-feet per year and is slowly increasing as the NMWD demands increase within its service area.

In 1992 the voters approved Measure V, a bond measure which included funding for a dedicated MMWD pipeline to deliver the supply it had already secured from the SCWA. The pipeline and its associated infrastructure were planned to be constructed in phases, as needed. The MMWD empowered a citizen's advisory committee to study the balance between supply and demand and make a recommendation as to when the pipeline construction phase should be implemented. In 2000 the committee recommended not to proceed with construction of the pipeline, and to instead focus more attention on water conservation as a method to reduce the overdraft of available supply.

In order to supplement the increasing deficit, provide reliability and reduce the dependence on water from outside its service area, the MMWD chose to explore the use of desalinated water produced from the San Francisco Bay by using reverse osmosis technology. It began the environmental review process for the project in July 2003, and should complete the Environmental Impact Report by late 2004. The proposed project would produce up to 15 million gallons per day.

3. Treatment

Before distribution, water is treated in one of the three treatment plants maintained by the MMWD. Water treated at the Bon Tempe Water Treatment Plant is distributed primarily to southern Marin. Water treated at the San Geronimo Water Treatment Plant is consumed in central Marin. Water from the Intertie at Ignacio is adjusted for corrosion control and monitored for quality before being accepted into the northern portion of the service area.

4. Distribution

The MMWD maintains 132 water tanks with a storage capacity of 76,478,000 gallons. In addition, it has five tanks dedicated to recycled water with a storage capacity of 1,675,000 gallons. Because of the County's varied and steep topography, supplying water to the MMWD's customers requires a tremendous amount of pumping. Storage tanks are needed at 200-foot intervals of elevation in order to assure adequate water pressure and fireflow. Developers are required to install all new facilities (pipes, pumps, and tanks) to serve proposed developments or provide in-lieu fees for facility development. A developer proposing to extend service into a new undeveloped area with further development potential is required to size the facilities to accommodate the ultimate development potential of the area. The tanks and main lines are then deeded to the MMWD, which owns and maintains the entire distribution system up to the property line.

The MMWD has no gaps within its service area for those customers who elect to be served. Areas that have no customers generally will have no infrastructure, such as piping, tanks and pumps until it is needed. New services will include the appropriate facilities to provide the water with the new customers bearing the cost.

Since its inception in 1913 the MMWD has absorbed the infrastructure of 27 water entities within its current service area. Some piping from these systems is over 120 years old. Other lines have an above-average maintenance cost because they lie on steep slopes, in bay mud, and in landslide-prone areas. Maintenance and replacement of water lines are ongoing concerns of the MMWD and are financed through the sale of water. Large-scale capital improvements have been funded through bond issues and one-time charges. The total length of piping owned and maintained by the MMWD is about 900 miles. A maintenance/replacement program is ongoing and currently averages $7 million dollars per year for approximately 11 miles of replacement piping and related facilities.

5. Proposed Improvements and Conservation Measures

Table 3 shows the MMWD's long-term water demand projections and known sources of water supply and water saving programs.

Table 3. Marin Municipal Water District:
Water Demand Projections for the Year 2025

Supply	Acre-Feet/Year
Projected Water Demand (year 2020)	41,400
Projected Operational Yield (current facilities)	28,000
Conservation (currently in place)	7,300
Recycled Water (currently in place)	700
Amount Required Through Additional Conservation, Recycling and Supply	5,400

In 1992 and 1994, the MMWD Board of Directors adopted a long-term facilities improvement program to replace outdated facilities, improve operational efficiency of the distribution system, increase the District's water reclamation operations, and increase the reliability of the water supply for existing and future consumers. The components of the program are presented in the District's 15-year capital projects report, in its water supply master plan, and in its integrated water supply program. In addition, the District has implemented a variety of water-conservation and demand reduction measures. These efforts will narrow, but not close, the gap between long-term projected demand and supply.

In response to the 1976-77 drought, the MMWD developed a number of programs to encourage water conservation. These programs include media campaigns, educational materials, and training seminars to inform the public about different ways to reduce water usage, including low-flow plumbing devices, low water-use landscaping materials, and landscape irrigation methods. In addition, the District has implemented ordinances that require water-saving devices to be used in new structures and which also restrict the amount of turf in landscape areas to no more than 25 percent.

The District's efforts in the mid-1980s to achieve a 15 percent reduction in water use through voluntary conservation were not completely successful. A review in 1991 found that an 11 percent overall reduction through conservation had been achieved. The MMWD's data on per capita water consumption shows a 19 percent increase between the periods of 1979/80 and 1986/87. New water hookups, including residential, office, and commercial space, account for roughly half the increase in per capita consumption. An increase in daily water usage by residential customers accounts for the other half.

The decade of the 1990s witnessed the development of greater sophistication in water conservation measures. A water conservation master plan was developed in 1994 and a number of programs were funded. One of the most vigorous programs targeted the replacement of toilets with ultra-low flow models. A total of 42,000 toilets were replaced through the MMWD programs. There are a number of discrete programs currently in place, including:

- Toilet Retrofit Programs. The MMWD is attempting to replace all toilets in its service area with 1.6 gallon water conserving models. This program consisted of two parts. The first was a toilet rebate program that offered residential customers a contribution of $75.00 off the price of a 1.6 gallon flush toilet when purchased to replace a higher water use toilet. The success of this program began to diminish and it was determined that most of the willing participants had been reached. The program was terminated on June 30, 2002. The second part is a commercial and institutional

retrofit program, which offers a complete, no-cost initial replacement of toilets to qualified accounts with reimbursement to the MMWD from savings achieved through the water bill, until the initial cost is recovered.

- On July 1, 2002, the MMWD started its new toilet program, pursuant to Ordinance 394, which requires the installation of low water use plumbing fixtures at the time of real property transfer. The MMWD determined that the time of resale of homes is the most effective point at which to require ultra low flush toilets to be installed without being too intrusive on property owners who did not take advantage of the previous rebate program.
- Recycled Water Program. The MMWD offers recycled water at reduced rates for certain large Tumble-Action Washing Machine Rebates. A $75.00 rebate is available for the purchase of a qualifying tumble action washing machine.

- Conservation Assistance Program (CAP). On-site water use consultations are offered to large single family accounts (generally those using 149,600 gallons or more per year), and multi-family, commercial/institutional, and landscape accounts. A CAP site evaluation identifies ways to reduce water consumption both inside the building and for outside landscaping. Based on the findings, the MMWD may offer financial incentives to help defray the cost of implementing water saving recommendations.

- Water Efficient Landscaper (WEL) Program. This is a half-day course designed specifically for the landscape professional. It covers the MMWD billing policies, troubleshooting and repairing of system components, and the fundamentals of water management, such as proper irrigation scheduling. A listing of landscape professionals who have successfully completed the WEL Program is available from the MMWD.

- Landscape Seminars. A series of free water-efficient gardening seminars is offered to the public. Three topics are currently available: Irrigation System Basics, Understanding Drip Irrigation, and Low-Water Use Plants.

- Water-wise Landscape Contest. This contest, which has several different categories, recognizes customers who use water conserving plants and efficient irrigation methods to create beautiful landscapes.

- School Education Program. Water education materials for grades K – 12 are available at no cost to all teachers in the MMWD service area.

- Speaking Engagements. MMWD employees engage in various speaking opportunities throughout the community on the subject of water conservation.
- Recycled Water Program. The MMWD offers recycled water at reduced rates for certain large Tiered Rate Structure. The MMWD has developed an inclined block structure of pricing for each billing period. Three blocks, or tiers, are in place. Each tier has a different rate structure. The cost rises as water consumption increases.
- Recycled Water Program. The MMWD offers recycled water at reduced rates for certain large landscape accounts or for commercial activities with high water use, such as car washes. This

supply is presently located at the Las Gallinas Sanitation District Plant and is offered in selected areas within the northern San Rafael and Terra Linda area.

- Public Outreach. The MMWD offers a variety of public information activities, including free low-flow showerheads, booths at the Marin County Fair and Home Show, and informational brochures and bill inserts. The MMWD web site also contains information relating to water conservation.

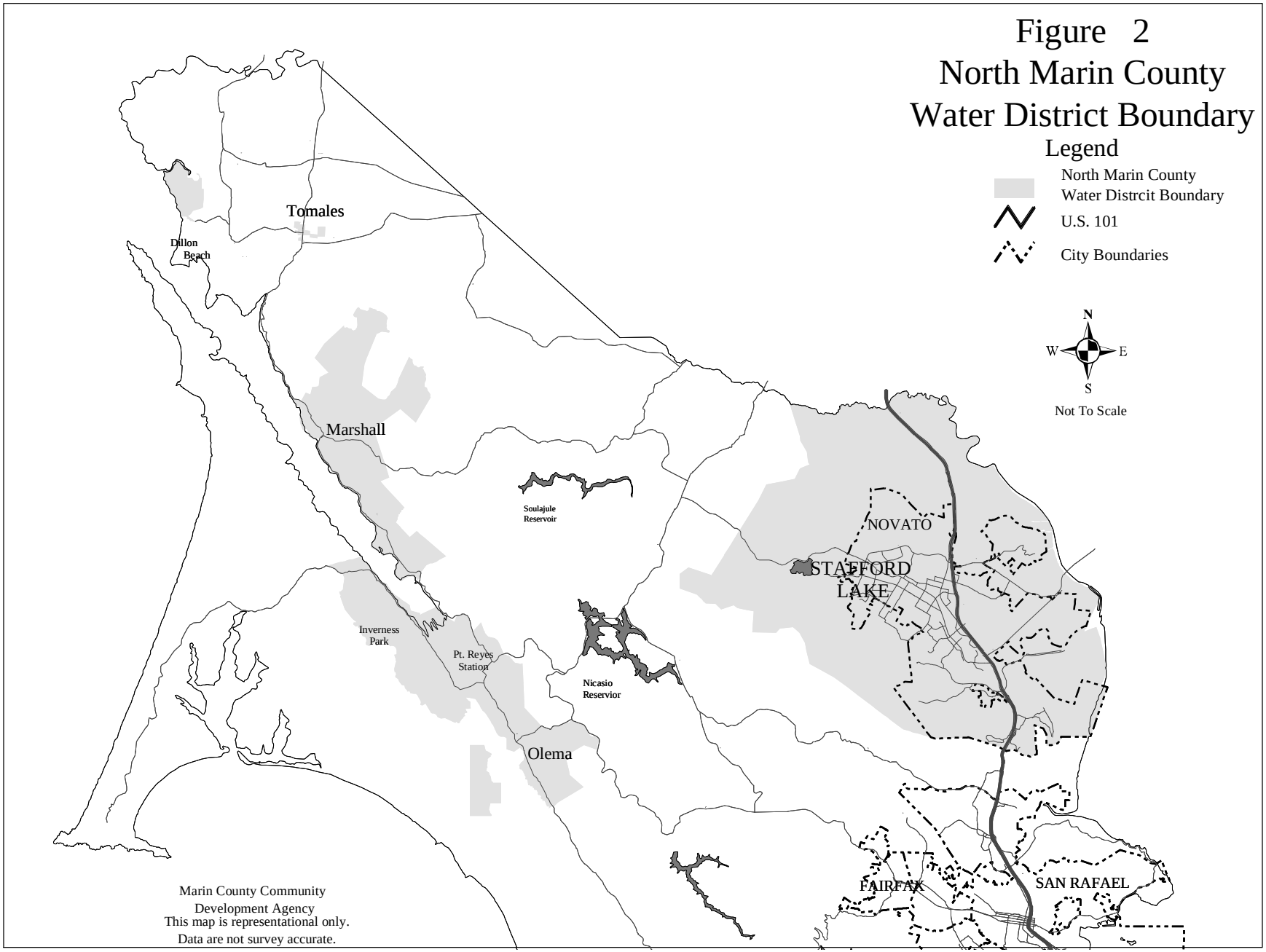
- The MMWD is also a member of the California Urban Water Conservation Council (CUWCC). As a member the MMWD is obligated to carry out 13 of 14 best management practices (BMPs) developed by the CUWCC. Most of the BMP's are reflected in the conservation programs listed above. These BMP's include:
  1. Water survey programs for single-family residential and multi-family residential customers.
  2. Residential plumbing retrofit program.
  3. System water audits, leak detection, and repair.
  4. Metering with commodity rates for all new connections and retrofit of existing connections.
  5. Large landscape conservation programs and incentives.
  6. High-efficiency washing machine rebate programs.
  7. Public information programs.
  8. School education programs.
  9. Conservation programs for commercial, industrial, and institutional accounts.
  10. Wholesale agency assistance programs (which are not applicable to the MMWD).
  11. Conservation pricing.
  12. Hiring of a conservation coordinator (and support staff as needed).
  13. Water waste prohibition.
  14 Residential ultra-low flow toilet replacement programs.

B. NORTH MARIN WATER DISTRICT

1. Water Demand

The North Marin Water District (NMWD) was formed in 1948 to provide water to Novato and surrounding areas. Today the NMWD serves a population of 56,000 in Novato in addition to approximately 1,750 residents in West Marin. The NMWD Novato service area is approximately 75 square miles (see Figure 2) while the West Marin service area is approximately 24 square miles.

Figure 2
North Marin County Water District Boundary



Respective annual water production rates for the NMWD's Novato and West Marin service areas during fiscal year 2001 were 10,969 acre-feet and 372 acre-feet (see Table 4). The two service areas have separate sources of supply and are not interconnected. Annual water production for the NMWD's Novato service area in 1986/87 was 9,803 acre-feet.

Table 4. Water Production for NMWD's Novato Service Area

Fiscal Year	Acre-Feet	Average Day of Peak Month (MGD)*
1980-1981	8,507	12.33
1981-1982	8,183	11.58
1982-1983	8,125	11.06
1983-1984	9,253	12.05
1984-1985	9,436	12.75
1985-1986	9,351	12.70
1986-1987	9,803	12.81
1987-1988	9,892	12.57
1988-1989	9,549	12.44
1989-1990	9,543	13.09
1990-1991	10,069	12.92
1991-1992	9,446	11.50
1992-1993	9,121	12.25
1993-1994	9,831	13.18
1994-1995	9,779	13.59
1995-1996	10,328	13.49
1996-1997	10,639	13.92
1997-1998	9,211	14.08
1998-1999	10,119	13.67
1999-2000	10,784	14.68
2000-2001	10,969	14.55

*MGD = million gallons per day

Water demand in the District has risen steadily by 27 percent since 1980 largely due to growth in the Novato area. The NMWD uses the Marin Countywide Plan and City of Novato General Plan development projections in conjunction with its own data on past trends in usage and types of users to project future levels of water demand. Based upon regression analysis and projection of historical consumption trends from 1981 to the present, the NMWD projects a Novato Service Area annual water demand of 14,155 acre-feet and a peak month demand of 19.05 million gallons per day (MGD) by the year 2025.

2. Water Supply

The NMWD's Novato service area has two sources of water supply: Stafford Lake and Russian River water imported from the Sonoma County Water Agency (SCWA). Water from the SCWA is treated before it is pumped to the NMWD. Water from Stafford Lake is purified at the Stafford Lake

treatment plant located near the lake. Stafford Lake, a reservoir located within the NMWD boundaries, has a storage capacity of 4,400 acre-feet. The lake provides a historical annual yield of 2,000 acre-feet, which is approximately 20 percent of the NMWD's total annual demand. The balance of the NMWD's annual demand is obtained through a master water supply agreement with the SCWA. The safe long-term annual yield of Stafford Lake is 1,750 acre-feet. Water can be produced from the lake throughout most of the year but emphasis is placed on summer time operation in order to optimize the lake's peak month yield

As for the Russian River source, the NMWD is restricted in how much it can take from the SCWA by its peak month entitlement in the Russian River aqueduct system. The 11th Amendment to the master water supply agreement specifies that the District has a peak month entitlement of 19.9 MGD. However, because of delays in improvements needed to meet the SCWA's total water delivery obligations, the SCWA has declared a temporary impairment of its transmission system. The NMWD and other public agencies receiving Russian River water from SCWA have agreed to a memorandum of understanding regarding water transmission system capacity allocation during temporary impairment (impairment MOU) that became effective in March 2001 and expires in September 2005. The impairment MOU allocates summer month water deliveries at specified rates for the next five years through the North Marin aqueduct. Apportionment of these deliveries to the NMWD and the MMWD is governed by an intertie agreement between the two water districts. The 2001 summer month allocation to the North Marin aqueduct is 18.1 MGD, which increases to 20.1 MGD in 2005.

In fiscal year 2001, the NMWD's annual demand was 10,969 acre-feet, resulting in an annual average daily demand of 9.79 MGD and peak month average daily demand of 14.41 MGD. With the local Stafford Lake treatment plant summer month production averaging 3.34 MGD over the past three years, the NMWD expects to meet all water obligations during period of the temporary impairment MOU until 2005.

To meet ultimate buildout demands through the year 2025, the 11th Amendment to the SCWA agreement (executed in January 2001) provides the NMWD with an average day peak month entitlement of 19.9 MGD and an annual allotment of 14,100 acre-feet.

West Marin Service Area

Water for the West Marin communities of Point Reyes Station, Olema, Inverness Park, and Paradise Ranch Estates is supplied through one interconnected supply and distribution system. The NMWD's Point Reyes water system is completely separated from water facilities in the Novato service area.

The NMWD also serves the Point Reyes National Seashore Headquarters at Bear Valley, Silver Hills, the U.S. Coast Guard Housing Facility in Point Reyes Station and two West Marin dairies. The Point Reyes Water System has been undergoing gradual expansion and improvements since the original system, serving Point Reyes Station and Inverness Park, was acquired by the NMWD in 1971.

The source of water for the Point Reyes system is drawn from two wells at a site adjacent to Lagunitas Creek. The two primary wells are located on the U.S. Coast Guard property in Point Reyes Station. Additionally, a back-up water supply well, located at the Gallagher Ranch, has been developed for use during periods of low streamflow when salt water intrusion from tidal inflow can occur in the two

downstream wells. The single well constructed at the Gallagher Ranch site does not have sufficient capacity to meet peak month water demands in the Point Reyes system area and is not yet interconnected to the West Marin distribution system.

Water supply to the wells is drawn from a gravel aquifer adjacent to Lagunitas Creek. The aquifer's water supply is dependent primarily on the amount of water flowing in the creek. Streamflow in the creek is regulated by releases from the MMWD storage reservoirs as required by the State Water Resources Control Board (SWRCB) Order WR 95-17 and greatly exceeds water needs to supply the Point Reyes system. Annual runoff to Tomales Bay from Lagunitas Creek, after upstream water diversions, averages 63,900 acre-feet per year (AFY) while system withdrawals, based on average daily consumption in fiscal year 2001, amounted to 372 AFY, or approximately 0.6 percent of average annual stream flow.

Order WR 95-17 required the NMWD to identify an alternate source of water during low flow months, usually July through October, of dry years. The District utilizes a water exchange program with the MMWD that was established in the 1993 Intertie Agreement to satisfy the requirements of the SWRCB. Under the agreement, stored water can be released by the MMWD into Lagunitas Creek from Kent Lake in exchange for an equal amount of water delivered to the MMWD from the NMWD's Novato water system. The intertie agreement includes this provision because, although the NMWD has adequate water in the Novato service area to handle both systems' needs, it does not have a pipeline to transport the water to West Marin. Therefore, it utilizes the MMWD's storage and transport facilities and receives the necessary water via Lagunitas Creek. The NMWD then repays the MMWD with Novato water derived from the Russian River.

The existing intertie agreement between the two water districts runs through 2014 and provides for a maximum of 250 acre-feet to be exchanged annually. This figure represents approximately 0.6 percent of the MMWD's total water production, which is 26,000 AFY. The NMWD has also entered into an agreement with the Giacomini Ranch in Point Reyes Station and acquired a portion of the property's appropriated water rights license to further satisfy requirements of the SWRCB. The recently acquired senior water right can be relied upon as the West Marin source of water during dry years. The NMWD is currently in the process of perfecting both the place and purpose of use for this water with the SWRCB.

The NMWD's West Marin water supplies are sufficient to meet forecasted buildout demands and the long-term needs of all other communities served by the District.

3. Proposed Improvements

The 11th Amendment to the master water supply agreement negotiated between the NMWD and the SCWA provides the NMWD with an additional daily water delivery entitlement of 8.7 MGD (19.9 – 11.2 = 8.7 MGD.) This entitlement increases the District's total peak month production capacity to 19.9 MGD and annual delivery entitlement to 14,100 acre-feet. Since the NMWD estimates that its service area may ultimately require 15,360 acre feet annually, the NWMD has implemented an aggressive demand management program aimed at reducing demand by ten percent through permanent conservation techniques.

The District's service capability is currently limited by the peak month demand. Presently, the delivery capacity of the SCWA aqueduct transmission system is insufficient to meet the District's projected peak month demands. The District has been working with the Sonoma County Water Agency, cities, and other districts served by the SCWA to make additional improvements to the aqueduct system to meet the SCWA's total current obligation of 92 MGD and ultimate obligation of 149 MGD. These improvements include additional water production facilities and the construction of additional interconnecting aqueducts to make the existing system more efficient and to expand the system to meet future water delivery requirements.

C. STINSON BEACH COUNTY WATER DISTRICT

1. Water Demand

The Stinson Beach County Water District (SBCWD) was formed in 1962. The total area of the District is approximately 12 square miles of which 9.5 square miles is watershed and 2.5 square miles is service area (see Figure 3). The District presently serves water to 708 metered connections including residential, commercial and federal and state park recreational uses. The District's facilities include wells, water collection facilities, water distribution mains, water storage tanks, water booster stations, and a water treatment plant.

Summertime and weekend visitors greatly increase the District's normal water demands. The population of this small community can easily reach 10,000 visitors on any given weekend from July through October. Recreation areas at Stinson Beach include the beach with picnic areas, hiking trails in the Golden Gate National Recreation Area, and the state park hostel cabins located in Steep Ravine.

The District produced 185 acre-feet of water in 2000, which equates to approximately 230 gallons per day per dwelling unit. Production in 1987 was 184 acre feet. Growth potential is limited in Stinson Beach by the publicly owned lands surrounding the community. The District estimates that there may be potential for 60 additional lots to be developed before the town is built out.

2. Water Supply

Water supply sources for the Stinson Beach County Water District include three active wells and several catchment basins located within the watershed. The watershed is located on publicly owned State and Federal government lands. The watershed area produces a water supply estimated at 323 acre-feet, assuming normal rainfall conditions. Based on the SBCWD's water demands, these projections seem adequate, although the water supply can be constrained by drought and peak summertime water demand. The SBCWD treats the water before it is distributed to the community.

The District initiated a capital improvement plan in 1978 and installed a majority of the infrastructure between 1978 and 1984. The SBCWD has recently revised its capital improvement plan and has completed several projects. The completed projects include: a meter replacement program; construction of two new steel water tanks to increase water storage capacity; installation of approximately five miles of new pipeline, which replaced insufficient waterlines including service laterals and hydrants within a majority of the community's streets; rebuilding and revitalizing three existing wells; and rebuilding several water booster stations.

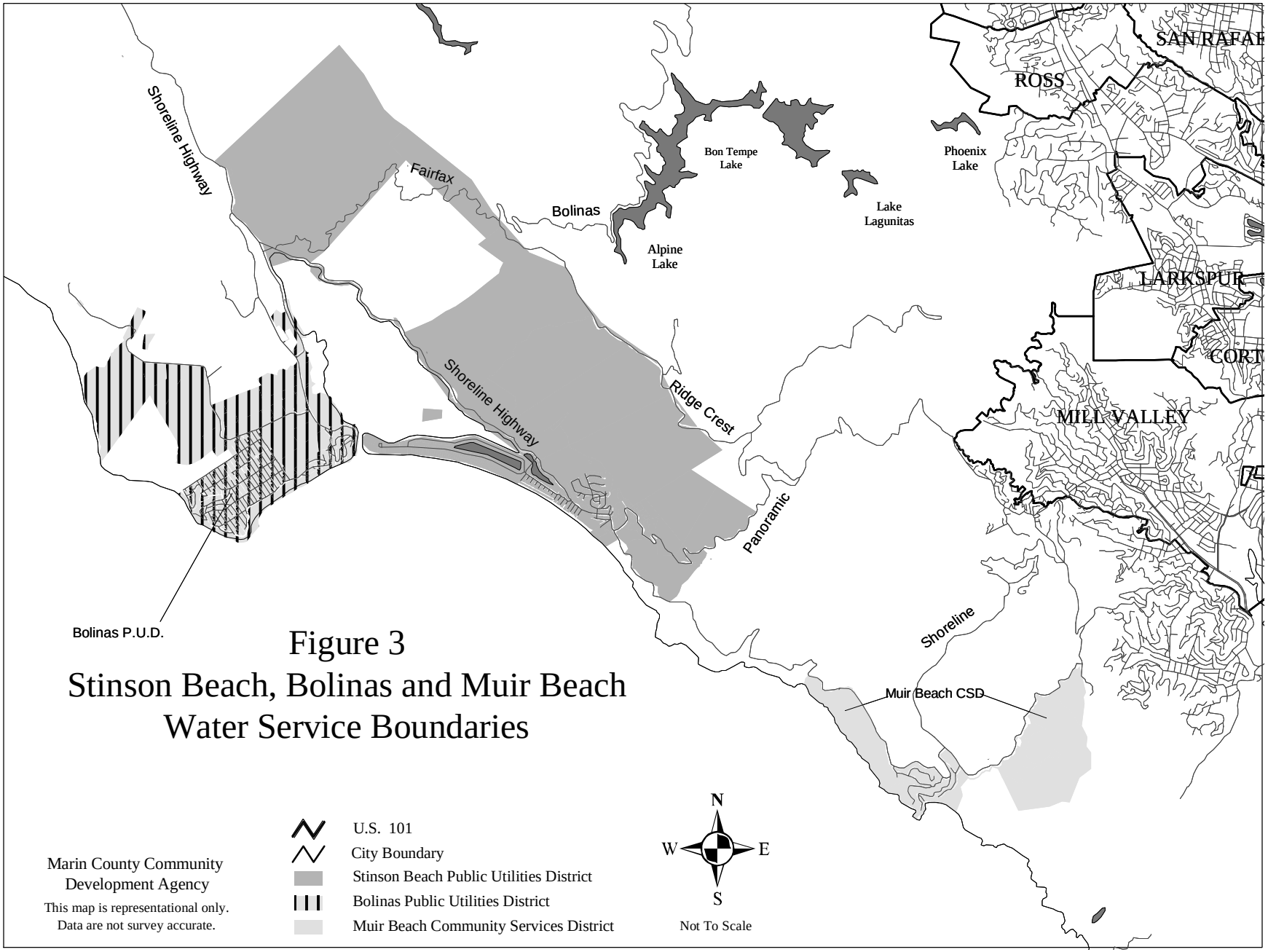


Figure 3
Stinson Beach, Bolinas and Muir Beach
Water Service Boundaries

3. Proposed Improvements

The District proposes to make several improvements to its system facilities. These improvements include: replacing old deteriorated pipelines, installing two new steel raw water tanks, replacing the two existing raw water tanks with four new steel tanks, installing a new booster station, replacing an existing well, and upgrading the water treatment plant. These items are included in the SBCWD's capital improvement plan over the next five years. A habitat/riparian restoration plan and water conservation plan is being prepared to meet the requirements of the federal Endangered Species Act.

D. BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT

1. Water Demand

The Bolinas Community Public Utility District (BCPUD) provides water collection, treatment, and distribution services to 581 connections. Of these 581 connections, three are agricultural, nineteen are commercial, and the remainder are residential. The BCPUD serves approximately 1,500 residents. The District boundaries are shown in Figure 3. In 1987 the BCPUD produced 175 acre-feet of water. Total production in 2000 was 150 acre-feet. Average daily demand on an annual basis is 140,000 to 150,000 gallons per day.

2. Water Supply

The BCPUD has two sources of surface water supply: the Arroyo Hondo stream, which provides 135 acre-feet of water, and two storage reservoirs which have a combined net safe yield of 40 acre-feet. The BCPUD has one water treatment plant, constructed in 1996, that uses advanced microfiltration technology. The BCPUD also has two 430,000-gallon treated water storage tanks; two earthen reservoirs that capture runoff and hold 39 acre feet net safe yield; two catchment dams on the Arroyo Hondo stream, which supplies approximately 90 percent of the BCPUD 's total water supply; one pump station; and twenty miles of pipeline.

For six to seven months of the year sufficient water supplies can be drawn from the stream. During the dry season the storage ponds must augment this source. Maximum water production capacity, when allowances are made for routine downtime, is 190,000 gallons per day.

The age of the District's distribution system ranges from two to 63 years old. The District has replaced a substantial amount of older pipeline, which has reduced the amount of water lost due to leakage from 15 percent to approximately ten percent. In 1989 the cost of replacing the remaining older pipes and increasing pipeline capacity where needed was estimated at $1.5 million. In 1988, the District established a modest reserve fund to continue this important pipeline replacement work. In 1996 the BCPUD spent $1.3 million on a new treatment plant, a new pump station, and new transmission lines. An additional $300,000 was spent between 1998 and 2000 for the rehabilitation of water storage tanks, while $150,000 was spent between 1991 and 2000 for pipeline replacement.

Prior to the construction of the new treatment plant in 1996, increased stream water turbidity caused by heavy winter storms overloaded the capacity of the treatment plant. However, the new treatment plant has resolved this problem.

In 1971, the community of Bolinas enacted a building moratorium because of the lack of adequate water storage capacity. Since that time, the BCPUD has constructed the two water storage facilities. However, the community continues to enforce the "water shortage emergency condition", which forbids new water hookups, because engineering studies indicate that present facilities may not be sufficient for future needs. An engineering study conducted for the BCPUD recommends that 80 to 120 acre-feet of storage capacity be built to accommodate present and future water demands. The BCPUD has maintained a moratorium on new water service connections because of chronic shortages in the dry season, particularly in drought years.

3. Proposed Improvements

The 1985 Bolinas Community Plan includes a policy for providing infrastructure improvements to the community's water and sewer systems. System improvements have included the rehabilitation of the BCPUD's two water storage tanks and replacement of pipeline. The BCPUD is considering a project to install a wind energy conversion system at the water treatment plant. The local electorate must first approve any system expansion plan.

E. INVERNESS PUBLIC UTILITY DISTRICT

1. Water Demand

Table 5. Inverness Public Utility District: Annual Water Production

Fiscal Year	Acre-Feet	Fiscal Year	Acre-Feet
1980-1981	77	1991-1992	89
1981-1982	77	1992-1993	91
1982-1983	86	1993-1994	97
1983-1984	89	1994-1995	86
1984-1985	92	1995-1996	94
1985-1986	87	1996-1997	102
1986-1987	93	1997-1998	85
1987-1988	92	1998-1999	96
1988-1989	90	1999-2000	103
1989-1990	88	2000-2001	101
1990-1991	95	2001-2002	97
		2002-2003	102

The Inverness Public Utility District (IPUD) serves 500 customer connections, or approximately 540 residential unit equivalents (RUEs). A RUE is a measurement that allows commercial and residential users to be grouped together. Of the 500 customer connections, 482 are residential services and 18 are nonresidential. The full time population of the District is estimated to be about 702 people (2000 U.S. Census). Of the 574 housing units in the District, only 367 (64 percent) are occupied on a full-time basis. The remaining 185 housing units (36 percent) in the Inverness area are vacation and weekend houses.

The IPUD collects surface water from District and state-owned watershed lands. The District boundaries are shown in Figure 4. The District's facilities include two active water treatment plants, water catchments, mains, and storage tanks. In 1990, the IPUD replaced a 20,000-gallon storage tank with a 70,000-gallon tank, which increased the total storage capacity to 345,000 gallons. The District estimates that the current supply should be able to meet peak demand under normal conditions since this amount exceeds the highest demand levels recorded since it acquired the water system in 1980.

The IPUD produces an average of 95 acre-feet of water per year. Local users consume approximately 85 acre-feet and ten acre-feet are reserved for system overhead, unmetered use, and losses due to leakage.

Future growth within the District is limited by the Point Reyes National Seashore and Tomales Bay State Park, which surround the community. The IPUD estimates that ultimate development will be 600 RUE's, a 10 percent increase over present service demand.

Figure 4
Inverness
Public Uitility District

2. Water Supply

The IPUD's water supply consists of water obtained from streams in the surrounding watershed. Since there are no reservoirs within the District, there is no water being held in long term storage. The District is dependent for its water supply on the daily flows in the streams in the Inverness watershed area. It is estimated that under normal rainfall conditions, the network of three principal streams annually provides approximately 124 acre-feet of water. However, during late summer and fall (and until winter rains begin), the amount of water available in the streams sometimes gets very close to equaling the system's production demand. The volume of available water can range from more than 2,000,000 gallons per day (in winter during heavy rainfall periods) to 69,000 gallons per day (which occurred during August 1994, following the 1993/94 drought year). For perspective, the water system's all-time peak one-day demand, which occurred in 1996, was 170,000 gallons; during a typical summer peak demand period, production will be in the range of 150,000 to 155,000 gallons per day.

The IPUD believes that adequate water supplies exist for the next fifteen years under normal rainfall conditions. Water supply problems may arise during summer peak use periods and during drought conditions. The District has implemented a peak demand conservation program that reduced the weekly variation in customer demand from 48 percent to 12 percent. The District currently maintains an emergency water agreement with the North Marin Water District.

3. Treatment

The IPUD operates two water treatment plants. The main plant operates continuously year-round, while the small plant is used seasonally on an as-needed basis, which is generally from late spring through fall. Both plants provide micro-filtration and chlorination. The main plant (called F1) was upgraded in early 2002, and is now rated nominally at 100 gallons per minute (GPM) of treatment capacity, while the small plant (called F3) is rated nominally at 15 GPM of treatment capacity. Thus, the entire system has a maximum finished-water capacity of 115 GPM, which is equivalent to 165,600 gallons per day. However, the IPUD's realistic capacity on a sustained basis is only about 155,000 gallons per day (GPD). A new treatment unit, which was acquired in early 2002, is currently being installed, which will add approximately 85,000 GPD.

The only chemical added to the water is chlorine. Both plants are equipped with instrumentation for the continuous monitoring and recording of intake (raw) water turbidity, treated water turbidity, and chlorine residual. If an abnormality is detected, an autodialer begins automatically dialing a preprogrammed list of staff members to notify them of the event. If the abnormality reaches a critical point, the equipment automatically shuts the plant down. The F1 plant is also equipped with a permanently installed 35 kilowatt emergency power generator with an automatic transfer switch and a 500-gallon propane tank, which is sufficient to operate the plant for approximately one week.

4. Distribution

The District is deficient in water storage capacity. Total storage capacity at this time for finished water is only 325,000 gallons, of which 45,250 gallons are valved out as a fire reserve. The water is stored in redwood or steel tanks at four tank sites:

- The Tenney site (at 146 Perth Way, near the F1 treatment plant) has one 60,000-gallon redwood tank erected in 1981 and one 10,000-gallon redwood tank of unknown age. A second 10,000-gallon redwood tank was dismantled in 2001 due to age.
- The Colby site (at 60 Perth Way) has one 100,000-gallon steel tank which was erected in 1960, plus three 10,000-gallon redwood tanks of unknown age. A fourth 10,000-gallon redwood tank was dismantled in 2001 due to age.
- The Seahaven site, at 225 Via de la Vista, has one 70,000-gallon steel tank that was erected in 1990 and one 15,000-gallon redwood tank that was built in 1982.
- The Stockstill site, at 591 Via de la Vista, has two 20,000-gallon redwood tanks that were erected in 1969.

At the time of a 1986 study prepared by Brelje & Race Civil Engineers, the amount of storage available was 295,000 gallons. The study recommended that the District would need to add 197,000 gallons of capacity by the time the number of customers served reached the approximate level it was in 2001.

5. Proposed Improvements

The current capital improvement program includes a major effort over the next few years to replace aging finished-water storage tanks and to increase finished-water storage capacity. The IPUD's top priorities for major capital improvements at this time are to increase the usable existing storage to its rated capacity of 345,000 gallons by replacing the removed tanks and to rehabilitate or replace deteriorating tanks that are still in use.

The IPUD does not anticipate much additional growth as there is no possibility for expanding the District's service boundaries. There is very little buildout potential within the existing service area because there is a limited number of undeveloped lots and those lots tend to have development or land use limitations, such as severe slope issues, septic limitations, and proximity to waterways. In addition, many of the undeveloped lots are in a type of ownership that effectively precludes development, or they do not constitute legal building sites.

F. MUIR BEACH COMMUNITY SERVICES DISTRICT

The Muir Beach Community Services District (MBCSD) serves approximately 150 residences. The District relies on groundwater pumped from wells located in the Frank Valley. Water supply is limited and conservation measures are implemented during severe droughts. The maximum community build out is limited to approximately 165 dwellings (depending on the number of lots privately reserved for view preservation) because the community is surrounded by national and state park lands and agricultural preserves.

G. DILLON BEACH COMMUNITY

The community of Dillon Beach relies on groundwater for drinking water supplies. Water service in Dillon Beach is provided by two privately owned water companies: California Water Service Company and Estero Mutual Water Company, which operate a stream diversion and storage system. Estero Mutual has two wells that together supply approximately 10,000 gallons per day (GPD). In addition, Estero Mutual has the facilities and necessary permits to divert up to 400 GPM from a stream tributary

of Estero de San Antonio. Diverted flows are stored in a small reservoir with a capacity of 16 million gallons, or 49 acre-feet.

The Coast Springs Water Company has 200 service connections and serves up to 240 households in the old part of Dillon Beach. Water demand per unit for average and peak use in 1985 was recorded at 96 GPD and 170 GPD respectively. Coast Springs water supply comes from three sources: (1) a large well located in the channel of Dillon Creek Gulch capable of producing 18,000 GPD, depending on creek flow; (2) six vertical wells; and (3) an infiltration tunnel. These three sources combined are capable of providing a sustained yield of 33 GPM.

IV. MARIN COUNTY WASTEWATER SERVICES

A. SEWERAGE AGENCY OF SOUTHERN MARIN (SASM)

The SASM includes the following agencies (see Figure 5): Richardson Bay Sanitary District, City of Mill Valley, Tamalpais Community Services District, Alto Sanitary District, Almonte Sanitary District, and Homestead Sanitary District. SASM serves approximately 25,000 residents.

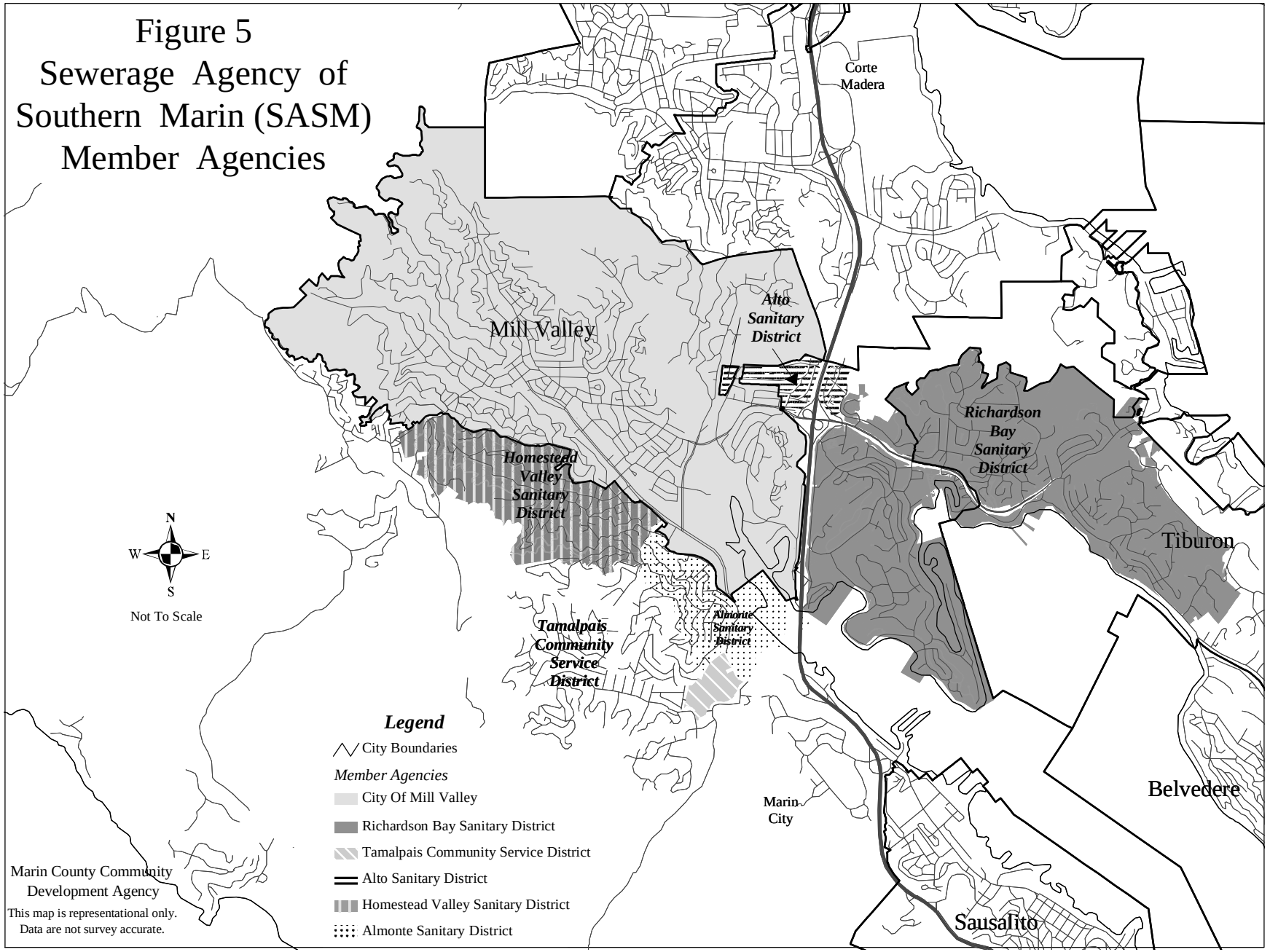
The City of Mill Valley contracts with the SASM to provide operation, maintenance, and management of all SASM facilities. Each SASM member agency is responsible for administering the sewage collection system within its district. Wastewater is then transported to the SASM treatment plant, which is located in Mill Valley. The six member agencies receive a capacity allocation based upon 1980 estimates of service requirements. There are no other inter-jurisdictional contracts.

The purpose of SASM was to facilitate expansion and improvements to the Mill Valley treatment plant. These improvements were completed in 1983. All wastewater from the member agencies is treated at the Mill Valley treatment plant, which is a secondary treatment facility, and discharged via a deep-water outfall into Raccoon Strait. Substantial improvements were also made to each member agency's collection system through a grant obtained by the SASM in 1986.

The SASM plant consists of six pump stations, five miles of gravity sewer mains, and nine miles of force mains. The plant has a dry weather flow processing capacity of 3.6 million gallons per day (MGD). The Average Daily Dry Weather Flow in 2000 (as determined by the lowest three months of the year average per Regional Water Quality Board specifications) was 2.55 MGD, 30 percent below capacity. It is not expected that the plant's capacity will be exceeded in the future. The SASM also operates a dump station at the treatment plant that is designed to receive hauled septic wastes.

The SASM conducted a detailed performance assessment, which resulted in re-rating the plant capacity from 2.90 to 3.60 MGD. In addition, the SASM has performed a number of upgrades to its system over the last ten years. These improvements include: upgrading the capacity of four of its six pump stations, building a small, 180,000 gallon per day reclamation plant; converting the chlorination system from gas to liquid; and adding a small storage building. All other projects categorized as capital projects have actually been large maintenance and repair projects that simply extended the life of existing facilities. The main treatment plant has not been expanded in the last ten years.

Figure 5
Sewerage Agency of Southern Marin (SASM) Member Agencies



In 2001, the SASM assumed ownership of a five-mile trunk sewer system from the SASM member agencies. This system required upgrading to prevent sewer system overflows and back-ups. Much of the work has been completed, however one project remains that is estimated to cost about $750,000.

1. Richardson Bay Sanitary District

The Richardson Bay Sanitary District maintains 40 miles of gravity sewer mains, four miles of force mains, and 24 pump stations. An average of 30,000 gallons per day of secondarily treated wastewater is reclaimed from April until October and is used for irrigation, dust control, and hydro cleaner. The only future development potential within the district boundaries consists of two small parcels where approximately 16 single-family dwellings could be built.

2. City of Mill Valley

The City of Mill Valley provides sewage collection service for the area within the Mill Valley City limits, a region with an area of approximately 4.7 square miles and a population of 14,000. Current facilities consist of 59 miles of collection mains and 4 pump stations. For the last ten years, the City of Mill Valley has spent $450,000 annually on sewer line rehabilitation, which is expected to continue in the future. No other equipment expansions or upgrades are planned.

3. Tamalpais Community Services District

The Tamalpais Community Services District provides an area of 1.7 square miles and a population of 5,851 (as of 2001) with sewage collection, pump house and system maintenance, parks and recreation and garbage and recycling collection. While the TCSD is a member of SASM, only the wastewater collected in the Kay Park area of the District is pumped to the SASM treatment plants. The remaining wastewater collected in the District is treated by the plants in the Sausalito/Marin City Sanitary District under a separate contract.

4. Alto Sanitary District

The Alto Sanitary District provides sewage collection, system maintenance, and administration of garbage and recycling collection contracts. The District serves a land area of 0.2 square miles and a population of 939 (as of 2000). The total operating revenue for the District for fiscal year 2001/02 was $178,800.

5. Almonte Sanitary District

The Almonte Sanitary District provides only wastewater collection in its service area, as well as administration of the garbage and recycling contracts with the Mill Valley Refuse Service. The District services the Almonte area of the city of Mill Valley, a land area of 0.4 square miles and a population of 1,478 (as of 2000). The District does not foresee any problems with growth that would impact its existing capacity in the treatment facility, as the area served is already substantially built out.

Between Corte Madera and Tiburon is the Seafirth treatment plant, a small private plant serving approximately 100 homes (see Figure 8). In the past the plant has had operating problems and residents have requested annexation to either Tiburon or Corte Madera. Neither city agreed to annexation in part due to difficulties in providing sewer service. Sanitary District #2 indicates that it

declined to provide service because sewage from this area would have to be pumped several times over a fairly long distance to join its system. This could create health hazards.

The plant has had a number of process and equipment upgrades over the past ten years. Seafirth Estate Company, which owns the plant, may be interested in connecting to a public treatment facility if the logistics can be successfully worked out to make the connection economically feasible. This will probably require sewering a large portion of the east side of Paradise Drive in Tiburon, where a number of homes are currently on septic systems.

6. Homestead Valley Sanitary District

The Homestead Valley Sanitary District provides sewage collection, system maintenance, and administration of garbage and recycling collection contracts. The District serves a land area of 0.7 square miles and a population of 2,354 (as of 2000). The total operating revenue for the District for fiscal year 2001/02 was $246,700.

B. SANITARY DISTRICT #5 (Tiburon Area)

Sanitary District #5 is responsible for the operation and maintenance of the District's two sewage treatment facilities, its nine pumping stations and its approximately 11 mile collection system (see Figure 6). The service area reaches from the southern end of the Tiburon peninsula northward to Trestle Glen on the east side, and to Gilmartin Drive on the west. The District serves approximately 9,000 people.

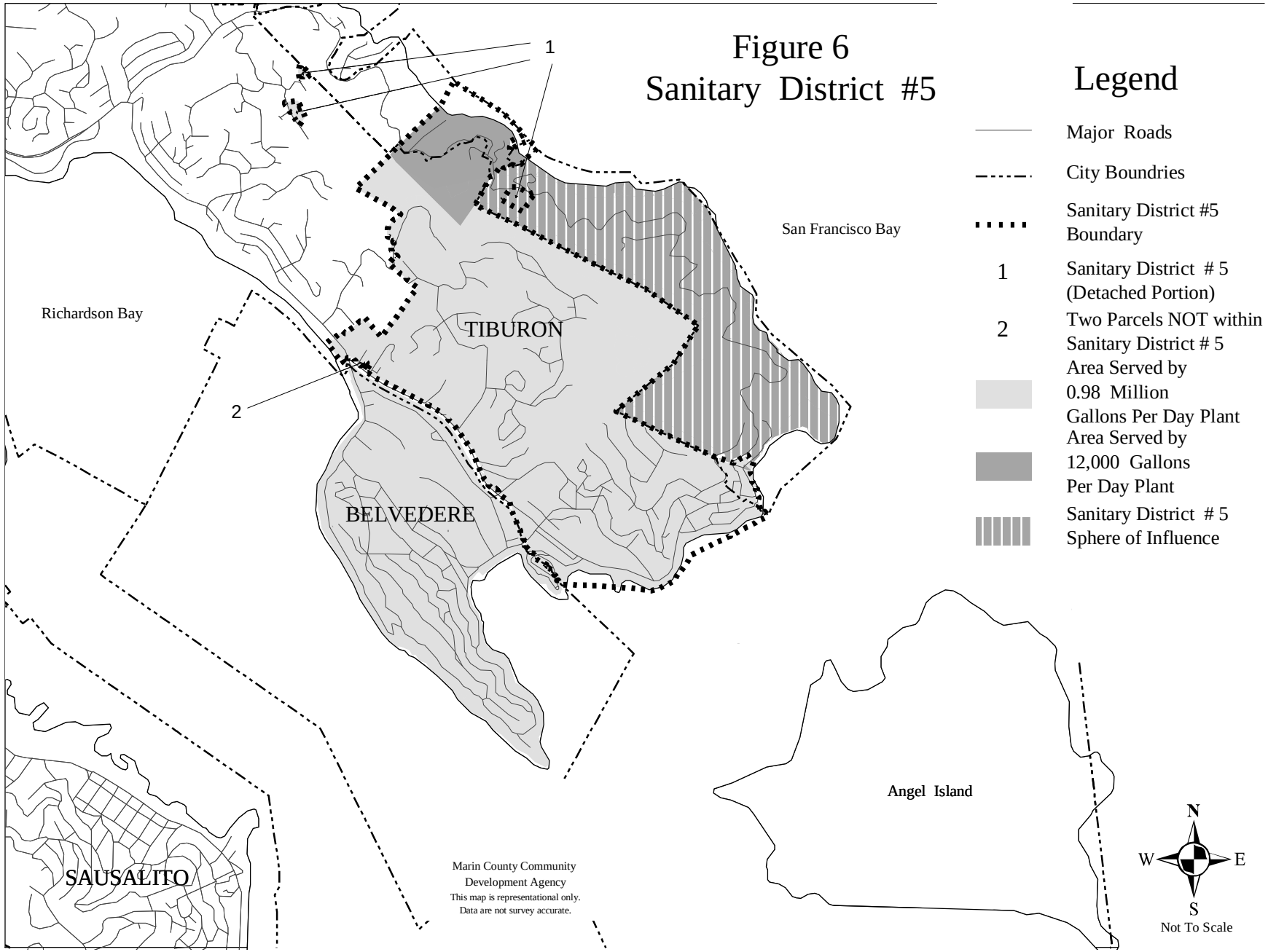
The plant was designed to accommodate a 1991 population projection of 9,787 people. The facility can process an average daily dry weather flow of 0.98 (MGD). In 1987, average dry weather flows from Tiburon, Belvedere, and small pockets of unincorporated areas were 0.75 MGD, or 77 percent of plant capacity.

After treatment the effluent is discharged 400 feet offshore into Raccoon Strait. The same outfall line is also utilized for wastewater treated at the SASM plant in Mill Valley.

The District is on contract with the City of Belvedere to provide water treatment services. Belvedere maintains its own collection system and has an ongoing capital improvement program. Old lines were recently replaced throughout its wastewater system. As a result, there has been a substantial reduction of salt water and storm water infiltration into the system. The hilly terrain makes it necessary to operate a large number of pump stations, which are expensive to maintain. In 1994 Belvedere completed a program to overhaul all 15 pump stations.

The District has two treatment facilities. The main treatment facility, located at 2001 Paradise Drive in Tiburon, has been operating at about 75 percent of its treatment capacity since 1987. The San Francisco Bay Regional Water Quality Control Board issued a new National Pollution Discharge Elimination System (NPDES) permit for the plant in December 2002. The new permit does not include any limitations that would preclude the District from allowing additional connections to its main facility, nor does it require extensive modification to meet the level of treatment standards to achieve compliance.

Figure 6
Sanitary District #5



Legend

- Major Roads
- City Boundries
- Sanitary District #5 Boundary
- 1 — Sanitary District # 5 (Detached Portion)
- 2 — Two Parcels NOT within Sanitary District # 5
- Area Served by 0.98 Million Gallons Per Day Plant
- Area Served by 12,000 Gallons Per Day Plant
- Sanitary District # 5 Sphere of Influence

Sanitary District #5 also operates a small secondary treatment plant that serves a subdivision near Paradise Cove. This plant can process 12,000 gallons per day and could eventually handle future development located between Trestle Glen and Playa Verde; however, the plant has very little additional capacity. There have been past discussions with homeowners on septic systems and other property owners in the area about joining the sewerage system, though no comprehensive measures have been advanced to date. Since major improvements would be required before the treatment plant could handle a significant amount of future development, it is likely that, if there were any significant increase in future treatment load, the plant would be converted to a pump station, which would pump to the main facility.

The NPDES permit for this facility was subject to renewal in April 2002. However, the renewal did not occur due to delays at the Regional Water Quality Control Board. Permit renewal is expected in Fall 2003 or possibly later. Since the facility is more than thirty years old, it can be expected that its age, as well as new compliance-related issues, will require it to be replaced in the near future. The facility has not yet reached capacity but that is still a concern. Some developments in the District are in the process of hooking up to the system and the District is waiting to see how that affects plant capacity.

Sanitary District #5 has an ongoing capital improvement program, which includes plans to overhaul one of the District's nine pump stations each year. Significant improvements were made to the District's sewer lines when the treatment plant was upgraded. As a result, wet weather infiltration averages less than five million gallons per day while the treatment plant is designed to handle wet weather flows up to 6.3 million gallons per day.

During the 1990s, Sanitary District #5 made several facility upgrades. Improvements in 1993 eliminated the need to use gaseous chlorine and sulfur dioxide, while in 1995 the District covered the wet weather clarifier, upgraded the odor control scrubber, and installed a plastic liner in the dry weather clarifier. In 1998, one of the plant's digestive covers was replaced.

Table 6. Sanitary Treatment Plant Design Capacities (Dry Weather)

Agency	Capacity (MGD)	Flows (MGD) (2000)	Capacity Remaining (2001)	Capacity Reached (Year)
Sausalito/Marin City CSD	1.80	1.57	13%	N/A
SASM	3.60	2.55	20%	N/A
Sanitary District #5	0.98	0.75	23%	N/A
CMSA	10.00	8.00	20%	2001
Las Gallinas Valley Sanitary District	2.92	2.33	20%	2020
Novato Sanitary District				2001
Novato Plant	4.60	3.14	32%	N/A
Ignacio Plant	2.10	1.63	22%	N/A
Bolinas PUD.	0.065	0.035	54%	2000

N/A = Exceedence not expected, given current trends and regulations. Future regulation could alter that.
MGD = million gallons per day

C. SAUSALITO/MARIN CITY SANITARY DISTRICT (SMCSD)

Formed in 1950, the SMCSD provides wastewater conveyance and treatment services to the City of Sausalito, Marin City, parts of Tamalpais Valley, Muir Woods, and the Marin Headlands area. Figure 7 shows the District's service area boundaries. The SMCSD maintains the collection system in Marin City, while the City of Sausalito and the Tamalpais Community Services District are responsible for the maintenance of their respective collection systems. In 2000, SMCSD's service population was estimated at approximately 18,000 people.

The SMCSD conveyance facilities consist of six pump stations, 3.1 miles of force mains, and 1.2 miles of trunk sewers. Under a service agreement arrangement, the SMCSD operates and maintains three pump stations that are owned by the City of Sausalito. The SMCSD wastewater treatment plant provides secondary level treatment and has an average day dry weather design flow capacity of 1.8 MGD. The plant has been designed to treat 5.5 MGD of average day wet weather flow. Plant effluent is discharged to the Central San Francisco Bay via a deep-water outfall. Based on 2001 flow data, the plant discharged an average day dry weather flow of 1.57 MGD. The SMCSD maintains approximately six miles of gravity sewer in unincorporated areas, including Marin City.

In 1984, the SMCSD began making substantial improvements to trunk lines in the north end of the District's service area. Since 1990, the SMCSD has replaced 1.2 miles of deteriorated force main piping, completed a major upgrade to its largest pump station, and installed sand filters and a standby emergency generator at the treatment plant. In addition, the SMCSD converted its gaseous chlorine disinfection system to a liquid chlorine disinfection system. In the next ten years, the SMCSD plans to upgrade two additional pump stations, replace two pump stations with gravity sewers, rehabilitate the Marin City collection system, and install a new sludge dewatering facility at the treatment plant. In partnership with the National Park Service, the SMCSD also plans to study the feasibility of supplying recycled water to Fort Baker for irrigation and other purposes. The District's existing conveyance and treatment facilities are sized to handle the projected growth of the District's service population and, therefore, no major capacity improvements are planned over the next ten years. The treatment plant was upgraded from a primary treatment plant to a secondary treatment plant in 1986.

Figure 7
Sausalito - Marin City Sanitation District (SMCSD)

Marin County Community Development Agency

This map is representational only. Data are not survey accurate.

D. CENTRAL MARIN SANITATION AGENCY (CMSA)

The Central Marin Sanitation Agency treats wastewater from the San Rafael and Ross Valley areas. Its member agencies consist of Sanitary District #1 of Marin County (Ross Valley), Sanitary District #2 of Marin County (Corte Madera), the City of Larkspur and the San Rafael Sanitation District, which all serve a population of approximately 100,000 (see Figure 8). Geographically, the 44 square mile service area includes most of the City of San Rafael (excluding Terra Linda and Santa Venetia, which are part of the Las Gallinas Sanitary District), Larkspur, Ross, San Anselmo, Kentfield, Greenbrae, Fairfax, and Corte Madera.

The CMSA was formed under a joint powers agreement in 1979. The purpose of the agency was to oversee the planning, construction, and operation of a new and improved wastewater treatment plant for agencies in central Marin.

The plant, which was completed in 1985, is located on the north side of Point San Quentin along Anderson Drive in San Rafael. The biological treatment units were designed to process up to 30 MGD of wastewater in wet weather, but the official rated capacity during dry weather is ten MGD. Dry weather flow in 2000 was 8.0 MGD, or 80 percent capacity. In 1987, dry weather flows were 7.9 MGD. During large storms, flows in excess of 30 MGD receive pretreatment (grit removal), primary sedimentation and disinfection for flows up to 125 MGD. The CMSA's existing facilities are described in the sections for Sanitary Districts 1 and 2.

The wastewater treatment processes at the CMSA include bar screen, grit removal, primary sedimentation, biofiltration, conventional activated sludge, secondary clarification and disinfection. After disinfection, the flows are discharged through a seven-foot diameter outfall extending over 8,000 feet into the San Francisco Bay. The discharge point is on the western edge of the shipping channel in the Bay. The treatment of solid waste consists of anaerobic digestion, thickening, and de-watering. Methane gas from the digestion process is used to make electricity and to provide heat for space conditioning and processes.

The CMSA contracts with Sanitary District # 2 (Corte Madera) and with the City of Belvedere to maintain the sewage pumping stations in those areas. The CMSA does not manage or monitor individual septic tanks, but the facility does receive waste removed from septic tanks in Marin County by commercial septage haulers, portable toilet waste, and grease from restaurants. The total amount of hauled waste processed at the CMSA plant for the year 2000 was 653,400 gallons.

Improvements over the last ten years have included the conversion of the CMSA disinfection facilities from processes involving liquefied gases (chlorine and sulfur dioxide) to using chemicals that are in solution form (sodium hypochlorite and sodium bisulfite). The CMSA has also switched from relying on chlorine compounds for disinfection to using a non-hazardous chemical injected at upstream pump stations (calcium nitrate) and to using a polishing chemical near the treatment facility (hydrogen peroxide). Other improvements have included upgrading the cogeneration facility to comply with new air discharge requirements by the Bay Area Air Quality Management District, replacing the facility monitoring and automation system, and modernizing the biosolids thickening processes.

Figure 8
Central Marin Sanitation Agency (CMSA) Member Agencies

Actual treatment capacity of the CMSA facility is expected to exceed the rated capacity of ten MGD only if there is a sudden increase in population. Daily flow has been fairly consistent for nearly the past two decades. There are currently no plans to increase the treatment capacity of the CMSA facility.

The Agency is addressing the management of marine outfall and the control of odors from the treatment plant. The outfall is sized for maximum flows of 120 MGD. Residual particles from the activated sludge process accumulate in the pipeline and tend to settle out. Over time, the settled solids reduce the hydraulic capacity of the outfall and must be removed. The CMSA is evaluating ways to keep residual particles suspended in order to reduce the frequency of removal. The agency is also working on improving the control of odors from the facility's sewage treatment processes.

1. Sanitary District # 1 (Ross Valley)

Sanitary District #1 currently serves the area from Larkspur Landing in Larkspur westward to White's Hill in Fairfax, and from Bret Harte Heights in the north to the Corte Madera town limits in the south. The area includes Fairfax, Oak Manor, San Anselmo, Sleepy Hollow, Ross, Kentfield, Greenbrae, Larkspur, and Murray Park.

The District's facilities consist of six major pump stations (including the pump station at San Quentin Prison), six minor pump stations, and eight lift stations. The District also maintains approximately 185 miles of gravity sewers and five miles of force mains. The District currently pumps its wastewater for treatment to the Central Marin Sanitation Agency (CMSA). It is estimated that Sanitary District #1 serves a population of approximately 60,000.

The District has an ongoing capital improvement program for the replacement of inadequate and aging sewer lines and pump stations. Over the past ten years the District has replaced approximately ten miles of gravity sewer lines and has modernized three minor pump stations and one lift station. The capital improvement program also included an evaluation of the need to increase the size of lines and pumping capacities to accommodate current and future needs of strategic areas. The District's budget for capital improvements is approximately $1 million per year.

The District has no gaps or deficiencies within its service area. There are, however, some areas within the District that are still served by septic tank. As these septic tanks begin to fail and renewal is not an option, it is the property owner's responsibility to provide sewer service to the property when connection to a sewer line is physically feasible. In some cases where several lots are involved, the District may consider an assessment district, which requires the consent of a majority of the property owners. All septic tanks within the District's service area fall under the jurisdiction of the Marin County Environmental Health Services (EHS). When an existing septic tank is abandoned and a new sewer system connection is made, connections must meet current EHS regulatory requirements.

Over the years, Sanitary District #1 has developed guidelines for the installation of both private and public sewer systems. Other sanitary districts within the county have adopted the District's "Standard Specifications and Drawings – 1996," which covers all aspects of sewer construction and installation, entirely or in part.

2. San Rafael Sanitation District (SRSD)

The San Rafael Sanitation District (SRSD) owns and operates 126 miles of gravity sewers, 12 miles of pressure force mains and 32 pump stations of various sizes. Sewage collected by the SRSD is pumped to the Central Marin Sanitation Agency for treatment and disposal. The SRSD serves a population of 30,678, and used approximately 4.8 of the 10 MGD processing capacity of the CMSA in 2000, up from 4.6 MGD in 1999. Average dry weather flows for 2002 was 3.7 MGD, down from 4.15 MGD in 2001.

The original sewers in San Rafael were installed in the late 1800s. About two-thirds of the sewers now in use were installed prior to the 1960s before watertight pipeline materials became available. The older sewers tend to have leaks and allow entrance of groundwater and surface water into the sanitary sewer system. This water, termed infiltration/inflow (I/I), can overload the sewers and pumping facilities during periods of high rainfall. There are also almost ten miles of corrugated metal pipe sewers, which are known to be severely deteriorated and can fail, becoming blocked or causing sinkholes in streets.

In the late 1960s and 1970s, new large trunk sewers were installed in certain areas of town, together with the North Francisco Pump Station and force main, in order to eliminate raw sewage overflows during wet weather. Although the basic cause of the high I/I in the sewer system is leaking sewers and laterals, the District, rather than replacing the old sewer lines, has devoted much of its resources to upgrading the capacities in the transport system to compensate for the higher discharge elevation at the CMSA treatment plant and to prevent overflows.

The SRSD improvement program has been guided by the 1986 Long-Range Plan for Wastewater Treatment System Improvements, which was updated by the 1997 Capital Improvement and Replacement Program. Both of these plans placed a high priority on improvements of the pump station and transport system. In April 2000, the District adopted an updated capital improvement program (CIP) that addresses the necessary improvements to both the gravity sewer and force main systems for the next ten years. Some of the improvements outlined in the CIP include: transport system improvements consisting of upgrading nine of the District's pump stations and replacement of some force mains; collection system improvements, primarily replacing deteriorating corrugated metal pipe in the Canal area and other low-lying areas; miscellaneous smaller sewer rehabilitation and repair projects throughout the District; interim improvements which are necessary to keep pump stations operating until they can be upgraded as a part of the program; and emergency repairs which are necessary to fix collapsing sewers or other problems that occur before the facilities can be scheduled for rehabilitation. These improvements are estimated to cost $15.9 million.

There are no planned improvements to facilitate additional growth because the area served by the District is substantially built out, with the exception of small pockets of potential development and the isolated construction of single-family housing.

3. Sanitary District #2 (Corte Madera and Tiburon)

Sanitary District #2 serves an area of approximately 4.5 square miles, including most of Corte Madera and a small portion of Tiburon. The population of this area is approximately 9,100 people. The Sanitary District operates a sewer collection system with an average flow of 1.4 MGD, which feeds into the CMSA treatment plant. The District has 17 pump stations and 39 miles of gravity collection mains

and force mains. The District's sewer permit process does not allow for the construction of any new septic tank systems.

Sewer mains continue to be upgraded. Within the last ten years, a force main was installed from the Paradise Drive pump station to the City of Larkspur. The District is in the process of refurbishing the Lucky Drive pump station and has plans to upgrade additional pump stations in the near future.

The District utilizes its own Standard Specifications and Drawings, dated April 1996, which may be used in the Countywide Plan and Environmental Impact Report for measuring impacts.

The District raised user fees in the late 1980s in order to replace its line under Corte Madera Creek, upgrade three pump stations, and replace a section of a force main.

4. Larkspur Department of Public Works (LDPW)

The Larkspur Department of Public Works used to manage sewage collection within the City for the area south of Corte Madera Creek. Sewage collection and maintenance responsibilities were transferred to Sanitary District #1 in July 1993.

E. LAS GALLINAS VALLEY SANITATION DISTRICT (LGVSD)

The LGVSD's current service area is approximately seventeen square miles and includes the tributary areas to Miller Creek and Gallinas Creek, with the Miller Creek tributary going to the southern portion of Lucas Valley. Approximately 30,000 residents are served by the LGVSD. Its average dry weather flow capacity is 2.92 MGD. Current dry weather flow is approximately 2.33 MGD. The District has seen a reduction in dry weather flow, due to its success in reducing inflow/infiltration into the sewer system. The District currently has 23 pump stations, which it maintains, as well as 100 miles of gravity collection mains and 30 miles of force mains.

After the final step of treatment, wastewater is discharged to San Pablo Bay in wintertime or reclaimed in the District during the summer. The reclamation use of treated wastewater is provided by the LGVSD in cooperation with the MMWD in four ways: pasture irrigation, filling of storage ponds, storage pond evaporation, and a cooperative effort between the LGVSD and the MMWD in treating the secondarily treated wastewater through the tertiary treatment stage and sending it back to customers within the District as landscape irrigation water.

Since 1989 the LGVSD has had an agreement with the MMWD to provide a joint agency effort to treat the District's secondary treated wastewater through the tertiary phase and then extend a distribution system throughout the District to make the treated wastewater available for landscape irrigation and for other purposes. A good illustration is the use of the District's treated wastewater at the Marin County Civic Center. The Civic Center is using treated wastewater for landscape irrigation as well as for toilet flushing in the jail facility.

The District has completed a new laboratory for the purpose of improving sampling and testing abilities and has built a classroom where, during the months of May and June, approximately 1,000 students within the District will be educated about wastewater treatment and how treated wastewater is utilized.

Figure 9
Las Gallinas Valley Sanitarv District

In the past ten years, the LGVSD has completed substantial rehabilitation improvements to the collection system amounting to approximately $4 million. These improvements have occurred principally in the Santa Venetia area to make the collection system more resistant to inflow/infiltration. Also, the LGVSD has completed various improvements within its 23 pump stations to improve their reliability and to provide both backup power at the pump stations and a more reliable pump station alarm system. The last major improvement made to the LGVSD plant and reclamation system was the 1985 purchase and development of 383 acres of land. From this purchase, 40 acres of land were developed as storage ponds, 220 acres were converted to pasture and irrigation uses, 20 acres were set aside as a marsh habitat pond, while ten acres were reserved for a saltwater marsh area.

The LGVSD has an NPDES permit from the San Francisco Water Quality Control Board, which was issued in October 1998, and which will be subject to renewal in October, 2003. By that time, the District must implement further treatment to reduce metal concentrations in its effluent. The District has satisfactory financial reserves to provide the financing for this further treatment to reduce metal concentrations as required by the Regional Water Quality Control Board.

The District is approximately 70 percent built out, with its future growth principally consisting of the Silveira and St. Vincent's properties. In order to meet proposed growth, the District will have to provide some additional plant improvements to accommodate the additional flow and work with the Marin Municipal Water District (MMWD) to expand the recycled-reuse system to allow the LGVSD to remain in reclamation mode for six months of the year. With the anticipation of future connection fee revenue, the District will have sufficient financial revenue to provide for the financing of these improvements.

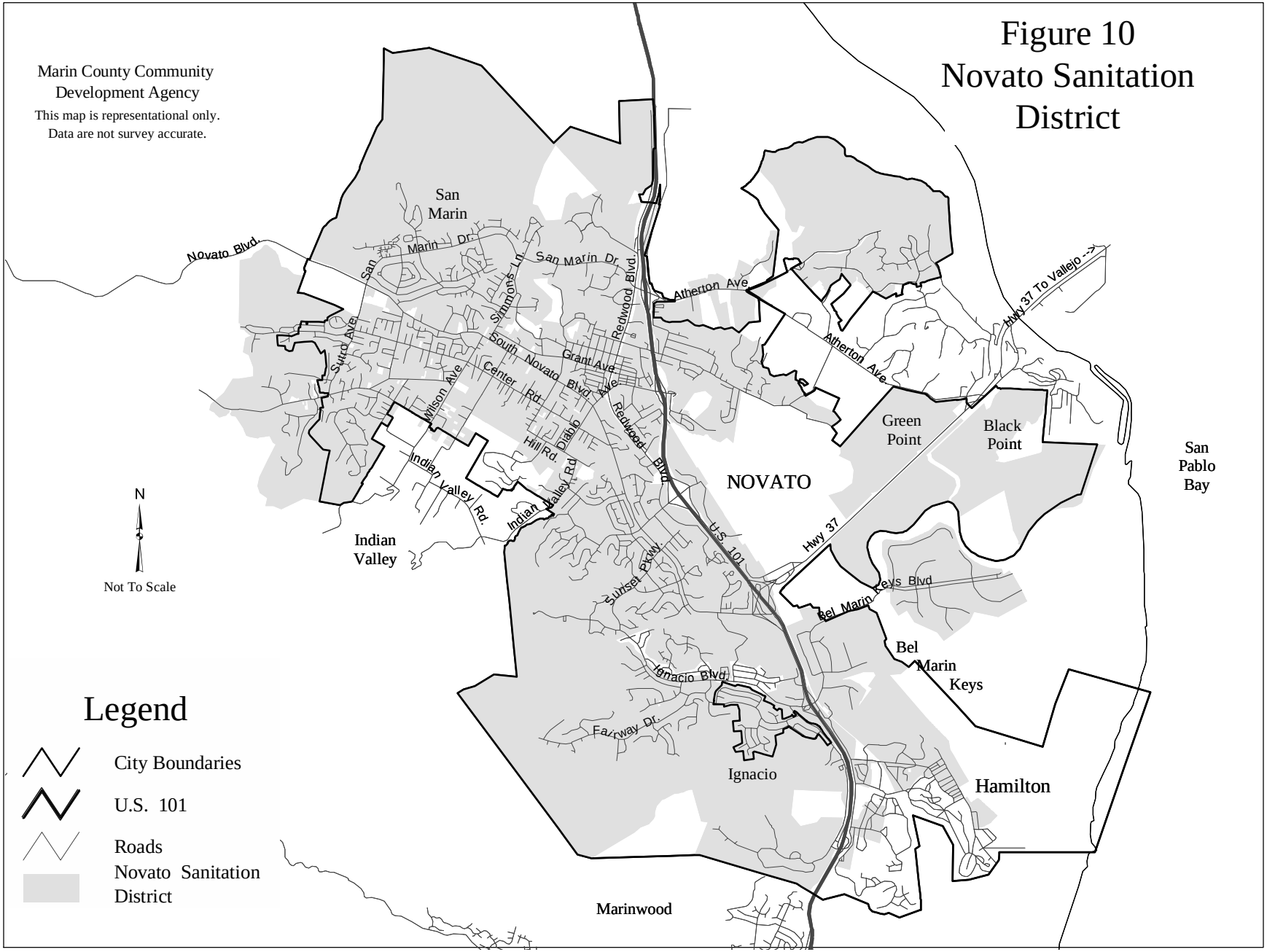
F. NOVATO SANITARY DISTRICT (NSD)

The NSD operates two treatment plants which are located in Novato and Ignacio (see Figure 10). The District serves approximately 18,500 households. The Novato plant was upgraded in 1984 and provides tertiary treatment, which includes nitrification and filtration. This plant has a maximum dry weather flow capacity of 4.6 MGD and, as of the year 2001, has demonstrated sufficient capacity to meet buildout as projected by the Novato General Plan. In 1986 the District completed major capital improvements to the Ignacio plant, which were part of a program initiated in 1970. This plant has a 2.1 MGD dry weather flow capacity (see Table 5).

Both plants discharge treated wastewater into the near shore waters 1,100 feet beyond Hamilton Air Force Base during wet weather months. During dry weather, the treated wastewater is used to irrigate 1,000 acres of District-owned or leased pasturelands. The irrigation program, which has been operating since 1986, provides environmental benefits and has proven to be a financial success for the District.

Both District sewage treatment plants are expected to handle future population growth projections, as growth has been less than expected. The Ignacio plant serves the redevelopment at the Hamilton Air Force Base. Because this development is primarily the re-use of existing facilities, it has not had a

Figure 10
Novato Sanitation District



significant impact on treatment capacity. In the future, increased load at the Ignacio plant may be transferred to the Novato plant, though no plans currently exist to do so.

G. BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT (BCPUD)

The Bolinas Community Public Utility District (BCPUD) provides sewage collection, treatment, and plant and system maintenance to Wharf Road, Brighton Avenue, Olema-Bolinas Road from the intersection of Wharf/Brighton north to include 16 Olema-Bolinas Road but no further, the Little Mesa, Park Avenue and Terrace Avenue west to Canyon Road. All other developed properties within the district are served by on-site wastewater disposal systems. The Marin County Environmental Health Services (EHS) has jurisdiction over those systems.

The BCPUD sewage system serves 163 connections with a District population of approximately 480 people. The District's collection system consists of a pump station, 2.1 miles of gravity collection mains, and a force main that transports an average of 0.035 MGD of dry weather flow, up from an average of 0.03 MGD in 1991.

The treatment plant, built in 1975, was designed to treat 0.065 MGD, which was the expected flow predicted for the year 2000. The District uses the reclaimed water to irrigate 45 acres of land surrounding the primary pond system between the months of May and October. There is no outfall of treated wastewater. The District is currently operating at capacity in non-dry weather months.

In June 1990, the BCPUD completed a collection system replacement project with the support of the Environmental Protection Agency and a grant from the California State Water Resources Control Board. Ninety percent of the collection mains were sliplined to reduce storm water and seawater intrusion, at a cost of $1.2 million. At the time, infiltration rates were reduced by approximately 75 percent. However, unwanted infiltration/inflow often overwhelm the facility during winters of above-average rainfall. It is sometimes necessary to seek special permission from the Regional Water Quality Control Board to spray during the late winter to avoid flooding the ponds. There is a moratorium on new connections to the system until the capacity issue is addressed.

One concern of the District has been pollution of groundwater caused by chloride migration (seawater) from the sewage treatment plant ponds. A study commissioned prior to the collection system upgrade showed that chloride was migrating toward wells used for drinking water. The study estimated that in 12 to 45 years, a chloride removal program would need to be implemented at the treatment plant. However, the BCPUD thinks that the chloride migration problem has been mitigated by the system improvements. Specifically, the project cleared up leaks in the lagoon where seawater was being taken in at high tide.

One-third of the community is linked to the sewerage system. The remaining units use septic systems. Septic tanks in the District are periodically pumped and the effluent is hauled to the treatment plant. The District accepts up to three 1,200-gallon loads per day from District residents only. The pumped solids are disposed of in the settling ponds. The concentrated state of this septic tank effluent periodically puts the ponds at their organic limit for safe treatment of the District's present level of wastewater. As a result, the District may reduce the three-loads-per-day limit.

Figure 11
Bolinas Community Public Utilities District

Marin County Community
Development Agency

This map is representational only.
Data are not survey accurate.

Approximately 68 to 75 new dwelling units could be built in Bolinas under the 1985 Bolinas Community Plan. However, due to insufficient water capacity, a moratorium on the issuance of new water services has been in effect since 1971. There also may not be adequate capacity for the additional development because of the level of demand created by the summer tourist population and the ongoing septic tank hauling. Meeting these demands reduces the capacity available to serve present and future sewer service connections.

H. DILLON BEACH

The North Marin Water District provides sewer service within the Oceana Marin Subdivision in the Dillon Beach community. The gravity system flows to a lift station that is located west of Oceana Drive, which has a pumping capacity of 100 gpm (144,000 gpd). Flows from the sewerage lift station are discharged into two three million gallon storage and treatment ponds located on the ridge top near the subdivision. Treated effluent is discharged to an 11-acre subsurface disposal field. The existing system serves 199 residential connections, including 9 lots located in the "old" Dillon Beach Village. The total number of lots that may connect to the Oceana Marin sewer system is estimated at 331, an increase of 132 over existing services. Sewer service for the remainder of the community is provided by individual septic systems.

I. TOMALES

The community of Tomales opened a sewage collection and service system in 1977. The system is designed to handle waste from the existing residences and commercial establishments, the school facilities, and approximately 50 new residential units. Any development beyond that would require the expansion of the treatment plant facilities.

J. REMAINDER OF WEST MARIN

The remainder of West Marin is on septic systems. Stinson Beach has an innovative septic system management program to ensure proper maintenance of septic systems.

V. FIRE PROTECTION

Fire protection is provided by 16 fire protection districts, including the Marin County Fire Department. The County provides fire protection to areas outside of District boundaries. Most of the fire protection districts have mutual aid agreements.

Fire district regulations are uniformly applied to new development located in County unincorporated areas. Ministerial applications (e.g. building permits) are required to meet only the standards of the County Fire Code. The Marin County Fire Department now requires residential sprinklers in all new construction. In the case of discretionary permits (e.g. subdivisions, design review, etc.), County Planning staff reviews applications and may recommend that more restrictive regulations be required as conditions of permit approval. The Marin County Fire Department estimates that approximately half of all development applications are discretionary in nature.

A. NOVATO PLANNING AREA

1. Existing Level of Service

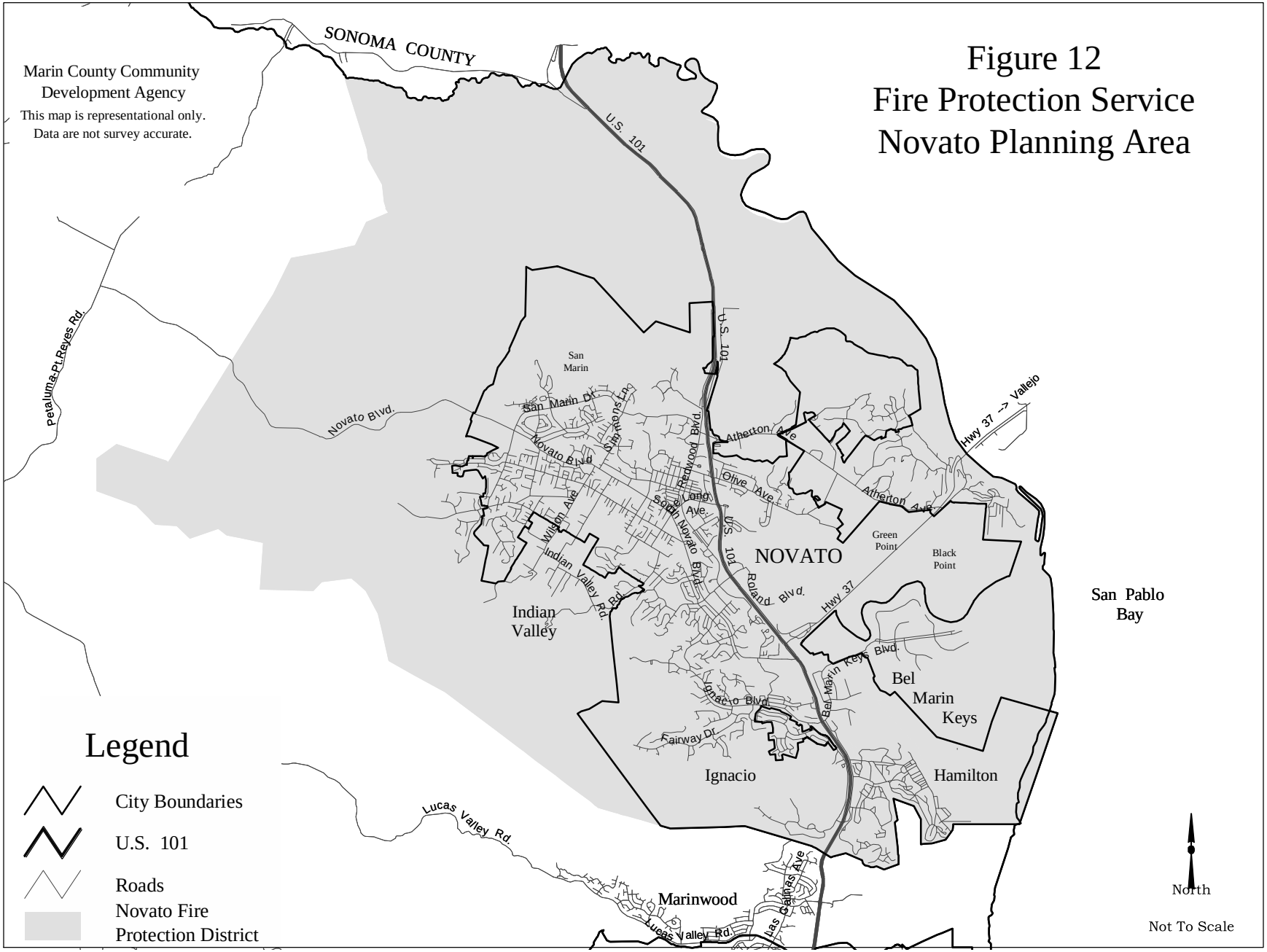
The Novato Fire Protection District (NFPD) provides fire protection and emergency medical services to the entire Novato planning area which includes the City of Novato as well as surrounding, developed unincorporated areas (see Figure 12). The area is approximately 71 square miles. The District was established in 1926 and currently has four fire stations, which include a training facility and mechanics shop.

The District has 96 full-time personnel and approximately ten volunteers. The staff includes 6 firefighters, 32 firefighter / paramedics, 21 engineers, 18 captains, one inspector, one deputy fire marshal, one public educator, five battalion chiefs, two division chiefs, one deputy chief, one chief, one administrative services manager, one accountant / budget analyst, four clerks, and one mechanic. All firefighters, engineers, and captains are certified as emergency medical technician defibrillators. Twenty personnel, including a battalion chief, staff the stations 24 hours a day, making four type 1 engines, one aerial ladder truck, and two paramedic ambulances available.

The District cross-staffs a variety of apparatus based on need. The apparatus inventory includes seven type 1 structure engines, three type 3 brush engines, four paramedic ambulances, one basic life support ambulance, one water tender, one heavy rescue vehicle, one rescue boat, and 16 staff vehicles. All of the older equipment in the NPFD has been recently replaced per the District's Business Plan, which was adopted in 2003.

The District participates in the Marin County Mutual Aid plan and has automatic aid agreements with the San Antonio Volunteer Fire Company and Lakeville volunteers, as well as mutual aid from Petaluma and the California Department of Forestry and Fire Protection.

Figure 12
Fire Protection Service
Novato Planning Area



The District receives 85.7 percent of its funding from property taxes. The remainder comes from fees and a special tax that is charged based on square footage. The impact of the Educational Revenue Augmentation Fund (ERAF) has been significant since the District has been required to return approximately $15 million to the State of California over the last ten years.

The District can respond to 71% of all calls in five minutes or less. To improve service, the District requires that all new development have a fuels management plan, and all commercial development over 2,500 square feet have automatic sprinkler systems. Approximately 1,500 homes within the District had automatic sprinklers in 1987.

2. Future Service Capability

The District has a comprehensive plan projecting the future staffing and equipment needs to allow the organization to remain current in its ability to provide fire and life safety services to the community. Fire Station 5 is under construction at 5 Bolling Drive in Hamilton Field and should be completed by June 2004, providing two stations east and three west of the highway. This station configuration is critical for disaster operations such as earthquakes.

Funding for personnel has been greatly reduced by ERAF. The NFPD will need to secure long term, stable funding for additional personnel. A tax measure to alter the existing tax and add an inflation clause was passed by Novato voters in March 2002.

B. LAS GALLINAS VALLEY & SAN RAFAEL BASIN PLANNING AREAS

San Rafael Fire Department (SRFD)

1. Existing Level of Service

San Rafael Fire Department (SRFD)

The San Rafael Fire Department (SRFD) protects the City of San Rafael while County Service Area (CSA) 19 protects Santa Venetia, Los Ranchitos, St. Vincent's and unincorporated islands in the sphere of influence. The Marinwood Fire Department protects Lucas Valley and Marinwood. The planning areas are shown in Figure 13. The SRFD has six stations at the following locations dispersed throughout the District's service area: County Civic Center, Upper Terra Linda, Downtown, Montecito (near the Country Club), East San Rafael and Peacock Gap near Point San Pedro. Each station has one engine capable of pumping 1,500 gallons per minute. The Civic Center station houses a 75-foot aerial ladder truck and there is a 100-foot aerial ladder housed at the Peacock Gap Station.

All stations are staffed with three firefighters per shift, which includes one captain, one engineer and a firefighter, except for the downtown station, which has five firefighters on staff. The downtown station is staffed with two paramedics in addition to the captain, engineer and firefighter. The San Rafael fire suppression force totals 75 of which, 24 are paramedics. Fire department staffing, including 15 administrative staff, totals 90. All non-paramedic fire suppression personnel are trained as emergency medical technicians. A dispatching system matches the San Rafael Fire Department's level of response to a fire by evaluating the structure's value, location, and internal protection systems. All the lands within SRFD's sphere of influence are within an eight-minute Total Reflex Time of one of the six fire

stations. Total Reflex Time is defined as the amount of time between the time a call is received at the station and the time a unit arrives on the scene of the event.

CSA 19 provides funding to the SRFD for fire protection and paramedic services to nearly all unincorporated areas in San Rafael's sphere of influence, except Lucas Valley and Marinwood.

Marinwood Fire Department

The Marinwood Fire Department, a part of the Marinwood Community Services District, protects the areas of Lucas Valley and Marinwood. Marinwood's Fire Department is under contract with the Marin County Board of Supervisors to provide fire protection and emergency medical services to CSA 13, which covers Rotary Valley Senior Housing, Marin County Open Space District property, Juvenile Hall, and the Marin County Juvenile Courts and Services facilities at 1450 Lucas Valley Road in Lucas Valley. The Marinwood Fire Department has one station located at 777 Miller Creek Road and has a total staff of 36 employees, which includes a fire chief, three captains, seven firefighters, and 15 volunteers. All paid personnel are required to maintain emergency medical technical status as a condition of employment. Thirteen of the current volunteers are trained as emergency medical technicians. Minimum on-duty staffing is three personnel.

The Department is equipped with one 1,500 gallon per minute (gpm) Type 1 pumper engine, one 1,000 gpm Type 1 pumper engine, one 250 gpm Type 3 engine for wild land use and a utility vehicle equipped for rescue and salvage. The Department also has a sport utility vehicle assigned to the Fire Chief.

Response times and ranges to the furthest boundaries for areas served are as follows: westerly – 2.9 miles, 4 ½ minutes; easterly – 2.3 miles, 5 ½ minutes (Contempo Marin speed bumps greatly reduce response time); southerly – 1.3 miles, 2 ½ minutes; and northerly – 1.7 miles, 4 minutes.

The Marinwood Fire Department participates in the Marin County Mutual Aid Plan and has a 1998 joint powers agreement with the City of San Rafael where the SRFD can be dispatched for calls in Marinwood when needed. Funding sources for the 2000/2001 budget include 17.1 percent property taxes fund, 32.1 percent service charges fund and 50.8 percent contracts for service fund.

New development and structural remodels of 50 percent or more require the addition of residential or commercial fire sprinkler systems as appropriate and the installation of class A roofs.

Paramedic service is provided by contract with the San Rafael Fire Department (SRFD). Primary units are stationed at SRFD Station #1 on C Street and R56 stations at SRFD Station #6 on Del Ganado Road. Reserve units operate out of both stations, and are utilized as staffing and need dictates. Funding is by voter approved paramedic service charge, currently at $47 annually per improved parcel.

Lucas Valley

County Service Area (CSA) #13 is located in Lucas Valley between the Marin County Juvenile Hall site and the Lucas Valley Estates development at the western end of Lucas Valley. CSA #13 contracts with the Marinwood Community Services District for structural fire protection and with the City of San Rafael for paramedic services. Structural fire protection is funded by a building tax of $0.12 per square

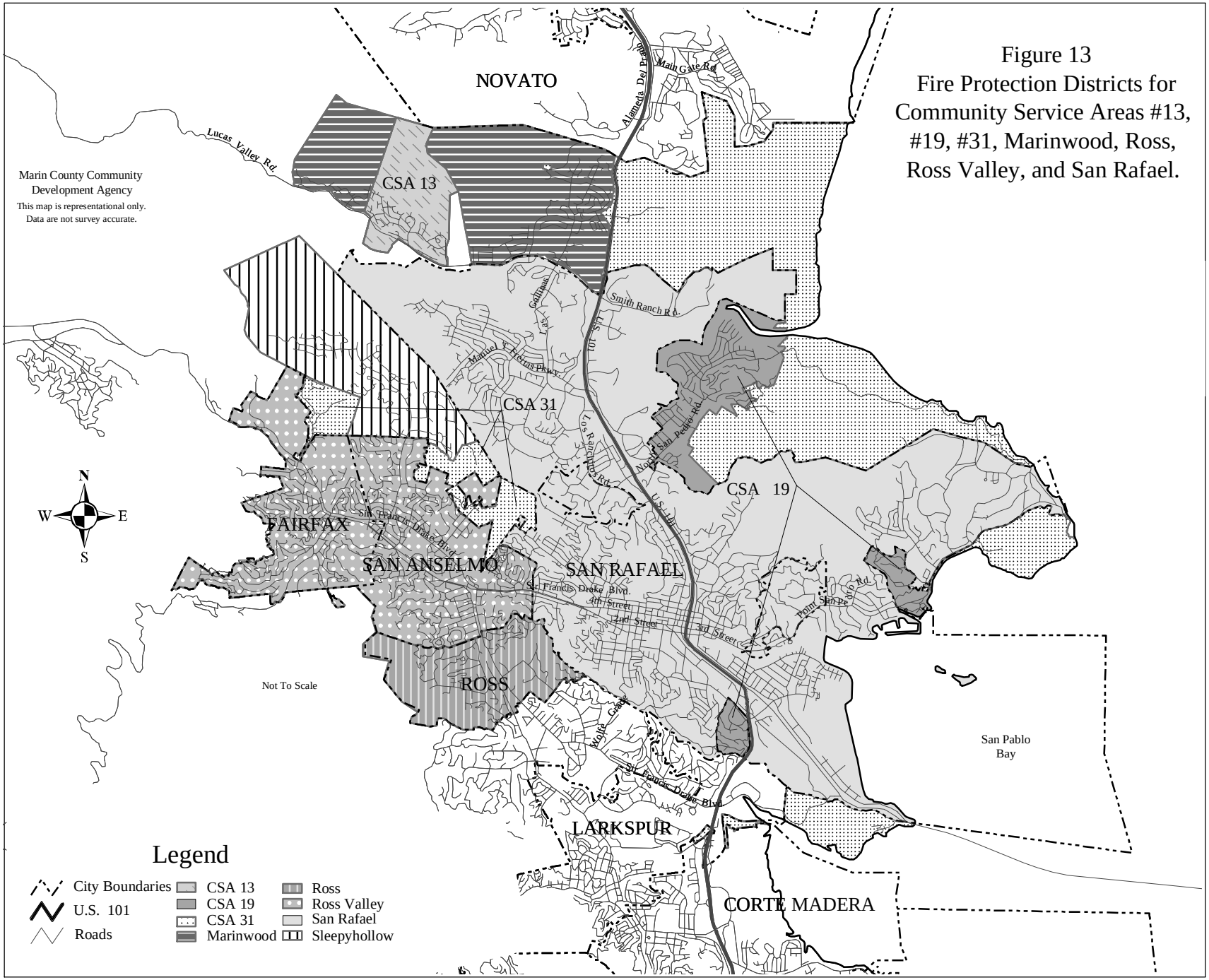


Figure 13
Fire Protection Districts for
Community Service Areas #13,
#19, #31, Marinwood, Ross,
Ross Valley, and San Rafael.

foot and by a small portion of the one percent property tax assessment. Paramedic services will be taxed at $50 per home for the 2001/2002 fiscal year.

The San Rafael Fire Department and Marinwood Fire Department work closely together under a joint powers agreement. The SRFD does dispatching for Marinwood fire calls. The two agencies are functionally consolidated but still maintain separate administrations. The SRFD also provides paramedic services to CSA's 13 and 19.

2. Future Service Capability

San Rafael Fire Protection District

The six fire stations in the City of San Rafael are strategically located to provide adequate fire response times to all areas within the San Rafael sphere of influence, with a few exceptions. When the St. Vincent's/Silveira site is developed, it is anticipated that an additional station and a paramedic unit will be required, though a location has not been determined. The SRFD and Marinwood Fire Departments are negotiating over the provision of future service to the undeveloped property west of Highway 101 and north of Lucas Valley Road.

For all remodeling projects, the City of San Rafael requires sprinklers in all residential and commercial buildings that are beyond the five-minute response time. Although the SRFD has proposed a similar requirement for all future residential development, this requirement has not been approved. The City of San Rafael will require sprinklers in future development at St. Vincent's if that is the most economical solution to adequate service provision. Sprinklers are presently required in any residential remodel of 50 percent or more and in newly remodeled commercial buildings.

An additional station serving the proposed St. Vincent/Silveira development would present the District with the need for additional staffing. Approximately 78 percent of all fire department calls are medical in nature.

Marinwood

There are currently no plans to consolidate fire protection services. Potential future development in the Marinwood area includes the Oakview development, located on the 106.3-acre parcel located at the northwest corner of Highway 101 and Lucas Valley Road; the Rocking H Ranch, the 501-acre parcel located on the south side of Lucas Valley Road, southeast of Big Rock; and development on the Grady Ranch for the Industrial Light and Magic buildings. The Oakview development is within the current response ranges. The Rocking H Ranch and Grady Ranch properties lie west and outside of the existing response ranges. It is estimated that response times would be increased by two minutes for calls to these properties.

The Marinwood Fire Department does not plan to hire additional staff, equipment or add equipment or facilities. However, the Department does maintain budget reserves for the replacement of apparatus and equipment as needed.

C. UPPER ROSS VALLEY PLANNING AREA

1. Existing Level of Service

Fairfax, San Anselmo and Sleepy Hollow

In 1982, the Towns of Fairfax and San Anselmo, along with the Sleepy Hollow Fire Protection District, entered into a joint powers agreement that created the Ross Valley Fire Department (RVFD). The RVFD serves the spheres of influence of the Towns of San Anselmo and Fairfax, including Oak Manor and all the pockets of unincorporated property in the Upper Ross Valley.

The District has three fire stations. One is located in downtown Fairfax adjacent to the police department and Town Hall, and the other two are located in San Anselmo: one is located downtown, while the other is on lower Butterfield Road and is known as the Sleepy Hollow substation. There are approximately 450 homes in the Fairfax sphere of influence and in the unincorporated areas, not including Sleepy Hollow. They receive substantially the same emergency service from the RVFD, as do San Anselmo, Fairfax and Sleepy Hollow. Sleepy Hollow residents pay approximately $500 per home for fire protection to the RVFD. The County of Marin pays approximately $70 per home to the RVFD for the 450 homes in the unincorporated areas.

The Fairfax station has one 1,250 gpm type 1 pumper and one 500 gpm type 3 pumper engine. The San Anselmo station has two type 1 pumper engines (with one in reserve), and one chief's vehicle.

In terms of staffing, the Fairfax station is normally staffed with one Captain/EMT and one firefighter/paramedic. The firefighter/paramedic provides first response advanced life support for the upper Ross Valley to supplement the ALS services provided by the Ross Valley Paramedic Authority. The downtown station in San Anselmo is staffed with a minimum of three firefighters per shift, including one battalion chief and two firefighters. The Sleepy Hollow substation is staffed with two firefighters per shift and has two 1,250 gpm pumper engines, with one in reserve. The RVFD staff totals 26 firefighters.

The three stations respond to all reported fires in the service area. The average response time is 3.25 minutes from the receipt of a call to the arrival of the first unit. Approximately 16 percent of the Department's jurisdiction is beyond a five-minute response time with a maximum of eight minutes to remote areas. The extended response time is a function of distance as well as steep, winding, narrow roadways.

The Department is integrated into the Marin County Fire Rescue Mutual Aid Plan and has a written contract with the County to provide protection as needed. The Department additionally responds to provide protection to Ross and San Rafael as needed per an agreement based on Computer Aided Dispatch rules.

The Ross Valley Paramedic Authority (RVPA) provides advanced life support services to the RVFD, while the RVFD itself provides first responder ALS through its paramedic engine company based in Fairfax. The RVPA is a Joint Powers Authority created in 1982 between the jurisdictions of Corte Madera, Larkspur, Kentfield, Ross, San Anselmo, Fairfax, and the County to provide paramedic services. A rescue unit (Rescue 40), staffed by two firefighter/paramedics from the Marin County Fire

Department under contract with the RVPA, is stationed at the Ross Fire Department and is available to serve the Ross Valley as needed.

The RVFD's three member agencies contribute proportional shares of the Department's budget based on percentages determined when the RVFD formed in 1982. Typical contributions, over time, have been: San Anselmo: 55 percent; Fairfax: 30 percent; and Sleepy Hollow: 14 percent. The breakdown of contributions in 2001 was: San Anselmo: 53.6 percent; Fairfax: 30.4 percent; and Sleepy Hollow: 16 percent. The RVFD receives about a sixth percent of its funding from other sources.

In 1985, the RVFD attempted to consolidate with the Town of Ross Fire Department; however, the Ross Town Council rejected the offer. At some future date this consolidation may be sought again.

Town of Ross

The Ross Fire Department is a part of the Ross Public Safety Department, which provides both police and fire protection to the Town. The Fire Department has one fire station with two type 1 engines and one water tanker. Three captains, three paid firefighters, and seven volunteers staff the Department. Dispatch services are provided by the Marin County Communications Center. Every location in Ross is within a three to five minute response time. Automatic aid is available from the Ross Valley Fire District for certain streets and structures.

The Town of Ross has no plans to expand its staff or purchase additional equipment because the town is nearly built out. No residential sprinkler ordinance is proposed for new development because response times to all areas of Ross are adequate.

Unincorporated Areas

The Marin County Fire Department is responsible for fire protection services in the unincorporated areas outside the jurisdiction of the Ross Valley Fire Department (refer to Section H – Unincorporated Areas for details on the Marin County Fire Department). The Marin County Fire Department requires roughly six minutes to reach Oak Manor and eleven minutes to reach the Monte Cristo tract. To ensure adequate protection, the Marin County Fire Department maintains an automatic aid agreement with the Ross Valley Fire Department. Under the provisions of this agreement, the RVFD will automatically send a minimum of one engine to any emergency call. With this assistance, an engine can be on the scene in outlying areas within three to seven minutes.

2. Future Service Capability

The Ross Valley Fire Department is capable of serving all areas within the Department's sphere of influence as long as detection and/or extinguishing systems are required in all residential and non-residential structures that are either located beyond a five-minute response time or exceed the service capabilities of the Department. It is anticipated that no additional staff, equipment or stations will be required to maintain this level of service; however, a substantial increase in call volume may mandate additional personnel to maintain this level of service.

All new structures are required to provide adequate water supply for fire protection. The Department requires fire sprinklers in all new residential structures, and has an ordinance prohibiting wood shake roofs. All roadways must be designed to permit sufficient turning radii and turnabouts for emergency

vehicles, as well as the integrity to withstand the weight of fire vehicles. These requirements can be enforced in the County's unincorporated areas only when the agency reviewing development permit applications incorporates these requirements as conditions of project approval.

D. LOWER ROSS VALLEY PLANNING AREA

1. Existing Level of Service

Corte Madera

Fire protection is provided within the Town of Corte Madera by the Corte Madera Fire Department (CMFD), which has 17 paid staff members and 10 to 15 volunteers. All CMFD firefighters are trained emergency medical technicians, and many are paramedics. The main station, adjacent to Town Hall, is staffed at all times with three firefighters who operate an engine. The satellite station on Paradise Drive, which is leased to Marin Ambulance, can be used during major emergencies such as floods or summer fires. This substation is staffed with two firefighters/paramedics who operate an engine and an ambulance. The CMFD's firefighting equipment includes three engines, one ambulance, and several support vehicles. Corte Madera's small geographic area, specialized equipment, and staffing at two stations enable the fire department to provide adequate fire protection to the entire town. Response times of less than five minutes are standard, except to the area at the very top of Christmas Tree Hill, because of the area's steep topography.

Corte Madera maintains an automatic aid agreement with Larkspur. In addition, the CMFD responds automatically to freeway accidents along portions of Highway 101 in Tiburon, Mill Valley, and the Alto area. Paramedic ambulance service is provided by the CMFD, with agreements with surrounding jurisdictions for rescue and fire response mutual aid. The Department has active fire prevention and disaster preparedness programs.

Larkspur

Fire protection is provided by Larkspur's Fire Department, which maintains its main station in downtown Larkspur on Magnolia Avenue and a satellite station just off Sir Francis Drake Boulevard in the incorporated portion of Greenbrae. The main station is staffed with two persons per shift, while the satellite station has three persons per shift. Each shift includes two chiefs. The total staff includes 18 paid personnel. The fire department has two 1,500 gpm pumper engines, one 1,250 gpm pumper engine, one 500 gpm four wheel drive wildland engine, one 2,000 gallon capacity water tender, and four accessory vehicles. The Ross Valley Paramedic Authority serves Larkspur; most of Larkspur's firefighters have emergency medical technician status. The Larkspur Fire Department has an automatic aid agreement with both the Corte Madera Fire Department and the Kentfield Fire Protection District for structural fires, and mutual aid agreements with the San Rafael Fire Department. The Larkspur Fire Department is operating at maximum capacity.

The Department is able to serve all areas in its district within the desired response time, which is a maximum of six-minutes. Improved equipment and procedures have helped to reduce all response times, including the times to reach hillside neighborhoods. A residential fire sprinkler ordinance has been approved and adopted by the Fire Department and the City.

Figure 14
Fire Protection Service to Lower Ross Valley Service Area
ROSS
Kentfield
Sir Francis Drake Blvd.
Wolfe Grade
Magnolia Ave.
LARKSPUR
Doherty Dr.
Hwy. 101
East Sir Francis Drake Blvd.
San Francisco Bay
CSA 31
CORTE MADERA
Tamalpais Dr.
Paradise Dr.
MILL VALLEY
Legend:
City Boundaries
U.S. 101
Roads
Corte Madera Fire District
CSA 31 Fire District
Kentfield Fire District
Larkspur Fire District
Marin County Community Development Agency
This map is representational only. Data are not survey accurate.
North
Not To Scale

Unincorporated Areas

The developed unincorporated areas along Lucky Drive receive medical aid from the Marin County Fire Department out of the Marin City station, while both the Marin City and Woodacre stations provide structural fire protection. Response times to the Lucky Drive area are not adequate, so the county relies on mutual aid from local jurisdictions to compensate for the difficulty of providing adequate service to this and other unincorporated "islands".

The Kentfield Fire Protection District (KFPD) covers the unincorporated communities of Kentfield, Kent Woodlands, Del Mesa, and parts of Greenbrae, totaling approximately three square miles. The station is located in Kentfield on the corner of College Avenue and Sir Francis Drake Boulevard. The Department has two type 1 engines, one type 1 office/emergency services state pumper, one 2003 Pierce 75-foot aerial ladder truck, one pick-up truck, and one operations vehicle. Total staff includes 11 full-time paid firefighters, 15 to 20 volunteer firefighters and one administrative secretary. Four firefighters staff each shift. All safety personnel are certified emergency medical technicians.

The KFPD maintains an automatic aid agreement with the Marin County Fire Chiefs' Association and a zone drop agreement with the Larkspur Fire Department. In addition, the KFPD has entered into joint powers agreements with the Marin County Fire Chiefs' Association for hazardous materials protection and the Ross Valley Paramedic Authority (Rescue 40 and 41, two medics each) for paramedic service.

The KFPD covers a wide variety of structures and topography from the fairly dense, mixed-use development along Sir Francis Drake Boulevard to the steep, low-density residential hillside areas of Kent Woodlands. The Kentfield Community Plan identifies difficulties in responding to fires in the upper Kent Woodlands area, particularly the upper reaches of Crown Road, Goodhill Road, and Evergreen Drive, where typical response time can be as high as nine minutes. Response times for 80 percent of the District is less than four minutes. The Kentfield Fire District has adopted a sprinkler ordinance that requires that all new or remodeled structures install fire sprinklers.

The KFPD is funded from several sources, including property taxes (82 percent); special assessment (17 percent); and contracts with Marin General Hospital, Marin County Sheriff's Office, and cellular phone companies (1 percent). There are modest gaps in water systems serving some small areas of the District. Some of these gaps are being addressed through the Marin Municipal Water District Fire Flow project.

2. Future Service Capability

Corte Madera

Corte Madera has a requirement that all new or remodeled structures install fire sprinklers. The CMFD is not planning any major facility improvements. A new engine and ambulance were purchased in 2002.

Larkspur

The Greenbrae fire station was rebuilt in 1991 and meets all current state structural safety standards. This facility, which is located in a flood zone, was also constructed according to current flood zone standards.

Unincorporated Areas

The Marin County Fire Department provides fire protection to the Greenbrae Boardwalk area, with the Larkspur Fire Department providing service under a mutual aid agreement. If the Larkspur Fire Department assumed responsibility for this area and other areas to the north and east, additional staffing, equipment, and possibly stations would be required. At one time the Larkspur Fire Department provided fire protection services to San Quentin prison, though the County is now responsible for the prison's fire protection. Fire protection for San Quentin is provided on site. However, the Larkspur Fire Department is available through its mutual aid agreement.

The Kentfield Fire Protection District has no expansion or consolidation plans. The District continues to look for ways to work jointly with adjacent agencies to improve effective and efficient service delivery. Equipment acquisition is based upon the current apparatus replacement schedule. Improvements to the Ross Valley Paramedic Authority's operational plan are expected to reduce advanced life support response times.

E. RICHARDSON BAY PLANNING AREA

1. Existing Level of Service

Southern Marin Fire Protection District

The Southern Marin Fire Protection District (SMFD) is an independent special district established by the Marin County Board of Supervisors in July of 1999. The District was formed by a merger of the Alto-Richardson Bay Fire Protection District and the Tamalpais Fire Protection District. The SMFD serves the communities of Tamalpais Valley, Almonte, Homestead Valley, Alto, Strawberry, and approximately 25 percent of the town of Tiburon and provides fire protection and medical services to all of the unincorporated areas within the Mill Valley sphere of influence. The SMFD receives federal funding for its support in providing fire protection to the Golden Gate National Recreation Area. The District covers 9.5 square miles, serving a population of approximately 20,500 with over 8,000 homes and commercial properties.

There are two stations in the SMFD. District headquarters are located in the Strawberry area of Mill Valley at 308 Reed Boulevard, while the substation is located in the Tamalpais Valley area at 309 Poplar Street in unincorporated Mill Valley.

The District has 37 full-time employees, including a fire chief, one deputy chief, four battalion chiefs, five captains, 24 firefighters/engineers (nine of whom are paramedics) and two administrative assistants. The SMFD also maintains a staff of 12 volunteer firefighters. All uniformed personnel are trained as emergency medical technicians. Daily staffing at Department's main station is between five and six uniformed safety personnel. At the substation there are between four and six uniformed safety personnel present on a daily basis.

Presently, the SMFD is equipped with three type 1 engines, one type 3 engine, one rescue squad vehicle, one ambulance, one command vehicle, and five staff utility vehicles.

The SMFD has automatic aid agreements with the Tiburon Fire Protection District, the Mill Valley Fire Department and the Corte Madera Fire Department. It also participates in the Marin County Mutual

Aid System, as well as the statewide mutual aid system. The SMFD also has joint powers agreements with the Southern Marin Emergency Medical Paramedic System (SMEMPS) and the Marin Emergency Radio Authority (MERA). In accordance with the SMEMPS agreement, the SMFD staffs a paramedic ambulance at its substation and a paramedic rescue squad at station headquarters.

Most of the developed areas within the SMFD are within the desired five-minute response time, with the exception of hillside and/or dangerous areas where street configurations make access difficult. A portion of Homestead Valley is slightly outside the five-minute range.

The SMFD operations are financed by property taxes and by a special fire tax. The SMFD enforces the California Fire and Building Codes of 1997. It also requires the installation of automatic fire sprinkler systems in all new construction, as well as substantially remodeled structures, including residential occupancies.

There are areas in Homestead and Tamalpais Valleys where fire flow is less than 1,000 gallons per minute and where there is poor vehicle access.

Mill Valley

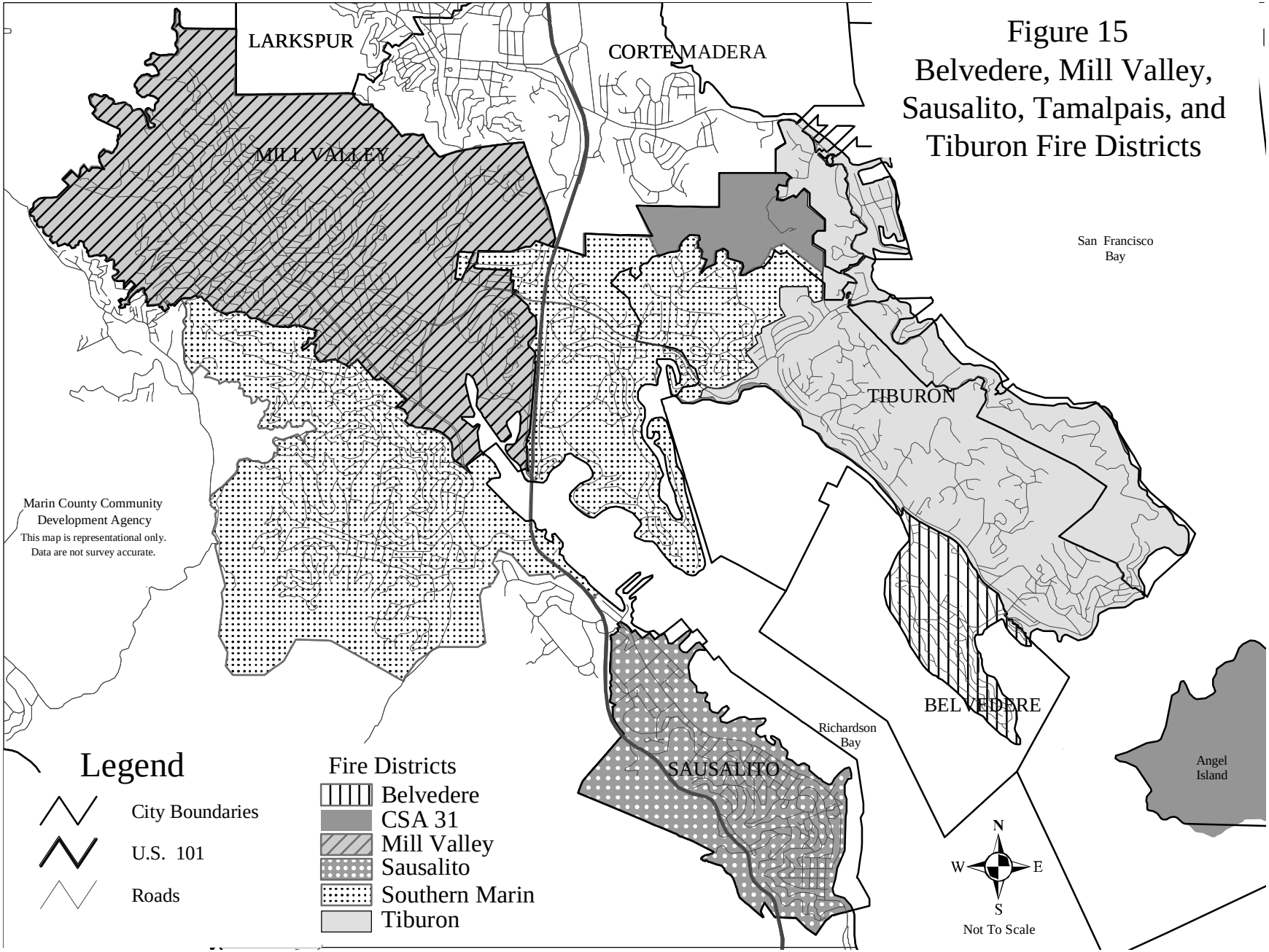
The Mill Valley Fire Department (MVFD) consists of two fire stations staffed with 25 firefighters and seven volunteers. The Department has three type I engines, one type III engine, one ladder truck, four utility vehicles (pick-up trucks), and one accessory vehicle.

The MVFD is a member of the Southern Marin Emergency Medical Paramedic System (SMEMPS). SMEMPS provides a high level of prehospital emergency care. The MVFD currently provides staffing for one Advanced Life Support (ALS) engine at the city hall station as part of the SMEMPS program. Further changes in the SMEMPS and ALS delivery system may require additional paramedics to meet the system's needs.

Certain parts of Mill Valley are outside the MVFD's desired five-minute response time. Neighborhoods at the city's northwestern end, such as the upper section of Summit Avenue, Fern Canyon Road, and Rose Avenue, are reached only after an arduous climb, which slows down pumper engines. The MVFD has adopted an ordinance to require fire sprinklers in all new residential construction and large-scale remodel projects.

Mill Valley has one of southern Marin's oldest water systems with some water mains dating back to the early 20th century, especially in the upper hill areas. Some of the water mains can carry only 500 gallons per minute rather than the 1,500 gallons per minute standard often used for insurance purposes. Developers are required to increase the capacity of these mains and extend them if hydrants are farther than 300 feet from a residence. Developers also must either install sprinklers or enlarge the capacity of the mains to 1,000 gallons per minute.

Figure 15
Belvedere, Mill Valley, Sausalito, Tamalpais, and Tiburon Fire Districts



The Marin Municipal Water District places a "fire flow" charge on water bills to be applied to the upgrading of water lines to current fire flow standards. In 1985 Mill Valley began upgrading water lines in the Edgewood and Cascade areas. The Department and the city have also instituted a hydrant replacement program to improve water delivery by installing over 240 larger capacity fire hydrants throughout the city. The city plans on the addition of 40 new, high-flow fire hydrants to coincide with the MMWD's water main rehabilitation and seismic upgrade project, which started in January 2000. This project will provide 105,000 feet of water main replacement in Mill Valley over the next 15 years.

The MVFD is working with the city and other outside agencies to implement the vegetation management program established in 1995-1996. This program includes clearing primary and secondary streets of flammable vegetation to increase access and removing dead tan oaks as a result of the sudden oak death syndrome. In cooperation with the Town of Corte Madera and the City of Larkspur, as well as the Marin Conservation Corps, fuel break buffer zones have been created in many areas between the cities. The MVFD also provides wood chippers to neighborhood associations and has marked and signed certain streets to maintain a minimum of eleven feet of clearance to provide for emergency response and resident evacuation. These programs have improved response times of emergency vehicles and have increased fire flow during structure fires.

As a participant in SMEMPS, Mill Valley provides paramedic service by staffing a paramedic engine company out of the city hall station and by providing personnel located at the public safety building in the city's southeastern corner. The MVFD is required to contribute three paramedics to SMEMPS, but sometimes more are provided when needed. All of the MVFD's firefighters are trained emergency medical technicians. They are trained to diagnose a patient's vital signs, which is a level of service above advanced first aid.

Property and business tax revenues fund the MVFD. Because the latter is a relatively large share of total receipts, the MVFD's funding has remained healthy in the post-Proposition 13 era.

Sausalito.

The Sausalito Fire Department (SFD) provides fire protection services within the city limits. The Department has nineteen persons on staff, in addition to a fire chief and one part-time administrative aide. The main station at Johnson and Caledonia Streets is staffed with a minimum of three and a maximum of four firefighters. The Department houses one engine, one truck, one Type III engine, one ambulance, one utility vehicle, an inflatable boat, equipment for a six-man dive team, and other specialized equipment to assist in mountain or water rescue. This station serves primarily the commercial and industrial areas along the waterfront, as well as all residential areas.

Station #2, located near Highway 101, is staffed with two firefighters at all times. Its equipment includes one engine and one reserve engine. Generally, over 90 percent of the structures are within the desired four-minute response time, which decreased from five minutes, although Wolfback Ridge is about a ten-minute distance from the downtown station. The Department maintains automatic aid agreements with all southern Marin fire agencies and the Marin County Fire Department.

A concern expressed by the Department is the inadequate capacity of the water lines in certain areas of Sausalito. Yet even with this limitation the Department is able to adequately protect all areas of the city,

including Wolfback Ridge and certain sites along the waterfront. All new development in these areas of concern will be required to contribute towards upgrading or replacing existing water mains.

Paramedic service is provided through the Southern Marin Emergency Protection Service, a joint powers agency formed by Sausalito, Tiburon, the Southern Marin Fire Protection District, and the Marin County Fire Department. The general service area includes all areas south of Alto Hill and Strawberry. The Sausalito Fire Department has mutual aid agreements with its neighboring jurisdictions.

Unincorporated Areas in Sausalito Sphere Of Influence (SOI)

The unincorporated areas in the Sausalito sphere of influence are the responsibility of the Marin County Fire Department. The station is located in Marin City and firefighters can easily reach all structures in Marin City within five minutes. While this station can adequately handle brush fires and minor house fires, it relies upon assistance from the Sausalito Fire Department to suppress major fires.

In the past, the Sausalito Fire Department has relied on a fireboat to provide protection to the 400 or so floating homes along portions of Sausalito's waterfront. The use of this boat was limited due to the tidal conditions, shallowness, and debris on the bottom of the bay. Additional fire protection is necessary for the waterfront area, where conditions exist for potential conflagrations and possible loss of life. Bids are currently out for a new fireboat that would be capable of reaching all areas, regardless of water depth, and would be able to provide water for the waterfront properties if water service to those areas is interrupted during an emergency situation. The Sausalito Fire Department expects to purchase the boat by the end of 2003.

Tiburon and Belvedere

Roughly three-quarters of the Town of Tiburon and the northern side of the Tiburon Peninsula are within the jurisdiction of the Tiburon Fire Protection District (TFPD). The TFPD also provides fire protection for the City of Belvedere. The TFPD maintains two stations, with its headquarters located in downtown Tiburon at 1679 Tiburon Boulevard and a substation at 4301 Paradise Drive.

The TFPD employs a total of 22 full-time firefighters and 21 volunteer firefighters, including: four firefighters, six firefighter/paramedics, three engineers, three captains, three battalion chiefs, one inspector, one fire chief, and one administrative/finance officer. All firefighters are trained as emergency medical technicians. On-duty staff number between three and four at station headquarters and between two and three at the substation. The TFPD operates three type I engines, one type III engine, one ambulance, and three staff vehicles.

The TFPD has automatic aid agreements with the Southern Marin Fire Protection District and the Corte Madera Fire Department. It also participates in the Marin County Mutual Aid System as well as the statewide mutual aid system. In addition, the TFPD is a member of SMEMPS and MERA. As a member of SMEMPS, the TFPD staffs a paramedic ambulance at its substation as well as a paramedic engine at the headquarters fire station. SMEMPS revenue is derived from ambulance transport fees. SMEMPS funds all equipment and maintenance needs of the paramedic system, but has no employees. Paramedic and EMT staffing of the SMEMPS ambulances and rescue unit is provided by the member fire departments.

Most development in the TFPD is well within the desired five-minute response time, except for hillside areas where street configurations make access difficult. The ridge top neighborhoods around Mount Tiburon Road, Sugarloaf Drive and parts of Belvedere are slightly outside the five-minute range. Response times to Teaberry Lane and the San Francisco State University Romberg Center on Paradise Drive are between seven and eight minutes from both stations.

The District's operations are financed by a combination of property taxes, state augmentation funds, special fire tax money, and a service contract with the City of Belvedere. In addition, fees are levied for fire code plan reviews.

The District enforces the California Fire and Building Codes, 1997 edition. The TFPD requires the installation of automatic fire sprinkler systems in all new construction and in substantially remodeled structures, including residential occupancies.

Negative impact from the Marin Countywide Plan is not anticipated, as the unincorporated area of the TFPD jurisdiction is nearly built out.

There are areas of the Tiburon Peninsula where fire flow is less than 1,000 gpm and vehicle access is poor. Since 1979 the TFPD has tried to address this problem with the adopted code requirements for built-in fire protection systems. In 1987, the TFPD began updating its water system. A five-year improvement plan was submitted to the Marin Municipal Water District, which established priorities for water distribution system improvement needs in the county. In addition, the TFPD is increasing hydrant capacities and utilizing large diameter hose to increase available fire flow. Although the section of water main extending from approximately the 3000 block to the 4000 block of Paradise Drive was identified as providing inadequate fire flow, it was not included in the MMWD's 1999 Fire Flow and Seismic Improvement Master Plan.

2. Future Service Capability

Southern Marin Fire Protection District

There are no planned staffing expansions for fire protection and emergency medical services, nor are there planned equipment expansions or upgrades other than the normally anticipated upkeep and replacement of vehicles. There are no plans to either consolidate or expand fire protection in conjunction with other districts, though the issue will always be open for discussion with neighboring jurisdictions.

Mill Valley

The MVFD presently provides adequate fire protection and emergency medical services to nearly all of the Mill Valley sphere of influence; no expansion of staffing or equipment levels is planned. The MVFD has been expanding its community educational services and outreach programs.

Sausalito

With twenty paid personnel and four conventional engines, the Sausalito Fire Department is adequately staffed and equipped to serve the projected development within the existing city limits. The Department has implemented an ordinance requiring the placement of sprinklers in all new residential development and existing homes when more than 50 percent of the structure is being renovated. This

requirement ensures that the fire department will be able to maintain its current level of service even as the city grows. The SFD plans to acquire a new engine to better serve residential and urban interface areas.

If Marin City were annexed to Sausalito, the response time to the Marin City bowl area would be five to six minutes. It would take an additional one to two minutes to reach the top of the ridgeland area from the present facilities, assuming that Sausalito did not take over the existing County station. Additional staff would need to be hired by the Department to serve this area.

Tiburon

There are no anticipated staffing or equipment expansions at this time, nor are there any plans to consolidate or expand fire protection services with other districts. All facilities meet state seismic standards for essential service buildings. Construction of the headquarters fire station was completed in 1994, while the substation underwent a significant seismic upgrade in 1999. The Tiburon Peninsula is surrounded by San Francisco Bay on three sides with elevations ranging from sea level to 600 feet. Access is limited to just two main roads into town. No changes in response times are anticipated.

F. WEST MARIN

1. Existing Level of Service

Three fire protection districts and the Marin County Fire Department provide fire protection in West Marin. The fire stations are located in Point Reyes Station, Inverness, Marshall, Tomales, Bolinas, Stinson Beach, and Muir Beach.

County Service Area #28 provides paramedic service in West Marin. This agency has two units. One unit provides service from Point Reyes north nearly to the county border and south to Stinson Beach. The second unit provides service eastward to San Geronimo. The City of Petaluma provides paramedic service to the northwestern corner of Marin County. Funding for this paramedic service comes from property taxes.

Bolinas

The Bolinas Fire Protection District (BFPD) staff consists of a full-time paid fire chief, a part-time paid assistant chief and a part-time secretary. Currently the BFPD has 14 citizen volunteers. A firefighter position is staffed twenty-four hours a day, seven days a week, either by a paid firefighter or by a compensated volunteer firefighter who is qualified as a duty officer. Of the latter, four are professional firefighters with other agencies in the county. The firefighter position is currently shared by four firefighters on a part-time basis. Two of the firefighters are Bolinas residents and also respond on their own time as volunteers. The other two are from other areas and are available only when on-duty. Fourteen of the staff and volunteers are trained as emergency medical technicians while two are paramedics employed by other agencies, but do not serve as paramedics in Bolinas. It is becoming increasingly difficult for the BFPD to recruit and retain paid and volunteer firefighters.

The BFPD is currently undertaking a capital campaign to raise funds for a new station. The existing station is seismically inadequate, has structural deficiencies, and is too small for current and future

needs. The District is seeking funding from both public and private sources for the project. The District hopes to break ground on the new station around the end of 2004 or the middle of 2005.

The BFPD currently operates two structure fire engines and one wildland fire engine. One of the structure engines was replaced in 1997 while the wildland engine was replaced in 1999. The second structure engine is sixteen years old. The District also maintains one rescue/command vehicle and one command/utility vehicle.

Automatic mutual aid agreements are maintained with the Stinson Beach Fire Protection District, the Marin County Fire Department, the Golden Gate National Recreation Area, and the Point Reyes National Seashore. District revenues come from property tax, state augmentation funds, interest on reserves, cell site rental, and grants from the National Park Service and other agencies.

Inverness

The Inverness Public Utility District (IPUD) provides fire protection services through the Inverness Volunteer Fire Department (IVFD) to the unincorporated community of Inverness in western Marin County. The fire department was formed in 1941 and was brought under the IPUD's jurisdiction in 1951. The voters formed the IPUD in 1948 as a special district under the California Public Utility District Act. An elected five-member Board of Directors governs the IPUD; directors serve four-year terms.

The IPUD encompasses some 1,600 acres and serves a full-time population of approximately 700 persons. It is not uncommon for the population to increase by as much as 50 percent on warm-weather summer weekends. The District is bounded on the north by Tomales Bay State Park, on the west by the Point Reyes National Seashore, on the east by Tomales Bay, and on the south by the Marin County Fire Department's service area. There is no potential for expansion of its boundaries.

The risk to the IPUD's assets from wildland fire is rated as "high". This assessment, made by the Marin County Fire Department, takes into account such factors as structures, population density, recreational activity, topography, weather, and vegetation flammability.

The IPUD's fire station is located at 50 Inverness Way, on the Village Green near the commercial center of the community. The IPUD owns the Firehouse/Village Green parcel. The firehouse was built in 1956 and was moderately remodeled and expanded in 1992. It houses the fire department, a community meeting room, and the IPUD and water system offices.

The IVFD maintains a roster of 17, including a chief and a training/maintenance officer, and a maintenance officer, who are employed by the Department on a part-time basis. Paid staffing totals approximately 1.0 full-time equivalents. Six of the Department's members are emergency medical technicians and nine are certified as first responders; all members are defibrillator certified. The Department has no paramedics.

As a volunteer department, personnel availability varies widely with the time of day and day of the week. All the IPUD's water system employees are also fire department volunteers and, thus, are capable of responding from the field. The firehouse is not staffed on a regular basis, but the IPUD's business

office in the firehouse is open during business hours on weekdays. All volunteers carry pagers with monitoring capability. Officers also carry portable radios.

The Fire Department has two type 1 structure engines, one emergency medical service (EMS) utility pickup, and one staff utility vehicle. In addition, both water system pickup utility vehicles are equipped for emergency response with full emergency lights and siren, a full complement of radios, and basic EMS equipment.

Dispatch services for the Fire Department are provided by the Marin County Fire Department (MCFD). An automatic mutual aid protocol was established with the MCFD in 1994. These mutual aid agreements, as well as the joint powers agreements discussed below, expand the IPUD's response zone to nearly 100 square miles. The IPUD's response zone extends west to the Point Reyes Lighthouse, north to Pierce Point on the west side of Tomales Bay and to Marshall on the east side of Tomales Bay, south along Highway 1 into the Olema Valley, and east to the Nicasio Reservoir area.

The Department is part of a cooperative fire agreement with the Point Reyes National Seashore. Other participants in this agreement include the Marin County Fire Department, Bolinas FPD, Stinson Beach FPD, Muir Beach Fire Department, Southern Marin FPD, and the Sausalito Fire Department. A cooperative agreement for local government fire suppression is in place with the Governor's Office of Emergency Services.

During the calendar year 2000, the "out the door" response times – from the time of dispatch to the time the first engine leaves the station at 50 Inverness Way – averaged four minutes 15 seconds for emergency medical service (EMS) dispatches and five minutes thirty seconds for fire and automatic aid dispatches. The chief and the assistant chief frequently respond directly to incidents from their homes or from work locations in the District. Dispatches are divided between 57.5 percent during daytime hours (6:00 a.m. to 6:00 p.m.) and 42.5 percent during nighttime hours (6:00 p.m. to 6:00 a.m.)

The majority of the Department's funding is from property tax revenue. The following percentages are derived from revenue for fiscal year 2000/2001: Ad valorem property taxes – 73.5 percent; District's Special Fire Tax – 13.8 percent; Local Agency Investment Fund (interest) – 6.7 percent; West Marin Emergency Services Fund – 3.3 percent; and Other – 2.7 percent.

The Inverness Public Utility District is within County Service Area (CSA) 28, the paramedic service area for West Marin. Property owners in the IPUD pay the CSA 28 parcel tax. This means that EMS responses within the IPUD are provided by the Marin County Fire Department, which typically responds from Point Reyes Station with two paramedics on board an advanced life support ambulance. The Inverness Fire Department also responds to all EMS dispatches within the District. Should the ALS ambulance transport a patient, the normal procedure is for one paramedic to remain in the area with the Point Reyes Station engine, which is equipped as an ALS engine. When both paramedics are involved with the transport, a second MCFD ALS ambulance staffed with two paramedics moves up to Point Reyes Station from Woodacre. The use of medivac helicopters is being increased in an effort to reduce the transport time for urgent-care patients.

There are four areas of deficiency in the District: volunteer recruitment, firehouse inadequacies, water supply inadequacies, and financial strains.

Inverness is not alone in struggling with the widespread problem of maintaining an adequate roster of volunteers. Reasons for this include the area's changing demographics; its aging population, the trend away from full time home occupancy towards weekend and vacation occupancies, and high housing costs that make it difficult for younger people to live in the community. In short, the pool of potential volunteers is shrinking; moreover, the younger, more physically qualified people who do live in the area are more likely today than in the past to commute out of the area to work and are thus less likely to become involved in the community. Nearly half the District's property owners live outside of the District. Recruiting is also complicated by the increasing time commitment which is demanded of a volunteer, who must obtain and maintain numerous certifications and who must keep current with a wide range of mandated skills and knowledge. Essentially, a qualified volunteer is asked to become as highly trained as a firefighter in a paid department. The Inverness Fire Department's volunteers are aging, with most of the core group of regular responders now approaching or in their 50s. The Department is also forced to go farther afield geographically to recruit new members, which makes it difficult for some volunteers to respond to dispatches in a timely manner.

Both existing fire engines are designed to transport firefighters standing on a rear running board, a practice that is no longer deemed desirable and that is not in accordance with National Fire Protection Association (NFPA) standards. When either engine is replaced with a model that includes the necessary crew cab, it will be difficult to accommodate such a vehicle in the firehouse because of the building's shallow engine bays. The firehouse is also deficient in storage, office, maintenance, and workspace.

Three areas in the District – the Highland Way, upper Vision Road, and upper Kehoe Way neighborhoods – are outside the water system's service area and lack municipal fire hydrants due to high elevation. There are approximately 32 residences in these neighborhoods. Fire protection water for some homes (typically, the newer ones) is available from on-site fire storage tanks, but most of the properties were developed before fire storage tanks were required. To fight fires at such residences, the District must rely on water tenders provided by the Marin County Fire Department pursuant to the automatic aid agreement.

Two subdivision applications for the upper Kehoe Way neighborhood, the Kehoe and the Connor subdivisions, have been approved by the County and are expected to result in extension of water system facilities. The Kehoe subdivision's final parcel map is pending. The District is in the process of negotiating the provision of fire flow protection to four of the parcels within the subdivision. The District is also in the process of engineering the extension of the water system for the Connor subdivision. It will include the installation of two water storage tanks. There are no known or anticipated initiatives that would result in extension of water system facilities to serve Highland Way or Upper Vision Road.

Since 1993, the State of California has diverted property tax revenues from cities, counties, and special districts to the Educational Revenue Augmentation Fund (ERAF). The diversion has had a severe impact on funding for the Inverness Volunteer Fire Department because it reduces the District's property tax revenues by approximately 27 ½ percent, which amounted to approximately $50,000 in 2001. This reduction has restricted capital planning and capital equipment purchases, such as providing for the replacement of aging fire apparatus. Implementation of the District's special fire tax

replaces only about 60 percent of the lost revenue. In addition, the District's finances are beginning to be impacted by the new, countywide public safety radio system (MERA).

Participation in MERA was not voluntary for the Inverness Fire Department. When the system becomes fully operational it is expected to add to the Department's operating expenses, however given the uncertainty of the status of the system the associated costs to the Department are uncertain at best.

Stinson Beach

The Stinson Beach Fire Protection District staff consists of a chief, an ambulance corps director, and an office manager. The District has approximately thirty volunteers. Twelve of these firefighters are trained as emergency medical technicians, providing basic emergency first aid only. The County provides paramedic service. The District has two stations, one located along Highway 1 and the other at Calle Del Arroyo. The District's equipment consists of four engines, one water tender, one squad car, and an ambulance. One of the engines is a new type 3 fire truck acquired in 2002. Because the staff is largely volunteer, a fire siren and an electronic paging system are used to call volunteers to emergencies.

Muir Beach

The Muir Beach Volunteer Fire Department includes thirteen volunteers, with an elected volunteer fire chief and assistant fire chief. The District has two emergency vehicles and anticipates adding a third. All fire vehicles are coordinated with the County vehicles for compatibility of use. All volunteers have completed the courses necessary to be certified by the state as emergency fire fighters, and are trained in CPR.

In addition to Muir Beach and the surrounding community, the District is generally the first emergency responder to the Muir Woods National Monument. The Department has an average response time of five minutes. The District, whose emergency equipment includes a "jaws of life" apparatus, acquires additional emergency equipment on an annual basis. As a unit, several of the District's volunteers are also qualified in cliff-side rescue. Funding for fire protection services is through the Muir Beach Community Services District.

2. Future Service Capability

Bolinas

Future growth in Bolinas will increase demands for fire protection services. The Marin County Fire Department notes that some homes within the District have been constructed with inadequate hydrant or water tank supplies. The District has adopted the countywide sprinkler and Class A roof ordinances. Following the County Fire Marshall's recommendation, the District was prepared to adopt the Uniform Fire Code "as adopted by the County," but the County never adopted the updated version. This should be resolved in the foreseeable future.

The BFPD has been active in monitoring and inspecting new construction and significant remodels for compliance with state standards on water supply, defensible space, and access. With recent staff changes, the District anticipates being able to undertake a more regular inspection program of both commercial and residential properties.

In an attempt to find the best way to provide ongoing service to the changing community of Bolinas, the BFPD conducted an assessment and strategic planning process that produced the strategic plan and mission statement that is now in place.

Inverness

No staffing increases are foreseen. The chief, who held the position for 20 years, retired on August 31, 2001. The IPUD does not foresee any paid staffing changes in the near future.

A long-standing need to replace the aging 1976 EMS utility vehicle has been on hold for several years for fiscal reasons. There is also a need to begin planning for the replacement of at least one engine, which has been in service for 22 years, but fiscal considerations have constrained planning for its replacement.

There is no direction in which the IPUD could expand its boundaries, nor are there any neighboring comparable fire districts with which the IPUD could consolidate. A major remodeling and upgrading of the firehouse was completed in 1993, and a number of energy-conservation (and potentially cost-cutting) improvements were made to the firehouse during the past year.

With fewer volunteers living or working within the IPUD, or living within a reasonable distance of the District, it is unlikely that response times will improve. A major concern is that if the roster of volunteers shrinks, response times may increase.

Stinson Beach

The Stinson Beach Fire Protection District serves the community of Stinson Beach and can reach all residents within five minutes. The District maintains mutual aid agreements with the Marin County Fire Department and the Bolinas Fire Protection District. Revenues are derived from property taxes. The District would like to train more emergency medical technicians but that is very difficult at this time.

Muir Beach

The Muir Beach Volunteer Department is consistently the first responder to calls within its service range, which includes the Muir Woods National Monument and half the highway distance from Muir Beach to Stinson Beach in the north and Mill Valley to the east.

G. UNICORPORATED MARIN

1. Existing Level of Service

The Marin County Fire Department serves an area of 251 square miles, a State Responsibility area of 198,945 acres and a population of approximately 14,000. The Department serves the unincorporated areas of Marin not protected by Fire Protection Districts or Federal Park Agencies. Services offered by the Department include fire control systems, integrated pre-hospital care system, fire prevention, public education, and emergency management. The Department maintains a staff of 84.5 including 1 Chief, 1 Deputy Chief, 3 Battalion Chiefs, 6 Senior Captains, 12 Captains, 3 Heavy Fire Equipment Operators, 8 Firefighter/Paramedics, 18 Fire Engineer/Paramedics, 17 Fire Engineers, 6 Firefighters, 2 Fire Captain Specialists, 1 BC/Training Officer, 1 Forester, 3 Dispatchers, 2 Administrative Personnel, 0.5

Technology Support Analyst, and 1 Search and Rescue Dog. In addition, the Department has one Heavy Fire Equipment Mechanic that Marin County Public Works has dedicated to the department. Staffing is enhanced during Fire Season by the hiring of approximately 45 Seasonal Firefighters, 2 Dispatch Assistant, 3 Paramedics, 2 EMTs, and 2 Fire Lookouts.

Services and responsibilities of the Marin County Fire Department include:

- Primarily provides rural all risk emergency management with extensive wildland responsibilities.
- Administrative jurisdiction of State Responsibility Areas as a Contract County with the California Department of Forestry and Fire Protection.
- Suppression assistance as required by Local and Federal agencies.
- Emergency medical services.
- Contractual provider of Paramedic staffing to the Ross Valley Paramedic Authority. Provide additional paramedic staffing in West Marin during the summer season from May through October.
- Marin County Urban Search and Rescue, in cooperation with the Marin County Department of Public Works.
- Water rescue.
- Provide fire suppression to Marin Municipal Water District and many of the other watersheds in Marin.
- Member of the County Mutual Aid Program.
- Chief is the Marin County Operational Area Coordinator for OES.
- Fire road maintenance.
- Business inspections.
- Vegetation management burns.

MCFD maintains 5 structural/Type I engines, 10 wildland/Type III engines, 3 water tenders, 4 paramedic ambulances, 1 dozer transport, 1 D-5 Bulldozer, 9 staff vehicles, and 10 utility vehicles. Dispatch and communications are provided by Emergency Command Center at Woodacre Headquarters.

Three volunteer fire companies supplement MCFD response in communities of: Nicasio, Muir Beach, and Tomales. These agencies have approximately 45 members and 5 fire vehicles. Skywalker Ranch Fire Brigade supplements protection to their area at Skywalker Ranch and their Big Rock complex. They have two fire vehicles and two fire utility vehicles and they also provide initial attack fire and medical assistance to the community surrounding their property.

MCFD operates six year-round fire stations in Marin County: Woodacre, Marin City, Mt. Tamalpais, Marin City, Point Reyes, Tomales, and Hicks Valley. All of the stations have fuel pumps with the Marin City, Woodacre, and Point Reyes stations being available to accommodate vehicles and personnel issued fuel cards by the County of Marin.

Woodacre

The headquarters of Marin County Fire Department is located in the West Marin community of Woodacre. This station serves Woodacre, Nicasio, Lucas Valley, Forest Knolls, Lagunitas, and the San Geronimo Valley. Mutual aid is provided to the community of Fairfax. This is the original

complex of the Tamalpais Forest Fire District. The station is staffed with four to six firefighters per shift and is equipped with four 1,000-gallon per minute pumpers as well as specialized equipment. Formerly the site of a railroad station, the complex has three buildings that were built prior to 1941, one main building built in the 1970's, a trailer leased for office space, a building formerly owned by MMWD that houses administration, supplies, and emergency communications center, and an apparatus barn. The buildings are aging and space is at a minimum, any additional staffing would require major upgrades to the facilities.

Mt. Tamalpais

The station located on Throckmorton Ridge is situated in a crucial location to respond to wildland fires in the urban-interfaced areas above Mill Valley. Throckmorton Ridge Station also responds to Muir Woods National Monument, Mt. Tamalpais State Park, Marin Municipal Watershed, the unincorporated area surrounding Mill Valley and Muir Woods, and provides mutual aid to Muir Beach. The facilities include one aging firehouse and storage facilities. This is the one station scheduled to be replaced.

Marin City

The Marin City Fire Station has the newest facilities of the department. They are housed in the County of Marin's Public Safety Building along with a Sheriff's Department substation and a community room. The station is staffed full time with two firefighters on each of the three shifts and is equipped with a 1,000 gallon per minute pumper. Marin City is located north of the Town of Sausalito and has the highest number of responses annually for the department. The jurisdiction is comprised of affordable housing, houseboats, commercial waterfront, and commercial property. Mutual Aid is provided to the Cities of Sausalito, Tiburon, and Mill Valley.

Hicks Valley

Hicks Valley serves Hicks Valley, Chileno Valley, and Nicasio Valley. Mutual Aid is provided to the community of Novato. Automatic Aid is provided to the Wilmar Fire Department and the San Antonio Volunteer Fire Department. Located between Point Reyes and Petaluma, the Hicks Valley station provides protection for numerous ranches and is routinely dispatched into Sonoma County as a mutual aid resource. Hicks Valley protects the last three remaining one-room schoolhouses in Marin County. The department manufactures a majority of its soft goods and performs all of its repair work at the sewing shop located here. The facilities include an aging firehouse and storage facility. Any increase in staffing would require major upgrades to these facilities.

Tomales

The Tomales station serves Tomales, Dillon Beach, Marshal, and Chileno Valley. Mutual Aid is provided to the communities of Bodega Bay, Two Rock, Valley Ford, and the US Coast Guard Base in Two Rock. Located in the community of Tomales, the station protects historic downtown Tomales, the Tomales Bay Coastline, Pacific Ocean, and local ranches. Due to its remote location, the Tomales fire station is the first location to house a fire engine with paramedic and lifesaving advanced life support equipment in Marin County. Tomales supplements their staffing with an active volunteer fire department. The Tomales facilities include an aging firehouse and storage facility. Any increase in staffing would require major upgrades to these facilities.

Point Reyes

Located in the Town of Point Reyes Station, this station protects over 100 square miles of ranchland, parkland and rural communities. The resources from this station respond regularly to emergencies in other jurisdictions and have developed a close working relationship with the Inverness, Bolinas, Stinson Beach and Tomales Volunteer Fire Departments and the United States Park Service Rangers and Firefighters from the Point Reyes National Seashore, Golden Gate National Recreation Area and the Tomales Bay State Park. This station serves the areas of Point Reyes Station, Olema, and Inverness Park. Mutual Aid is provided to Inverness Public Utilities District. The facilities were built in 1984 and house a Sheriff's Department sub-station and a community room. Even though this in not one of our older sites, if increase in staffing and equipment was required, we would need to make major upgrades to this facility.

Rescue 97-West Marin Emergency Services

From May to October, Marin County Fire staffs a Paramedic Unit at Stinson Beach. This ambulance supplements emergency service to meet the demand of the visitors to Marin County's coast. It is housed in a State Park building, which is also used by the lifeguards and sheriff.

Lookouts

Located on Mt. Barnabe and Mt. Tamalpais, Marin County Fire staffs these two fire lookout stations from June to October. These services supplement our fire detection system and update our Emergency Communications Center regarding weather and fire activity daily.

2. Future Service Capability

Current facilities would not adequately accommodate any increase in staffing or equipment if the need to provide enhanced or increased services developed. This would be dictated by an increase in SRA land, increase in population in the areas served, or any decreases to supplemental support given to Marin County Fire by the agencies in West Marin. Only one of our stations has accommodations for female staffing to have their own bathroom. Even though our female firefighters can have their own room on many occasions, none of the stations have sleeping facilities that can be dedicated for female personnel. Only three of our stations have ADA compliant restrooms for both public and staff use, and only one has an ADA compliant shower for personnel. On-duty personnel maintain all of our facilities and even though they are aging they are very well maintained.

VI. POLICE PROTECTION SERVICES

A. NOVATO PLANNING AREA

1. Existing Level of Service

Novato

The City of Novato's Police Department has sixty-two full-time sworn officers, including the Chief of Police. Thirty-five officers and seven sergeants are assigned to patrol duties. The Department no longer utilizes a reserve unit for patrol duties. Four traffic officers perform traffic-related enforcement and investigative duties. Nine officers and one sergeant are assigned to the investigations bureau. In the patrol responsibilities, approximately anywhere from seven to ten officers are assigned on any given night with a minimum of one to two supervisors on duty during the evening hours. The city is broken into four geographical areas with an additional two to four units serving as directed when needed.

Unincorporated Areas

The Marin County Sheriff's Department serves the unincorporated portions of the Novato Planning Area.

2. Future Service Capability

The Department expects to expand its ranks as needed to reflect population growth changes or changes in service demand. If unincorporated areas were annexed to the city, the Police Department would need to realign its beats to accommodate these areas and possibly add additional staff.

Ongoing infill development in Novato is increasing the demand for police protection. Over the next five years the Department anticipates the need to increase its motorcycle traffic patrol capability, add a canine unit, and hire an additional investigator.

The continued redevelopment at the Hamilton Air Force Base has required the hiring of additional staff. As the population in this area has grown, the Novato Police Department has added five officers, a dispatcher and a records specialist to meet the need for such services.

Unincorporated Areas.

Three to four patrol deputies will be assigned to the unincorporated areas in the Northern County area for both the day and night shifts when the Sheriff's Office is fully staffed.

B. LAS GALLINAS AND SAN RAFAEL BASIN PLANNING AREAS

1. Existing Level of Service

San Rafael

The San Rafael Police Department has one station, located in downtown San Rafael, and seventy-six sworn officers, including the Chief of Police. Of these officers, 37 perform patrol duties; four motor officers are assigned to traffic duty; and eight positions are assigned to the investigations unit. In addition, the Department has two full-time bicycle patrol officers to patrol the downtown area; one

officer assigned to the schools as a School Resource Officer; and one Mental Health Liaison Officer. The Department operates seven beats, each with two shifts. Each beat has one officer per shift. The Department has sixteen patrol cars, ten investigator's vehicles, four motorcycles, two 4-wheel drive vehicles, one prisoner transport vehicle, one search/rescue patrol boat, two canine units, and twelve other miscellaneous vehicles.

In 1988 the Department served a population of 45,885 (State Department of Finance estimate). In 2000 this figure had increased to 56,063 (2000 U.S. Census). The daytime service population of San Rafael may swell to over an estimated 90,000 people. Due to staff reductions and increasing demands for police services, response times are prioritized depending on the nature of the call. Responses to life-threatening calls average three to five minutes, while other service calls are handled within hours, the same day, or by alternate methods.

Unincorporated Areas

The County Sheriff is responsible for law enforcement in all unincorporated areas except for traffic enforcement, traffic complaints, vehicular accidents or auto theft investigations, which are all handled primarily by the California Highway Patrol. The Sheriff's Office handles traffic enforcement and traffic complaints as a secondary responsibility. County Sheriff's Station #3, located at the Marin County Civic Center, has 16 sworn officers, four supervisors, and three lieutenants. Each shift is staffed with three officers, one supervisor, and one lieutenant. Service in the unincorporated areas of San Rafael appears to be adequate.

2. Future Service Capability

San Rafael

The San Rafael Police Department is presently operating below adequate staffing levels, mainly because of staff injuries and problems with employee retention due to the high cost of living and long commutes. However, the Department has dealt with this problem for over thirty years. The staffing problem continues to be cyclical with the economy and job market. The Department is constantly evaluating its service delivery capabilities and devising alternative delivery systems, reducing levels of response, and in some cases eliminating functions. If the St. Vincent's property is developed it would be annexed to the City of San Rafael and receive police protection from the San Rafael Police Department. This would require the establishment of an additional beat in Terra Linda, as well as additional staff, vehicles, and equipment.

C. UPPER ROSS VALLEY PLANNING AREA

1. Existing Level of Service

Fairfax

Law enforcement activities are performed by the Fairfax Police Department (FPD). The Fairfax service area is approximately two square miles, with a population of 7,200. It encompasses both commercially and residentially zoned areas. The department is staffed with a chief, three sergeants, one detective/juvenile officer, one K-9 officer, six patrol officers, one community service officer, one reserve officer, four dispatchers and four reserve dispatchers. The day shift usually includes one supervisor,

two sworn personnel, one dispatcher and one community services officer. Night staffing usually includes one supervisor, two sworn officers, one K-9 officer and one dispatcher.

The FPD has four patrol vehicles, one K-9 vehicle, one four-wheel drive vehicle, one vehicle for the chief, and one electric community services vehicle. Average response time to calls is three minutes, and there are informal mutual aid agreements between the department and San Anselmo Police Department, California Highway Patrol, Marin County Sheriff's Department, and other nearby police departments.

The FPD recently upgraded its fleet of vehicles and computer equipment, and is waiting for the implementation of MERA. Current staffing levels are expected to remain the same.

Ross

The Town of Ross Public Safety Department provides patrol, traffic enforcement, crime prevention services, and general criminal investigation services within the incorporated town limits of Ross. A chief, two sergeants, six officers and one School Resource Officer staff the Department. Department equipment includes four marked patrol cars, one investigator's car, and one four-wheel drive pick-up. It is expected that an additional patrol car will be added in the near future, though there is no anticipated need to increase staffing in the future. Average response time to calls is two minutes. Dispatch services are provided by the Marin County Sheriff's Office.

San Anselmo

The Town of San Anselmo – a geographical area of two-and-a-half square miles with a population of approximately 12,500 residents – receives police protection from the San Anselmo Police Department. The Department is staffed with twenty-five full-time employees, including eighteen sworn police officers, one chief, two lieutenants, four sergeants, eight patrol officers, one juvenile officer, one detective and one motorcycle officer. The remaining staff, which includes one dispatch/records supervisor, five dispatcher/clerks, and one parking control officer, are not sworn police officers. There are also ten department volunteers: two reserve police officers, four police volunteers and four police explorers.

The Department has two shifts: a day shift and a night shift. The day shift, Monday though Friday, is staffed with one chief, two lieutenants, one sergeant, two patrol officers, one motorcycle officer, one parking control officer, one juvenile officer, one detective, one dispatch/records supervisor and two dispatcher/clerks. The night shift is staffed with one sergeant, two police officers, and one dispatcher/clerk.

Current equipment consists of five front-line patrol cars, three administrative vehicles, two detective vehicles, one parking control vehicle, one police motorcycle, one radar trailer, and one volunteer vehicle. The Department fields two patrol bicycles and has recently received a grant to purchase two more. It is expected that each patrol vehicle will soon be equipped with Mobile Data Computers.

Response time to calls averages less than three minutes. In addition, the Town of Ross and the College of Marin Police Departments contract with the Town of San Anselmo to provide dispatch services.

The population of San Anselmo has remained unchanged for ten years. With limited land available for development, the population is expected to remain relatively constant. However, with the advent of community policing and the rapidly changing world of technology, it is uncertain what demands will be placed on the department over the next ten years.

Unincorporated Areas
From the Kentfield substation, the Marin County Sheriff's Department is responsible for serving the unincorporated areas such as Oak Manor, White's Hill, and Sleepy Hollow. Nine full-time deputies serve an area between San Quentin Prison and Lagunitas with two deputies on each shift. A third deputy at this substation is on contract to the community of Kent Woodlands. According to the Marin County Sheriff's Department, this is one of the quietest sub regions in the County. However, the area encompassed is large and maximum response times average two to ten minutes, depending upon the location of the two deputies on patrol at the time of a call. The Department feels that the present staffing level is adequate and has no plans for expansion. Traffic enforcement in unincorporated areas is the responsibility of the California Highway Patrol (CHP). However, the Sheriff's Department will respond to and handle traffic enforcement when requested.

2. Future Service Capability

Fairfax, San Anselmo, Ross
The Fairfax, San Anselmo, and Ross Police Departments do not anticipate the need for future staff increases, unless, as previously stated, the Marin Town and Country Club is acquired by the Towns of Fairfax and San Anselmo and converted to a public park. If this does occur, possibly one additional vehicle and at least one more officer could be required to provide service from the Town of Ross Police Department.

Unincorporated Areas
If Sleepy Hollow were to become the responsibility of the San Anselmo Police Department, the department would need to acquire a new vehicle and hire up to five additional officers. A substation would not be necessary because response times from San Anselmo to Sleepy Hollow are within five minutes.

D. LOWER ROSS VALLEY PLANNING AREA

1. Existing Level of Service

Twin Cities (Corte Madera and Larkspur)
Corte Madera and Larkspur receive police protection from the Twin Cities Police Department (TCPD), which serves a population of approximately 21,100. Present equipment consists of ten marked vehicles, nine unmarked vehicles and three motorcycles.

The TCPD was formed in July of 1980, under a Joint Powers Agreement that combined the police forces of the two jurisdictions. The TCPD currently has thirty-four sworn officers and three reserves. Four officers are on duty at all times. There is one station in Corte Madera and one in Larkspur.

The consolidation has brought about greater efficiency in record keeping, purchasing equipment, scheduling, communications, and investigations. Consolidation has also allowed a decreased

supervisor/patrol officer ratio and a decreased mechanics/maintenance staff ratio. From a resource standpoint, the ability to deploy patrol officers on a more flexible basis into areas of concern has resulted in improvements in response time and greater visibility of patrol officers. Eventually, there will be a need for expansion of these facilities or construction of a new central facility. Corte Madera and Larkspur split their costs for administration and communication evenly, but other costs are apportioned according to the share of patrol each city receives. In 1987, Larkspur paid 55 percent of patrol costs and Corte Madera paid 45 percent of patrol costs. In 2001, Larkspur paid 51.7 percent and Corte Madera 48.3 percent. This funding formula changes yearly.

Unincorporated Areas

Lucky Drive and the Greenbrae Boardwalk receive law enforcement services from the Sheriff's Department and traffic control from the California State Highway Patrol (CHP). The Sheriff's Department regularly patrols this area.

2. Future Service Capability

Expansion of the Twin Cities Police Department service area to include the Greenbrae Boardwalk and Lucky Drive areas would not require additional police officers or equipment. However, in the growing commercial and residential areas of both cities, another beat may need to be created. This would require hiring four officers and purchasing an eleventh car.

In August 2001, the Twin Cities Police Authority received the results of a commissioned Police Facility Needs Assessment and Site Selection Report, which recommended a new site in Corte Madera. However, that site was turned down by the City Councils due to a cost issue. The Twin Cities Police Authority is now looking to build on-site at the Larkspur facility. A bond measure may be issued in June 2004.

Unincorporated Areas

Sheriff's deputies patrol Kentfield, Kent Woodlands and Greenbrae from a substation in Kentfield with supervision provided by the Sheriff's station at the Marin County Civic Center. Two to three deputies are on duty per shift. There are no areas in the sphere of influence outside the three to five minute desired response time. If additional help is needed, the Sheriff can call upon other units in the area or upon the Twin Cities Police Department under a reciprocal mutual aid agreement.

E. RICHARDSON BAY PLANNING AREA

1. Existing Level of Service

Belvedere

Law enforcement services in Belvedere are provided by the City Police Department, which is staffed by five patrol officers, one sergeant, and one Chief. The Department has a fleet of four patrol cars. At least one officer is on duty per shift. Dispatch services are provided by contract with the Marin County Sheriff's Communication Center. Because Belvedere is only one square mile in area, officers have little difficulty responding to calls within two to three minutes.

Belvedere has the lowest number of reported crimes in the Bay Area. Because of Belvedere's small community scale, its police officers perform many services beyond basic law enforcement (such as house checks when residents are absent) and respond to emergency and first aid calls. The City Police Department maintains a close mutual aid relationship with the Tiburon Police Department and the communities frequently assist each other. Although Belvedere has considered consolidation with Tiburon's Police Department, a survey of its residents indicated a strong preference for maintaining a city police department regardless of the added cost for doing so. The biggest problem facing the community is residential burglaries. To meet this problem, the City Police Department increased its staffing and implemented an aggressive neighborhood alert program.

Mill Valley

Mill Valley receives police protection from the Mill Valley Police Department (MVPD). The MVPD has twenty-two sworn officers, two parking enforcement officers, three civilian clerks, two reserve officers, one volunteer, and a police explorer program. In addition, one civilian community service officer and one civilian volunteer have been added to the department to address crime prevention issues and to work with investigators. Sworn officers are assigned one of four rotating teams, each working a twelve-hour shift. Staffing on each shift consists of three or four officers. Specialized types of assignments include traffic enforcement, investigations, school resource officer, and foot patrol. Average response time for non-emergency calls is five to six minutes.

Vehicular equipment consists of six patrol vehicles, two motorcycles, three unmarked vehicles, a community service van, a mobile communications van, two parking enforcement vehicles, two police bicycles and three administrative vehicles.

The central police station is located in the Public Safety Building on Hamilton Drive, on the east side of the city between Highway 101 and downtown Mill Valley. While the primary service area is the incorporated city limits, the MVPD is capable of serving areas outside the city limits, frequently providing mutual aid to neighboring jurisdictions as needed.

Dispatch services are provided by contract with the Marin County Sheriff's Communication Center.

Sausalito

The Sausalito Police Department provides primary police services to the incorporated city of Sausalito. The city of Sausalito is 2.2 square miles in area. The south city limit is Alexander Avenue at the Sausalito Lateral. The north boundary is Gate 6 Road, while the eastern boundary is Richardson Bay,

and Wolfback Ridge – to the edge of the Golden Gate National Recreation Area (GGNRA) – is the western border. The city's sphere of influence (SOI) includes: the Sausalito Lateral to the Golden Gate Bridge, including Vista Point and Fort Baker to the south; U.S. 101 to the Highway 1 turnoff to the north, including the Manzanita Park and Ride, as well as areas adjacent to U.S. 101 on the east and west (including the Heliport, Pohono Road businesses, Marin City and the Headlands); Richardson Bay to the east; and the ridgeline border with the GGNRA to the west.

The staff consists of twenty-six full-time employees and twenty-four volunteers. This number includes the chief, two captains, five sergeants, one investigator, thirteen patrol officers, three parking services officers, one administrative aide, and one administrative clerk. The volunteers perform court runs, front counter duties, data collection, traffic control, security at special community events, miscellaneous clerical tasks, vacation house checks, and a variety of other assignments.

The Sausalito Police Department is divided into two divisions: Operations and Support. Each division is under the direction of a captain. The Operations Division consists of four teams. Teams 1 and 2 split the week working from 7 p.m. to 7 a.m. These teams consist of a sergeant and three patrol officers. Teams 3 and 4 split the week and work from 7 a.m. to 7 p.m. Teams 3 and 4 consist of a sergeant and three patrol officers. In addition, the parking services officers work under the supervision of the Team 3 and 4 sergeants.

The Support Services Division consists of one team, called Team 5, which is composed of one sergeant and one investigator. This team typically covers the weekday shift from 7 a.m. to 5 p.m. In addition, the administrative assistant, administrative clerk, and all the volunteers are within the Support Services Division.

Dispatch services are provided under contract by the Marin County Communications Center. The average response time to emergency calls is approximately two minutes. Non-priority calls are generally responded to in less than ten minutes. Through countywide agreement, mutual aid is provided per established policy. Mutual aid at levels greater than intra-county capabilities is provided under the coordination of the Marin County Sheriff and the California Office of Emergency Services.

The Department's equipment includes six marked patrol units, four unmarked investigative vehicles, one pool car, four parking services vehicles (one of which is four wheel drive), two motorcycles, two radar trailers, and three bicycles.

The Sausalito Police Department currently operates from a temporary modular facility located at 300 Locust Street. The City of Sausalito is about to complete a comprehensive study that is focusing on the need for a police facility, as well as proper location, design, and funding resources.

In past years, commercial and industrial development in Sausalito's Marinship and Central Waterfront areas has created increased demand for police protection. The Department has responded by expanding its ranks and now has sufficient staff. The Sausalito Police Department has entered into a contract with the Richardson Bay Regional Bay Agency, a joint powers agency formed in 1987 by Sausalito, Mill Valley, Tiburon, Belvedere, and the County, to serve the water area of Richardson Bay. The Department patrols the area and enforces anchoring and mooring regulations in the Bay.

Tiburon

The Tiburon Police Department (TPD) currently patrols the town with 15 to 16 sworn officers, including a chief, one lieutenant, five sergeants, and eight police officers. The Department is staffed with four teams consisting of three personnel each, including one sergeant and two officers per team. Support personnel consist of an administrative secretary assisting the chief of police, and a Police Services Aide position. A staff of four reserve police officers also assists the TPD, though staffing levels and personnel functions are subject to change. The Department operates two beats, both of which exclude Tiburon's thinly populated pockets on the peninsula's eastern shore. This area falls under the jurisdiction of the Marin County Sheriff. Response to these areas occurs only when requested. All assigned beats receive neighborhood patrol.

The Tiburon Police Department responds to surrounding areas such as Belvedere, Mill Valley, Corte Madera, Larkspur, Sausalito, and unincorporated areas of Marin County when requested. Dispatch services are provided by contract with the Marin County Sheriff's Communication Center.

The Tiburon Police Department currently utilizes five patrol vehicles, one unmarked police car, and one police motorcycle. In 1999 the Department moved into a brand new, state of the art public safety building that also houses the Emergency Operations Center for the entire Tiburon peninsula.

Unincorporated Areas.

One of the County Sheriff's four substations is located in Marin City. Deputies from this facility serve the unincorporated communities of southern Marin, from the Golden Gate Bridge to Corte Madera and from the Tiburon Peninsula to Muir Beach. The Sheriff's Department Marin Patrol also operates out of this station. Current staffing at the Marin City substation includes 16 officers, with three on duty at all times, four sergeants, one lieutenant, and three complaint takers. This is the busiest station among the four operated by the County Sheriff 's Department. One or two officers could be added to the staff to serve better the southern Marin area. Nonetheless, the Sheriff's Department feels that staffing is generally adequate at the present time. Future development in southern Marin will require additional staff to maintain the present level of police service. The Sheriff's Department patrols Richardson Bay and the Marin County area of San Francisco Bay.

2. Future Service Capability

Mill Valley

It is anticipated that the MVPD's existing level of service will be adequate for the next ten years. The Mill Valley Police Department generally maintains a ratio of 1.7 to 1.9 officers per thousand persons.

Mill Valley could extend services into Homestead and Tamalpais Valley. The proximity of the city's Public Safety Building to Highway 101 means that it is well situated to assist in serving communities to the south and east.

A continual effort will be made to incorporate community policing into the daily routine of officer activity. School, community and residential safety will continue to be the focus as well as keeping the community safe from hate crimes and domestic violence. Focus on intervention programs; such as those to prevent hate crimes and domestic violence, will continue to be evaluated as the agency works closely with County programs.

Sausalito
The Sausalito Police Department is adequately staffed to meet present and future police protection needs of the city. If Marin City were annexed to Sausalito or if Sausalito provided police protection under contract, additional police officers and equipment would be needed. However, additional space will not be available in the new facility for further expansion, and there are no plans to expand services within the next ten years. In fact, there are proposals to cut staffing levels as currently established.

Tiburon
The Tiburon Police Department sees no difficulty in absorbing the areas within Tiburon's sphere of influence. The relatively small area of the peninsula permits the Police Department to respond to the majority of calls within five minutes.

Unincorporated Areas.
The type of future development in unincorporated southern Marin will dictate what is required to service the area.

F. MARIN COUNTY SHERIFF

The Marin County Sheriff serves as the primary law enforcement agency for all the unincorporated county areas. In addition, the Sheriff's Department operates the county jail, provides bailiffs (deputies) and security to the county's courts, operates the Marin County Sheriff's Communication Center (police, fire & medical dispatching), and manages the county's Office of Emergency Services. The Sheriff's Department is divided into three Bureaus: Bureau of Field Services, Bureau of Detention Services and Bureau of Administrative and Support Services, which includes the Communications Division. The Bureau of Field Services is comparable to a Police Department as it provides the full range of law enforcement services, including Special Units, with the exception of traffic accident investigations. The California Highway Patrol provides traffic enforcement and investigates traffic accidents in the unincorporated areas and on all the state roads in the incorporated areas.

1. Existing Level of Service

Bureau of Field Services
This Bureau is divided into three divisions: Patrol, Investigations and Volunteer Services.

Patrol Division
This division operates out of four Sheriff's Stations located in Marin City, Kentfield, Civic Center and Point Reyes Station. The Southern Station, located in Marin City, is responsible for all of unincorporated Marin County south of Corte Madera and Larkspur, including Muir Beach, Muir Woods National Park, the Boot Jack campgrounds in Mount Tamalpais State Park area, and Angel Island State Park. The Kentfield Station is responsible for all of the unincorporated areas south of Second Street in San Rafael out to the areas covered by the Southern Station. This area includes all of the unincorporated area of Greenbrae, Ross Valley, San Anselmo, Fairfax and San Geronimo Valley to the east side of Samuel P. Taylor State Park. The Civic Center Station, which is located in San Rafael, is responsible for all the unincorporated areas north of Second Street in San Rafael to the Marin/Sonoma County boundary. The Western Station, which is located in Point Reyes Station in West Marin, is responsible for the unincorporated areas of the west county that are not assigned to

another Sheriff's station. This includes the areas of Stinson Beach, Mount Tamalpais State Park, Samuel P. Taylor State Park, Olema, Point Reyes Station, Inverness, Marshall, Tomales, Dillon Beach, and Nicasio.

Five lieutenants, 10 sergeants, 58 deputies, two parking enforcement officers, and two senior sheriff's service assistants staff the Patrol Division. These personnel are dispersed throughout the Sheriff's stations and provide law enforcement services to the unincorporated area seven days a week, 24 hours per day.

The Volunteer Services Division augments the Patrol Division. The Volunteer Services Division provides personnel for specialized duties and normal patrol functions. Members of the Volunteer Services Division staff the patrol boat, crew the airplane, provide patrol reserves, and mounted deputies. They also provided services for specialized events. The Patrol Division has a lieutenant on-duty as a watch commander 19 hours per day, seven days a week. The on-duty watch commander allocates the distribution of manpower for each shift. Staffing considerations include, but are not limited to, calls for service, criminal activities and special details.

The Patrol Division has contracts with the Marin County Open Space District to provide a deputy to patrol the open space areas throughout the county. The Kent Woodlands Community Service District also contracts for a deputy, who provides patrol and law enforcement services to the Kent Woodlands community eight hours per day. The Marin County Housing Authority also pays the Patrol Division to provide a two-person walking beat in the Housing Authority area of Marin City. One patrol deputy is assigned to the Patrol boat to patrol the bay waters within the county boundaries. The Patrol boat also has a staff of volunteers, the Marine Patrol Reserves, which aid the patrol deputy. The Sheriff's Department similarly has contracts with the City of Belvedere and the Town of Ross to provide a lieutenant to each community to be the Chief of Police.

The average response time to calls for service is under five minutes, except in Area IV (Point Reyes), where it is under 15 minutes. This is due to the size of the beat area, traffic, road conditions, and weather (fog).

As established by state law, the Sheriff is the county mutual aid coordinator. If a local police department exhausts all its resources for an unplanned event, it can request additional resources through the Sheriff. The Sheriff provides assistance from the Sheriff's Department and can obtain other resources from local police agencies, surrounding counties, and/or state law enforcement agencies. This is known as the law enforcement mutual aid system, which is established by state law. The Sheriff's Department also provides assistance to local police departments through a program called mutual assistance. Mutual assistance is an informal system based on the mutual aid system by which local law enforcement agencies request the assistance of the Sheriff for a specific event or events. For example, the Sheriff's Department has formal agreements with San Quentin Prison for specific events and circumstances.

The Investigations Division investigates all serious crimes in the unincorporated area and provides augmentation and expertise to local police agencies when requested. The Division is divided into three units: Adult Crimes, Juvenile Crimes, and Scientific Investigation. The Investigations Division consists

of seven investigators, two sergeants, and one lieutenant. In addition, the Division manages a countywide, three-person probation enforcement team that consists of one sergeant and two deputies.

Volunteer Services Division

The Volunteer Services Division consists of five units of specially trained volunteers with unique skills. There are ten patrol reserve deputies, 15 marine patrol members, 38 search and rescue members, 18 air patrol members and 32 members of the Sheriff's mounted posse.

The Bureau of Field Services fleet includes the following equipment: 28 patrol units, five four-wheeled vehicles, one county-owned airplane, two county-owned boats (one 32 foot patrol boat and one 19 foot rigged hull), two wave runners, 12 investigator vehicles, two prisoner transport vehicles, three command vans, three canine units, one horse trailer, and specialized equipment for the dive, hostage, and search and rescue teams. In addition, the Sheriff's Office has access to privately owned airplanes and boats belonging to members of the Volunteer Services Division.

The ratio of officers per 1,000 residents in unincorporated areas nationwide is 1.7. In the Pacific Region, it is 1.3 officers per 1,000 residents. The Sheriff's Field Services Bureau currently operates at 1.3 officers/1,000 in the unincorporated area.

2. Future Service Capabilities

Staffing levels in the Field Services Division will be increasing. The Sheriff's Department has received a grant that will pay for an additional patrol deputy to work with mental health related crisis intervention. The grant started in July 2001. In addition, the legislature approved special funding for Sheriff's Departments that allowed for the funding of four additional deputies. The Sheriff's office is also pursuing funding for two school resource deputies.

The Sheriff's Department and the Marin County Administrator are currently planning for a new location for the Communications Center and County Emergency Operations Center.

The Marin Emergency Radio Authority (MERA) is installing a new radio system for public safety. MERA is a joint powers agency consisting of 26 agencies in Marin County, including the County of Marin, each municipality, and all the fire protection and water districts. This is a change affecting all law enforcement agencies. The timetable for the MERA system consists of three phases. Phase I is expected to begin around the end of 2003 or the beginning of 2004. It will have the system go online without the South Marin tower, which is still experiencing siting problems and lawsuits. Cities above Mill Valley will be able to use MERA but the Sheriff and County Fire Department will not because they need to operate countywide. Phase II will occur three to six months later with the installation of the Bolinas tower which will add the West Marin Area. Phase III will be getting the South Marin tower up. MERA officials are currently looking for an alternative site, which will then need and Environmental Impact Statement. They are hoping to have the tower up and operating by the beginning of 2005.

VIII. OTHER COMMUNITY FACILITIES

A. SCHOOL FACILITIES

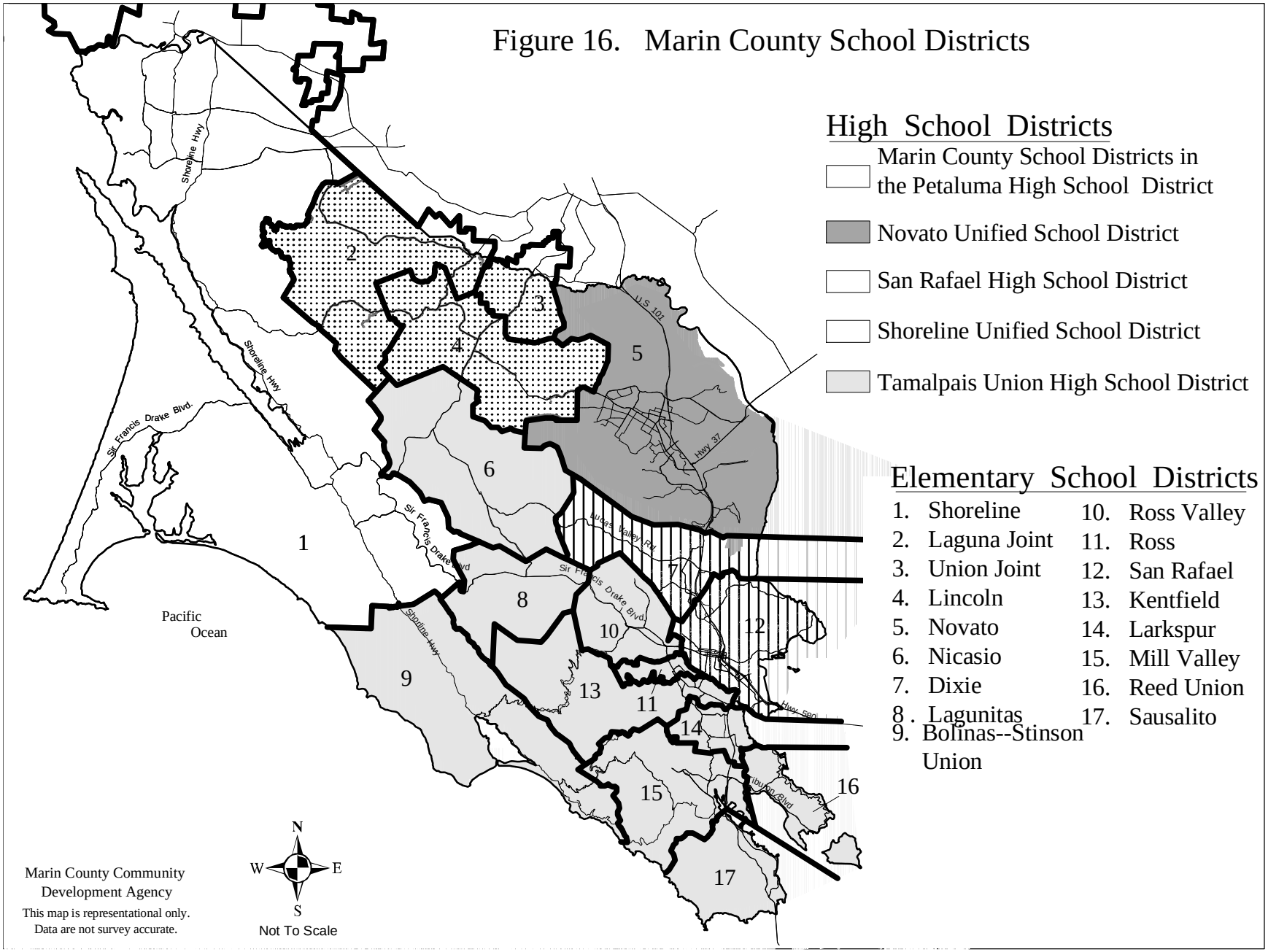
This section outlines general trends in school enrollment and identifies existing school facilities in the 15 elementary school districts, two high school districts, and two unified school districts (K-12) in Marin County (see Figure 16). Enrollment in public schools has fluctuated a great deal since 1970. The late 1970s showed a decrease in enrollment, which continued until the mid-1980s. The drop in the number of school children caused seven districts in Marin County to close schools. Some districts chose to lease the sites to day care centers, non-profit organizations or to other users. Other districts sold the facilities outright. There have been indications that enrollment is now on the increase. In 1986/87, average daily attendance (ADA) increased countywide for the first time in five years. Furthermore, since 1985 the following elementary school districts have had a steady increase in ADA: Dixie, Kentfield, Larkspur, Ross Valley, San Rafael Elementary, and Novato Unified. On the other hand, since 1990 the Lagunitas and Sausalito School Districts have experienced declining enrollments. Yet all the other elementary school districts exhibited moderate increases in ADA from 1990 through 1998. From 1998 to 2001, ADA for the elementary school districts either remained unchanged or showed slight decreases.

The increase in the number of elementary school children in the mid 1990s caused some school districts, such as the Mill Valley School District, to reopen closed schools or to expand existing facilities. The Dixie School District added additional classrooms and a science wing at the Miller Creek Middle School facility and reopened Mary Silveira School. In the Reed School District, three new classrooms were built at Reed School and another classroom was added at Del Mar Middle School. The San Rafael Elementary School District reopened Laurel Dale School.

From 1980 through 1990 all four high school districts experienced a decline in enrollment. However, high school ADA increased moderately for the Shoreline Unified School District, Tamalpais Union High School District, San Rafael High School District, and Novato High School District between 1990 and 2001. In 1990 the California Department of Finance (DOF) had projected that the number of children in the 15 to 19 age bracket would decrease steadily until the year 2005. Current DOF projections indicate that the number of children in this age bracket will actually increase slightly through 2010. This trend would indicate a continuing increase in enrollment but many factors may affect what actually happens.

In 1986, school districts were given authority to collect development fees and use those fees for construction of permanent facilities (California Government Code Section 65970 *et. seq.*). The development fees are only a supplement to State funds. Therefore, although the fees help mitigate the impact of new development, schools will continue to be largely dependent on State funding sources. The County has cooperated with the school districts that are collecting fees by requiring proof that these fees have been paid before issuing a building permit.

Figure 16. Marin County School Districts



In Marin County, the following school districts are collecting development fees: Kentfield, Larkspur, Mill Valley, Reed Union, Ross Valley, San Rafael Elementary, and Novato Unified. Collecting the fees will enable the school districts to build new facilities or expand existing facilities in order to accommodate projected growth. Projections by the school districts may take into consideration enrollment trends and pending development projects as well as age-specific population projections.

B. CHILD CARE

There has been a continual increase in the need for child care, both at the national and local level. This need has arisen from an increase in the number of women in the work force, often a result of single-parent households or two-income families. Many of these families rely on some form of child care. Other families may share child care responsibilities with spouses, have flexible hours, or work at home.

While Marin's supply of licensed child care has increased between 1990 and 2000, it has not kept pace with the demand for care from working families--with significant gaps in both infant and school-age care. Marin's relatively high cost of living has hampered efforts to increase supply. Child care programs are often unable to find the affordable space and/or staff needed to adequately house and run their programs. Unlike elementary and secondary schools that are publicly funded, financial support for the child care system comes primarily from private sources.[1] However, in 1998, additional resources were made available with the passage of the California Children and Families First Act.

State licensing agencies recognize two types of child care facilities: child care centers and family child care homes. A child care center is defined as any child care facility of any capacity in which less than 24 hour per day non-medical care and supervision are provided in a group setting. Residences generally do not qualify. A child care center is licensed by Community Care Licensing, State Department of Social Services. A family day care home is defined as regularly provided care, protection, and supervision of children in the caregiver's own home. The primary caregiver must live in the home and be present at least 80 percent of the time. The Marin County Department of Social Services is under contract with the State Department of Social Services to license family day care homes.

State law makes a further distinction between small family day care homes (up to eight children) and large family day care homes (up to 14 children). Under Senate Bill 163, the use of a residence as a small family day care home is considered a residential use of property for purposes of all local ordinances. This means that small family day care homes are allowed in all residential zoning categories. No city or county may require use permits, business licenses, fees, or taxes for operating a small family day care home.

The Marin County zoning ordinance contains policies regarding the regulation of childcare facilities. Both centers and family child care homes are required to obtain a conditional use permit under certain

[1] According the **Economic Impact of Child Care in Marin County**, July 1998 prepared by the National Economic Development and Law Center, the childcare industry produces approximately $57.5 million in gross receipts annually. Of this total, approximately 85 percent are from parent fees. About 10 percent come from government subsidies and less than 1 percent from the corporate sector.

circumstances and are subject to different approval processes. No clear distinction is made between the large family child care home and a child care center. All child care facilities with more that eight children are subject to a conditional use permit. Furthermore, large family day care homes and centers are restricted in planned districts unless approved in the Master Plan. The Marin County zoning ordinance does not prohibit the provision of child care, since child care facilities are allowed in all zoning classifications (subject to a conditional use permit in non-residential categories). However, child care development may be discouraged since the cost of the use permit is high due to the high cost of processing applications and noticing property owners.

While licensed supply has increased significantly over the last decade, estimated demand for care continues to exceed available licensed supply for both infant and school age care. Between 1990 and 1999, licensed child care supply increased by approximately 39 percent, from about 8,202 to 9,144 slots. This increase varied by age group with estimated infant care supply increasing by 57 percent, preschool care by 2 percent, and school age care by 17 percent, as shown in Table 7.

Table 7. Comparison of Licensed Child Care Supply 1990 vs. 1999

Age group	1990	1999	Percent Change
Infant care (0-3 years)	698	1,102	57 %
Preschool (3-5 years)	5,169	5,288	2 %
School age (6-13 years)	2,335	2,754	17 %
Total	8,202	9,144	37 %

Source: "California Inventory of Child Care Facilities" Issued by the California Child Care Resource and Referral Network, San Francisco, February 1987 and "Marin's Estimated Need for Child Care –By Age Group and Zip Code –10/99."
Supply data for needs assessment provided by the Marin Child Care Council.

In October 1999, Marin County had 9,144 licensed child care slots (see Table 8). Of these, about 80 percent were from 130 child care centers while the remaining 20 percent came from approximately 220 family child care homes located across the county.

Table 8. Marin County Licensed Child Care Supply – October 1999

Age of Child	Center Based Capacity	Capacity of Family Child Care Homes	Total
Under 3	358	744	1,102
3 to 5 years	4357	931	5,288
6 to 13 years	2568	186	2,754
Total	7283 (80%)	1861 (20%)	9144 (100%)

Source: "Marin's Estimated Need for Child Care –By Age Group and Zip Code –10/99." Marin County Child Care Commission, November 1999.
Supply data for needs assessment provided by the Marin Child Care Council.

Despite growth in the licensed child care system over the last decade, Marin continues to have significant shortages in licensed infant and school-age care. As shown in Table 9, an estimated 25,232 children under the age of 14 live in working families (i.e. families with two working parents or a single parent). These families are likely to need care for their children. There are an estimated 4,759 children under age three competing for 1,102 licensed infant slots. Estimated school-age demand also exceeds supply with 15,714 children competing for 2,754 licensed spaces. Many working families with infants rely on informal or license-exempt[2] care arrangements to care for their children as well. Similarly, many parents rely on after school activities and informal arrangements to care for their school-age children.

Licensed preschool supply is estimated to slightly exceed demand for care by working families. However, many families in Marin report difficulty in finding full time preschool childcare, as many of the vacancies are for part time care only. Furthermore, demand for preschool care for enrichment or educational purposes is much higher in Marin than in other counties. Much of this care is not full time and does not meet the needs of working parents.

Table 9. Marin County Child Care Demand versus Licensed Supply, October 1999

Age of Child	Total Demand (Estimated by children in working families)	Total Licensed Supply*	Difference	No. of children per licensed slot
Under 3	4,759	1,102	3657	4.3
3 to 5 years	4,759	5,288	-529	Less than one
6 to 13 years	15,714	2,754	12,960	5.7
TOTAL	25,232	9,144	16,088	2.7

Source: "Marin's Estimated Need for Child Care –By Age Group and Zip Code –10/99." Marin County Child Care Commission, November 1999.
Supply data for needs assessment provided by the Marin Child Care Council.
*Licensed supply includes centers and family child care homes. Family child care home supply is estimated to be 40% for infants, 50% for preschool, and 10% for school-age care.

[2] Licensed-exempt care is care which has been exempted from licensure and includes care (1) in a private home that includes children from only one family other than the provider's children, (2) by a person who is hired by a family to come into a home to care for the family's children, (3) in a recreation program that operates less than 13 hours per week or 12 weeks per year, or (4) provided by a school district directly.

Childcare costs in Marin County are among the highest in California with the average cost for full-time infant care at $9,789 per year.[3] Some subsidized childcare exists for low-income families within the county, although the number of qualified families far exceeds available subsidies. The Marin County Child Care Commission estimated in October 1999 that existing public childcare subsidies covered only seven percent of infants eligible for state-subsidized childcare. State subsidies were estimated to cover only 10 percent of eligible school-age children and 49 percent of preschoolers.

Providing high-quality, stable, and affordable child care depends primarily on having a safe and stimulating environment or facility and a well-trained and consistent teaching staff. Acquiring and maintaining facilities for child care has been a challenge for many providers. Because of Marin's high real estate costs and the narrow margin within which programs operate, many providers have relied on lower cost sources of space, such as excess public school sites or churches. However, many providers have lost their low cost sites as Marin's school districts have recaptured some of their leased space in order to implement California's class size reduction program. Religious communities are also reclaiming leased space to provide more programs for their aging parishioners. When looking for new sites on the commercial real estate market, providers face much higher real estate costs. Additionally, land use requirements have made it difficult for many providers to maintain or expand their ongoing programs. For example, the Head Start program had leased school district space at less than $1 per square foot, but faced commercial rates of $1.50 to $3.25 per square foot when it began looking for new space.

In response to these challenges, the Making Space for Children Project was established in 2001 to support child care programs in preserving and expand their existing programs. This project assists providers by: (1) locating space, including conducting feasibility analysis and budget development, (2) offering workshops on facility and business management, and (3) providing technical assistance on locating grants and loans.

A second component to maintaining and/or expanding child care supply is the dearth of qualified staff. Retention and recruitment of trained child care teachers or caregivers has been difficult during the last several years. Turnover rates within the center-based teaching staff are 20 percent for teachers and 37 percent for teaching assistants. MarinCARES, a program that provides stipends to teachers who remain in their jobs for at least one year and who complete specified training activities, was created in an effort to address child care staffing challenges.

Employers are beginning to recognize the benefits of ensuring that employees have access to quality child care. There have been many different approaches, all based on the premise that employees will be more productive if they feel secure about the care of their children. In addition, many employers feel that employees stay at the job longer and have lower rates of absenteeism if child care benefits are provided. Some of the benefits currently being offered by employers include the following:

- Flexible sick leave or family sick leave
- Tax-free payroll deductions for childcare
- Flexible work hours

[3] Excerpted from the "The 2001 Child Care Portfolio," produced by the California Child Care Resource and Referral Network."

- Cash payment of unused benefits, which can be used for child care
- Direct cash payment
- Child care facility on site (Lucasfilm provides on site care)

Unlike other local governments in California, Marin County has not required new developments to contribute to the expansion of child care supply by providing new child care slots or paying "in lieu" fees. Establishment of such a fee requires conducting a "Nexus Study." The study would provide justification for such a fee by determining the quantifiable need for child care slots created by new commercial or residential units. Santa Cruz, San Francisco and South San Francisco require developers of residential, commercial, office, hotel, and other projects to pay a fee, per square foot or per residential unit, to a facilities fund or include child care facilities in the project. In Contra Costa County, developers must submit a child care needs assessment and show that they intend to meet the need. The City of San Ramon is collecting development fees to offset the impact of new development on existing facilities.

Other counties have contributed to supply building efforts by providing child care on county property for their employees. Sonoma County, for example, has built a child care facility with 80 percent of the slots reserved for County employees and the remaining 20 percent open to the general public. Alameda County has also opened a county child care facility that is partially used for the general public. San Francisco operates several child care facilities for its employees and local residents. Marin County has taken a first step in considering the development of a county child care facility. It has completed a survey of employees about their child care needs.

Supply-building efforts could be further strengthened with the modification of several land use requirements. While not yet approved, the county's draft development code, which complies with state law, would streamline the permitting process for both large family child care homes and centers, and allow facilities in a wider range of zones. Further improvements could be made if conditional use permit requirements for large family day care homes were eliminated as they have been in San Francisco and Ventura counties. Finally, the County's general plan should specifically require that child care needs to be an explicit component of any master plan for planned-use developments.

C. LIBRARIES

The Marin County Free Library (MCFL), a special district operating under the authority of the Marin County Board of Supervisors, serves all the unincorporated areas of Marin and the cities of Corte Madera, Ross, Fairfax and Novato. The system has 11 branches and a bookmobile, which provides service to retirement and convalescent facilities, five children's programs, five West Marin schools, and fourteen unincorporated residential areas. In addition to the County libraries, there are six municipal libraries including Belvedere/Tiburon, Larkspur, Mill Valley, San Anselmo, San Rafael, and Sausalito.

The libraries receive the bulk of their income from property tax revenue, some additional local funding, and revenue from fines and fees. Minimal income is provided by the State when there is an imbalance in library use between patrons who are residents of a given jurisdiction and those who live elsewhere. For example, Mill Valley receives money from the State because a high proportion of the people utilizing materials from the library do not live in the City of Mill Valley. This form of compensation makes it possible for residents to use any library in the County, regardless of where they reside.

The State's shift in funding priorities from libraries to schools has caused a shortfall of approximately $1 million out of an $9 million budget for the Marin County Free Library. Possible new funding sources for the libraries include increasing the allotment from the County's property tax revenues, implementing a countywide sales tax measure, general fund monies, increased State funding, and grants and gifts. In 2001, the Board of Supervisors agreed to fund the MCFL up to $550,000 a year for FY01/02 and another year to help maintain the Library. If future funding cannot be secured, libraries may be forced to limit hours and reduce staff to cover the shortfall in revenue.

Approximately 148,176 borrowers represent 60 percent of the County's population and circulate 2,,569,498 books and other materials. All the libraries in Marin County participate in a cooperative circulation and catalog system through which residents may access materials from any of the 7 public libraries in the county, including MCFL's 11 branches. Dominican College, the College of Marin libraries, and other North Bay libraries participate through interlibrary loan agreements.

The library system exists to make a broad range of culture, information and knowledge available for the needs of the public. A survey conducted for the Library in August 2000 found that providing library services was one of the four most important issues for Marin County residents. Besides storing and circulating books, periodicals, videos, audiotapes, and CDs, the libraries offer a broad range of services. They are: children's and teen services, the bookmobile, reference services, senior services, literacy programs, the California History Room, and a government document depository at the Civic Center Library. The Library also supports outreach services such as home delivery to seniors and depository collections in convalescent homes. The FLAGShip takes literacy and health education services to the parents and caregivers of children ages five years and under. In addition, there are Spanish language collections in several branches.

The Marin County Free Library *Action Plan for the Years 2003-2006* outlined concerns to develop and maintain additional funding sources to ensure continued service and to continue seeking innovative and cost-effective ways to better serve the needs of the County's special populations, such as children, young adults, the elderly, and Spanish-speaking residents. The Plan also focused on upgrading technology and relocating the existing South Novato branch to the Hamilton area. The County will continue to address these needs as resources allow.

The MCFL expects several challenges in the future to meet the growing needs of Marin County's residents. One significant challenge has been, and will continue to be, for libraries to keep up with rapid changes in technology. Moreover, as the average age of Marin's population continues to increase, and as its ethnic backgrounds continue to become more diverse, it is anticipated the demand for services will increase. This may require reassessing the types of services and programs the libraries provide. A significant challenge will be finding and keeping qualified staff due to the high cost of living and salary disparities.

In the late 1980s there was some discussion concerning a plan to administratively consolidate the Civic Center Library and the San Rafael Public Library. This plan collapsed in 1993 when the libraries did not receive State library grant funds. The consolidation of the two libraries is now considered infeasible and unlikely to occur.

D. SOLID WASTE

Garbage collection in the county is governed by 22 franchising agencies. They include 10 of the 11 cities, 11 special districts, and the county. Each agency franchises with one of five private haulers, with the exception of one special district that provides its own service.

Redwood Landfill, located just north of Novato, is the only permitted landfill operating in the county. This facility is privately owned and operated. The West Marin Landfill facility located north of Point Reyes Station ceased accepting waste in 1998. In 1990, about 256,000 tons of waste were disposed of at the two facilities, with about 97 percent of the waste going to Redwood Landfill. In 2000, 381,102.55 tons of waste was disposed at Redwood Landfill. Table 10 provides a material type and source breakout of this amount:

Table 10. Marin County Waste By Type at the Redwood Landfill

Waste Type	Marin County (Year 2000)	Sources Outside Marin	Total Tons
MSW & Debris	182,473.99	178,924.87	361,398.86
Sludge (Wet Tons)	118.41	19,585.29	19,703.70
Total Tons	182,592.40	198,510.16	381,102.56

Projections done in the early 1990s had estimated that three million tons would be disposed of at these two landfills over the next 15 years, even with aggressive recycling and composting efforts.

In addition to disposing of solid waste, Redwood Landfill disposes of non-hazardous sewage sludge. In 1990, Redwood accepted 173,000 tons of wet sludge, dried it, and then disposed of the 59,000 dry tons in the landfill. About six percent of the sludge was from treatment plants in the county. The remainder was from treatment plants throughout the Bay Area. In 2000 Redwood Landfill received 23,578.52 wet tons of sludge that were utilized as alternative daily cover.

Redwood Landfill received a new Solid Waste Facilities Permit (SWFP) issued by the County on July 28, 1995. This permit allows the landfill to operate at a maximum of 2,300 tons per day (tpd) as follows: 1,270 tpd for non-hazardous general municipal solid waste (msw); 1,000 tpd for non-hazardous sludge; 10 tpd for non-hazardous separated or commingled recycleables; and 20 tpd for designated waste types.

As of June 1994 the Redwood Landfill facility has an estimated closure date of 2039. This is based on estimated remaining capacity of 10.9 million tons of waste, or an equivalent of 14.1 million cubic yards and includes a daily cover ratio of 3.5:1 and an in-place waste conversion factor of 1.2935 cubic yards per ton of waste landfilled. Increased recycling and resource recovery activities throughout the county are expected to extend the life span of this landfill.

Collection of separated recyclables is available to all single-family residences, multi-family complexes, and businesses throughout the county. Most of the collected materials are processed at the Marin Recycling Center in San Rafael. Additional resource recovery services are also provided at the Marin Resource Recovery Facility in San Rafael. These facilities are also privately owned and operated.

The county's waste management system is further described in the Source Reduction and Recycling Element, an element of the County Integrated Waste Management Plan that was prepared in accordance with the California Integrated Waste Management Act of 1989 (AB 939). This outlines a course of action for meeting the State's mandate of diverting 25 percent of the waste stream from disposal by 1995 and 50 percent by the year 2000. Diversion may include source reduction, recycling, composting, and limited transformation, such as wood incineration. In 1990, city-specific diversion rates ranged from 16 percent to 36 percent. Marin County's diversion rate in 1995 was 32.8 percent and the State approved diversion rate for year 2000 was 71 percent. Both of these rates exceed the 25 percent and 50 percent diversion mandates under the Integrated Waste Management Act, which has been adopted by each city in the County.

E. HAZARDOUS WASTE

The Marin County Hazardous and Solid Waste Joint Powers Authority is the countywide agency responsible for implementing the household hazardous waste collection project in Marin County. The County has sponsored periodic collection days for household hazardous waste (HHW) for Marin County and its cities since 1986. These events have increased public awareness of what constitutes household hazardous waste and how it should be properly managed. Marin Sanitary Service, in conjunction with the City of San Rafael, has been operating a permanent HHW collection facility in San Rafael since 1995. In December 1996, the HHW collection program in San Rafael was contracted by the Marin County Hazardous and Solid Waste Joint Powers Authority to extend service to all of Marin's jurisdictions, except for the City of Novato. Since 1996 the City of Novato has separately operated its own HHW collection program with the Novato Sanitary District for Novato residents and businesses. The permanent HHW facility in San Rafael is open year round for disposal purposes for county residents. Residents may also dispose of their HHW at satellite collection events or at the mobile unit. The mobile and satellite HHW collection programs are operated on an as-needed basis by local jurisdictions (Marin County Regional Summary Plan).

F. HOSPITALS

Marin County is within the Marin County Health Facility Planning Area, established by the Office of Statewide Health Planning and Development. Within the planning area are three acute care hospitals. These are Marin General, Kaiser Permanente Medical Center, and Novato Community Hospital. The Ross General Hospital was closed in February 1988.

Marin General Hospital, located in Kentfield, has 235 beds. A 100,000 square foot addition was completed in 1989. The new space contains a surgical suite, beds and an intensive care unit. The hospital also includes a Level III Trauma Center. In order to meet mandated state seismic safety guidelines Marin General must either retrofit two of three wings by 2008, or build an entirely new hospital by 2013. Kaiser Permanente Medical Center has 120 beds and includes an Emergency Department approved for trauma. The hospital provides medical, surgical, intensive care, and specialty services, in addition to ambulatory surgery and operating rooms. Kaiser plans to add an additional 50 beds within the next 15 years. Novato Community Hospital is licensed for 47 acute care beds, eight of which are set aside for critical care. Novato Community Hospital has expansion capabilities of up to 100 beds.

The Statewide Health Facilities and Services Plan (1985) indicates that Marin County has a significant excess of acute care hospital beds. The rising cost of health care has caused a shift to shorter hospital stays, and more outpatient facilities. Also, the delivery of healthcare has changed dramatically – with a greater emphasis on outpatient services, wellness and health maintenance. Thus, the need for hospital facilities is not expected to increase significantly.

G. GAS AND ELECTRIC SERVICE

Pacific Gas and Electric (PG&E) provides gas and electric service to the residents of Marin County. Residential energy consumption has been slowly climbing since 1995 (Marin Profile 2001). Total residential consumption increased 18.5 percent from 619 million per kilowatt hour (kWH) in 1995 to 734 million kWH in 2000. Non-residential energy consumption has also increased, from 646 million kWH in 1995 to 834 million kWH in 2000, an 18.5 percent increase. PG&E has been making continual improvements to the delivery system and expects to be able to provide energy resources to meet anticipated demand.

The California Legislature changed the distribution and supply of energy in 1996 when it enacted laws that deregulated the energy industry. This resulted in a significant increase in electricity and gas bills to Marin residents when the law went into effect in northern California in late 2000.

In addition to maintaining adequate capacity, PG&E is continuing its program to underground existing electrical lines. Several undergrounding projects that have been completed since the program began in 1988 include:

- Larkspur, Magnolia/Bon Air Road
- San Rafael, Lindaro, and 2nd Street
- Marin County, Redwood Frontage Road.

Upcoming undergrounding projects include North San Pedro Road from the Marin County Civic Center to Santa Venetia in San Rafael, and Sir Francis Drake Boulevard in Fairfax.

There are no anticipated problems in providing gas and electricity in Marin County.

H. TELECOMMUNICATION

Telecommunication is the transmission of information from one point to one or more other points using a variety of signals. These signals are transmitted via telephony, which consists of electronic signals over copper wire for telephones, video (frequency over coaxial cable), data (digital signals over copper, co-ax and fiber optic cable), wireless voice data, TV, AM/FM radio, two-way radio, and satellite transmissions for voice, radio, data and TV. Transmitting antennas are used to broadcast or direct a radio frequency signal, which is picked up by receiving devices such as receiving antennas, television sets, radios, car telephones, or pocket pagers.

Among the users of telecommunication facilities are cable television companies. Comcast is the primary provider of cable television in the county, having bought AT&T Broadband in 2002. AT&T had previously bought Viacom Cablevision and Chambers Cable. Viacom Cablevision served southern

and central Marin, while Chambers Cable served the Novato area. The west Marin area is served by West Marin Cablevision.

The accommodation of demand for telecommunications products and services has critical implications for land use policy in Marin County. These implications vary, depending on whether the telecommunication facilities are a major use on a property, such as a transmitter tower site, or a minor use accessory to a residential or commercial development, such as satellite dish antennas for single-family residences. Many telecommunications facilities must be located on ridgetops in order to be effective. The siting of these facilities may be in conflict with the ridge and upland greenbelt policies contained in the Countywide Plan. However, the County must accommodate telecommunication facilities and mitigate their potential adverse impacts by regulation for two basic reasons:

- Such facilities are necessary for quality of life and economic well-being of people in Marin County because telecommunication facilities provide necessary services ranging from radio and television to radio communication with emergency response vehicles; and,

- Federal and State regulations would not allow total prohibition or unreasonable regulation of telecommunications services.

Policy planning issues include more than land use. They should include the importance of the deployment of broadband (high-speed and high capacity data networks) for economic development. Communities need to encourage this infrastructure to attract and maintain industries that need high-speed access to the world wide web.

Other policy issues to consider are transportation, governmental services, access to public information, quality of life, and equal access to electronic services. The availability of broadband services can facilitate telecommuting options for employers and employees and remove commuters from highways. Governments can do much of their business electronically and can provide internet access to public information. Quality of life issues include access to the internet, cable TV, and satellite broadcasts. Equal access to electronic service for people who cannot afford their own computers and internet service can be provided in libraries and other community centers.

The federal government has primary regulatory power over telecommunications facilities through its powers to control interstate commerce. The Federal Communications Act gave the Federal Communications Commission authority to preempt local regulations prohibiting or discriminating against building or expanding telecommunications facilities. Through the California State Public Utilities Commission (CPUC), the State of California also regulates some telecommunications facilities that are considered public utilities. The Commission's primary interests include determining the necessity for the service, operating in compliance with State regulations, approving fee schedules, and serving as the lead agency for environmental review. The CPUC maintains that local jurisdictions cannot prohibit or restrict utilities such as cellular phone installations. Local regulations can prescribe land use and construction guidelines for telecommunications facilities, but cannot prohibit the use of a site if there is no reasonable alternative site. The FCC and the CPUC can prevent local decisions through commission orders that have the force of law and can require violators to go to court.

Most of the telecommunication infrastructure is installed underneath public streets. Martin Nichols, Executive Director of the Marin Telecommunication Agency, has advised local jurisdictions to insist that the telecommunications companies provide fair compensation for use of the public rights-of-way. In addition, the local governments should coordinate installation of various types of infrastructure in order to avoid multiple street cuts that damage public investment in roadways.

Due to the tremendous increase in demand for telecommunications products and services, Marin County has prepared a Telecommunication Facilities Policy Plan. This Plan contains policies and information about the potential impacts of telecommunications facilities. For more information, please refer to this plan.

I. TELEPHONE SERVICE

Two phone companies, SBC and Verizon, provide basic telephone service in Marin County. Verizon serves the Novato area and SBC serves the remainder of Marin County. Residents have the option of choosing between various long distance telephone service providers due to deregulation of the telephone industry in California in 1996.

J. JAILS

The current Marin County jail was opened in 1994. The Marin County Sheriff is responsible for staffing and operating the County jail. The main jail is located on the Civic Center grounds and houses both male and female adults who are either awaiting trial or are already sentenced for criminal and or civil violations. The bed capacity at the Civic Center jail is 294 (230 for males and 64 for females). In addition the County jail contracts with the U.S. Marshall's Service to house federal inmates who are waiting for legal action in the U.S. District Courts.

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APPENDIX 1-G

CULTURAL RESOURCES TECHNICAL BACKGROUND REPORT, FEBRUARY 2003

MARIN COUNTYWIDE PLAN

Cultural Resources
Technical Background Report

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I. Historical Background

The State of California has officially recorded 630 archaeological sites in Marin County. These deposits have received the traditional "trinomial" designation[1]. There are also potentially an unknown number of unrecorded sites. These sites are associated with all time periods of human occupation of the area. Generally, human occupation tends to reoccur at the same locations over time.

Recently, the Regional Office of the California Historic Resources Information System (CHRIS) has begun issuing "primary" or "P" numbers to all phenomena reported to them. Primary numbers can be assigned to archaeological sites, historic buildings, or any other artifact, feature, or site reported to the CHRIS. The primary number system effectively removes any distinction that existed between the built or architectural environment and the archaeological environment. Approximately 730 "P" numbers have been issued in Marin County since 1994. [2] Every archaeological site has or is receiving a "P" number, along with every building over fifty years old (potentially), and any other physical occurrence reported to the CHRIS. Primary numbers have been issued to abandoned equipment, individual artifacts, and other movable objects. This presents a problem to our inventory when portable items, not just assemblages of items, are officially recognized.

II. Archaeological Sites In Marin County

Several kinds of archaeological deposits are found in Marin County including settlements and villages, hunting camps, quarries, rock art sites, and trails associated with Native American settlement of the area. Spanish, Mexican and American era deposits are also present. The more recent historic era deposits frequently overlie the earlier Native American ones.

The distribution of known archaeological sites in Marin County is tilted toward the urban areas and the Point Reyes Peninsula. Throughout the historic period the more urbanized eastern part of the county was the center of activities, and this has been a concentrating force on the locations chosen for examination by archaeologists. The earliest attempts to systematically map the archaeological sites of the county occurred after the turn of the 20th century. These early mapping efforts were concentrated along the shoreline of San Francisco Bay, particularly in areas accessible by train. Later work appears to have been occasioned by discoveries at construction sites that were covered by local newspapers, or by telephone calls and letters to the anthropology department at UC Berkeley and San Francisco State University. Since the 1950's the Point Reyes area has attracted researchers due to its relatively untouched state and convenience to major universities. In the 1960's there was a major effort to gather information in conjunction with the movement to create the Point Reyes National Seashore.

Only a few researchers have examined the central part of the county and the extent of that coverage is limited. The many large, privately held parcels in central Marin have generally not changed use in many decades. These areas are not open for examination by archaeologists, and the distribution and frequency of recorded archaeological sites does not accurately reflect the distribution all sites.

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[1] CA-Mrn-xxx, a three-part number indicating the state, county, and sequential numbering of archaeological sites.

[2] "P" numbers are issued to documents received by the Regional Office. "P" numbers are not necessarily properties not previously cited and they may overlap with the previously recorded 630 archaeological sites.

Examination of the mapped archaeological site locations would not accurately reflect the distribution of prehistoric populations, only the distribution of archaeologists.

A. Distribution

The location of archaeological sites is not random: these locations correspond to a favorable combination of environmental conditions. Each culture views the available locations differently, but all are subject to the same human physical needs of water, environmental protection, and food sources. Once the important variables have been identified, the general locations of archaeological deposits can be predicted through modeling. Settlements and village locations tend to be well watered, level or fairly level, protected from the wind and other elements, and centrally located to the resources that support the settlement. Quarry sites can only be located where the geological resource to be exploited is found. Hunting camps tend to be more isolated from the settlements in use at the time the camp was established.

B. Frequency and Type

As noted above, 630 archaeological sites are recorded in Marin County. All types of sites and cultural eras are represented in the recorded sites. The 630 sites break down into the following types:

- **Permanent Settlements, including villages.** Village sites can be best represented by the large, often prominent, shellmounds found on the coast and along the shore of San Francisco Bay and its minor offshoots. These sites were often massive, covering two or more acres and many feet deep. Mrn-39 (on Belvedere Island) appears to have been over 9 meters (30 ft.) deep in some places, and Mrn-17 on DeSilva Island was about the same. These deposits commonly formed prominent mounds along the shore. The large shellmounds of Marin County tend to have been located along the shore, near reliable freshwater sources, and near exploitable ecological niches. They were commonly associated with salt and brackish marshes and estuaries. These sites were large, permanently occupied villages with populations of 300 or more individuals. The earliest record we have of major damage to these sites lies in an early requirement of Marin County to use shell from these mounds for road construction.

  Less prominent, but often as complex, are the earth mounds found in the interior parts of the county. Where the shellmounds were obviously associated with marshes and other locations where shellfish and other marine resources are available, earth mounds tended to be located where upland resources are concentrated. These sites were often associated with oak groves, near, but not too near, game trails, and other concentrations of food resources. As with the shellmounds, upland earth mounds were usually near permanent water sources, and were chosen for access to the resources important to the inhabitants of the site. Although they were not typically as deep as shellmounds, researchers have recorded earth mounds over two acres in size and over of three meters deep (10 ft) with depths of over one meter (40 inches) common.

- **Seasonal camps.** A varying population, with seasonal highs and lows, occupied large villages. Some large villages hosted seasonal gatherings that could temporarily triple the normal village population. The temporary camps associated with these seasonal gatherings tended to be scattered around the main villages: located up or down stream from the village, or on other suitable sites where seasonal

water was available. Additionally during the spring and summer the population tended to disperse to smaller camps distributed where seasonal resources were available. These deposits tended to look like smaller, less complex versions of the large village sites.

- Hunting camps and special use sites. In addition to seasonal camps, some sites were associated not with habitation, but with the acquisition and preparation of food. These sites differed with the type of resource exploited. They were typically located near the exploited resource, be it acorns, buckeye, other plant material, or an animal population. These deposits were often small in size, usually less than half an acre and often less than a quarter acre in surface area, and usually less than one meter (40 inches) deep. The purpose of these camps is apparent in the artifacts they contain and the locations that were chosen. Sites associated with acorn collection, for example, were near oak groves, and usually associated with water and outcrops of stone. The stone was used to make mortars for grinding the acorns into flour could be made and the water to leach the tannic acid out of the ground acorns.

- Quarries and extractive sites. These sites were limited to the location where the exploited resource is found. Quarries were usually associated with outcrops of chert, a siliceous stone used for knives and sharp edged tools, or chlorite schist, a soft rock commonly called "soapstone" and used for bowls, ornaments, and a variety of other uses. Quarries were also associated with basalt and other economic stone resources.

- Trails and petroglyphs. Petroglyphs are found on chlorite schist and other soft rocks throughout Marin County. Several different kinds of petroglyphs are found, and the type is often associated with specific rock formations. The small "pecked" oval glyphs called "PCN" petroglyphs are most commonly found on chlorite schist. The largest single occurrence of these is on Ring Mountain, although they are found throughout the county where suitable stone is found. Cupule petroglyphs are commonly found on chlorite schist, sandstone, and a variety of other stones, and the vertical scratches associated with the more recent past are often found overlapping the other two forms. There is only one prehistoric trail feature in the records. This site, recorded as Mrn-488, lies in the Novato Vicinity, near Indian Valley College.

C. General Condition

Many of the archaeological resources in Marin County are in a degraded condition. Over two hundred years of non-native culture has obliterated many traces of the prehistoric past. Those sites that remain are often in less than pristine condition. It is generally assumed that sites in the urban areas are in poorer condition than those in rural settings. This is based on the generally more disruptive activities that occur in urban areas. Agriculture, however, has a potential to significantly degrade the condition of archaeological deposits. Plowing and discing, two common practices in a variety of agricultural settings, disturb archaeological deposits to a depth of about 12 to 18 inches. This can amount to the upper half of some large deposits, and can completely penetrate some smaller ones. Deep ripping and other earth disturbing agricultural operations can damage sites to depths of four feet. These operations are not as disruptive as regular plowing, however, due to the infrequency of repetition. It is common to rip areas prior to planting grapes, for example, but to only use shallow discing over the life of a vineyard. Some of the best-protected archaeological sites are in watershed lands or in less used, remote parts of the county. Long standing cattle operations tend to help in the preservation of some deposits due to the

lack of discing and plowing associated with the industry. Rock art sites tend to be targets of vandalism. This is particularly true of the petroglyphs in the Ring Mountain area of the Tiburon Peninsula, but occurs elsewhere as well. Protection of rock art sites can be difficult since they are often prominent outcrops of rock, which seem to attract vandals with spray paint or sharp tools.

III. Reliability of the Information

The current information available is variable in quality: some archaeological sites have not been revisited in many decades and the information on them is questionable, others have been evaluated in the recent past and are well known. Generally, archaeological site locations are relatively accurate. The exact size and distribution of each site is, however, less well known. Each archaeological site has been plotted as a point on USGS Quadrangle maps. These maps have been maintained by a variety of agencies since about 1900. They were formally organized by the UC Berkeley Anthropology Department in 1948, and they have been updated continually since then. Through this process only the locational information survives for some sites, while others have extensive data sets available.

IV. Cultural Resource Evaluations

Archaeological sites have been evaluated under the California Environmental Quality Act since 1972. Whenever an activity requiring a County permit is undertaken, a determination is made as to which environmental conditions must be evaluated prior to issuing the permit, if any. For archaeological sites, a sensitivity map generated in the mid-1970's has been used to guide the decision making process. In recent years deficiencies have been noted in the existing map, and a new general evaluation of archaeological sensitivity is desirable. Archaeological evaluations can occupy several stages of the CEQA process, or all issues may be resolved at the initial study. The first step in an archaeological evaluation is usually a literature check and surface reconnaissance. If these steps generate no information, no further inquiry occurs. If either of these steps generates indication of a recorded, or previously unknown, archaeological deposit, further investigation is often necessary.

Once the level of sensitivity and the presence or absence of recorded archaeological sites has been determined procedures can be identified that will determine the presence or absence of negative impacts to cultural resources. In general, any parcel that is determined to be archaeologically sensitive should be subject to some level of archaeological evaluation. Before a permit for any grading, excavation, or construction is issued, an archaeologist should examine any parcel of 20 acres or less that contains one or more archaeological sites. For larger parcels a literature check should be initiated through the CHRIS to determine the state of knowledge about archaeological deposits on the parcel. A review by a contract archaeologist could be initiated to make this determination and to recommend an appropriate scope of work.

V. Existing Policies and Ordinances

In 1967, Marin County Ordinance 1589 was signed into law. The ordinance added Section 5.32 to the county code. This was the first county level law promoting the preservation of archaeological sites through the planning process. At that time there were no state or national laws or procedures encouraging the preservation of archaeological sites on private land. By today's standards, Ordinance

1589 is woefully inadequate in offering only the "protection" of allowing a set time period for scientific recovery of archaeological sites that are threatened by development. It has been more than 10 years since this ordinance was invoked, and it is now considered obsolete. The requirements of the California Environmental Quality Act and current County policies go far beyond Ordinance 1589 in offering protection to archaeological deposits.

A. County Ordinance 1589

Section 5.32.010 Purpose of chapter.

> In Marin County there exist certain deposits of shells and other materials in mounds hereinafter referred to as Indian middens, believed to have been deposited by Indians in the distant past. The middens may be of inestimable value in formulating the early history of the county and the habits of Indians when the middens are studied under the supervision of qualified archaeologists. Uncontrolled excavations into the aforesaid middens for commercial purposes without regard to their possible historical and archaeological values are destructive of the archaeological integrity of the sites. (Ord. 1589 § 1, 1967)

Section 5.32.020 Permit required to excavate.

> It is unlawful for any person, firm, corporation or copartnership to knowingly disturb in any fashion whatsoever, or excavate, or cause to be disturbed or excavated any Indian midden without a permit being issued therefor by the department of public works. (Ord. 1589 § 2, 1967)

Section 5.32.030 Liaison agency.

> Upon receiving written application therefor, the board of supervisors shall designate an institution of higher learning, or an association having as one of its major purposes the study of Indian relics or sites having archaeological significance, as a liaison agency between the department of public works and institutions of higher learning or associations, having as one of their purposes the study the objects of archaeological significance. (Ord. 1589 § 3, 1967)

Section 5.32.040 Application for permit.

> Application for a permit to excavate Indian middens shall be in a form acceptable to the director of public works, and may be made by the owner of the middens or a person authorized in writing by the owner, to make the application. The permit shall state whether the excavation is for either archaeological or nonarchaeological purposes. (Ord. 1825 § 1, 1971: Ord. 1589 § 4, 1967)

Section 5.32.050 Issuance.

> Upon receipt of an application for the excavation of an Indian midden, the director of public works or his designee shall forward the application to the liaison agency designated by the board of supervisors pursuant to Section 5.32.030. Within five days of the receipt of the application, the liaison agency so designated shall notify the director of public works whether the midden for which application is made for excavation is of archaeological significance. If the

designee certifies that the midden is not of archaeological significance, a permit shall be issued to the applicant upon the receipt of the certificate. (Ord. 1589 § 5, 1967)

Section 5.32.060 Conditions for issuance

In the event the liaison agency certifies that the midden for which application for excavation is made is of archaeological significance, the director of public works may issue a permit, but shall subject the permit to conditions including but not limited to the following:

A. Prior to nonarchaeological excavation or removal of materials from the middens, the permittee shall not excavate for a period of sixty days in order to allow archaeological excavation of the site;

B. The permittee or owner of the property shall be required to grant a license for the excavation, identification, and classification of artifacts and proper scientific analysis of materials having historical or archaeological significance to recognized institutions of higher learning or associations having as their major purpose the study of Indian relics and other sites having archaeological value. The terms of the license shall be such as are agreed to by the prospective licensee and property owner. (Ord. 1825 § 2, 1971: Ord. 1589 § 6, 1967)

Section 5.32.070 Conformance to stated conditions required.

Any act done under the authority of a written permit issued hereunder shall be in accordance with the terms and conditions of the permit. (Ord. 1589 § 7, 1967)

Section 5.32.090 Violation a misdemeanor.

Any person violating the provisions of this chapter is guilty of a misdemeanor and upon conviction thereof shall be punished as provided in Section 1.04.270. In the event of a continuing violation, each day that the violation continues constitutes a separate and distinct offense. (Ord. 1589 § 9, 1967)

B. Existing Policies

A review of the present policies of the County of Marin reveals no need for major changes. Archaeological and cultural resource protection is achieved through review of development applications. The present policies are as follows:

1. Preservation of Cultural and Archaeological Resources

Policy EQ-3.29 Review Sensitivity Maps. The Community Development Agency shall review the archeological sensitivity map for all development applications in order to determine potential impacts.

Program EQ-3.29a *Prepare New Sensitivity Map.* The County Community Development Agency should identify potential archeological locations or areas where there may be a high likelihood of archeological resources in a sensitivity map which is not site specific.

Policy EQ-3.30 Evaluate Presence of Site. Development sites identified as having a potential for the presence of archeological resources (through review of the sensitivity map or other available sources) shall be further evaluated to ascertain if an archeological site is actually present. This evaluation shall be the responsibility of the applicant and may be undertaken by conducting a record search at the Northwest Information Center of the California Archaeological Inventory to determine if the project area has been previously surveyed and if resources have been identified. If the record search reveals that no survey has been undertaken, the applicant may be required to undertake a survey of the site, depending upon the sensitivity of the site.

Policy EQ-3.31 Avoid Impact. When a site has been identified as an archeological resource, development shall be situated or designed to avoid impact on the archeological resources. This may be accomplished through one or more of the following methods:

- Siting buildings to completely avoid the archeological site;
- Providing parks, or some type of open space to incorporated archeological sites;
- "Capping" (covering the site with a layer of soil);
- Deeding the site as a permanent conservation easement.

Policy EQ-3.32 Discovery of Resources. In the event archaeological resources are uncovered during construction, all work must halt and an evaluation must be undertaken by a qualified archaeologist.

Policy EQ-3.33 Buildings with Historical Significance. The County Community Development Agency should require that buildings of historical significance are preserved when new development is proposed.

Policy EQ-3.34 Consultation with Local Organizations. Development applications received for projects in areas identified as having potential to impact cultural and/or archeological impacts shall be forwarded to interested organizations and/or individuals for their review and comment.

VI. Effectiveness of current policies

The current policies appear to be effective in identifying significant cultural resources during the planning process. Some improvement in the process can be achieved. The current procedures should remain in place with minor changes.

VII. Recommended Policies and Procedures

A. Repeal of Ordinance 1589

Ordinance 1589 was enlightened legislation in 1967. Since then, state and federal environmental regulations and county procedures have gone far beyond this ordinance to protect archaeological deposits. Under current policies, the archaeological excavation allowed by the ordinance would conflict

with Policy EQ-3.31, which specifically instructs the avoidance of impacts to archaeological resources in the planning process. Archaeological excavation is inherently destructive. Although artifacts and information can be preserved through excavation, archaeological sites are never preserved through this process. It is widely recognized that the policy of archaeological site preservation is more enlightened than a policy of excavating sites when they are "inconveniently" placed.

B. Continuation of Existing Policies

The existing policies have insured the protection of archaeological resources in Marin County. It is recommended that Policy EQ-3.30 be modified to require contact with the Northwest Regional Office of the California Historic Resources Information System whenever a site is identified as having a potential for the presence of archaeological resources.

C. Prepare a New Archaeological Sensitivity Map

The County Community Development Agency should identify potential archeological locations or areas where there may be a high likelihood of archeological resources in a sensitivity map which is not site specific.

APPENDIX 1-H

ENERGY TECHNICAL BACKGROUND REPORT, MARCH 2004

MARIN COUNTYWIDE PLAN

Energy
Technical Background Report

Implementing Sustainable Energy Policies Throughout the General Plan

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March 12, 2004

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Energy Technical Report

Introduction

Purpose

The Marin County Board of Supervisors set "sustainability" as the overarching theme of the 2004 Countywide Plan (CWP) update and adopted a set of sustainability principles to guide the revision of the plan. The purpose of this report is to provide information and a methodology to help translate the goal of energy sustainability into successful practice.

Energy is an essential commodity to every sector of the economy. Energy use affects the consumer directly through payment for energy used and indirectly through goods and services, jobs, income, environmental/health impacts, security, and other external costs. Electricity generation from fossil fuels (coal, oil, natural gas) is the single largest contributor to greenhouse gas emissions. The adverse environmental consequences also extend much further when the entire process is considered, from exploration to end-use.

Since Marin County imports nearly all its energy, most of the expenditures for energy flow out of the County and provide little local economic benefit. The dependence on energy imports also can impose a severe economic penalty to the community if energy prices quickly rise as they did in 2000-2001 costing Marin businesses and citizens an extra $60 million in one year.

Achieving a sustainable energy future requires three elements:

- using energy efficiently and wisely;
- producing as much energy as is feasible with local renewable resources; and
- importing energy from renewable resources for needs that cannot be met locally.

The manner in which the built environment is designed, constructed, and operated has a significant impact on energy use. Built-environment design decisions on every scale—from the region to the city to the neighborhood block, street, and building—determine the rate at which people use energy in their daily lives. Local government policies and programs impact energy efficiency, use of renewable energy, and green building. Renewable and other clean generation technologies are often smaller scale and built closer to the use moving regulatory control from the State to the local governments. In the new century, local governments play an increasingly important role in the development of a sustainable energy future.

1. What is a Sustainable Energy Future?

At the highest level, Marin homes, businesses, and industry would endeavor to use resources efficiently and all our sources of energy would be renewable (i.e., not diminishing), clean, affordable, and equitably produced. This would include the energy embodied in the goods and services and the infrastructure that captures and distributes the energy we use. The ideal is not a precise target but a process that allows us to learn and adapt as our environment changes over time. Our interim targets will be defined by where we're starting from and what is technically, economically, and culturally feasible to achieve within a defined timeframe. The starting point is an assessment of where we are today. Then we can examine where we are headed if we continue with our current practice. Finally, we can define a new future based on a course of action guided by the principles of sustainability.

2. The Energy Planning Process

Energy planning, especially with respect to sustainability, has not been a traditional part of the County planning process. Planners forecasted growth and PG&E would accommodate the growth in their resource plans. Since Marin has been able to import all of its energy, local governments have limited experience with energy resource constraints.

Marin's experience with integrated waste management may provide the closest model for integrated *energy* management. Increasing solid waste flows, diminishing landfill resources, toxics and other issues forced local governments to plan and manage the solid waste stream. Formerly, new landfills accommodated the growth in solid waste. Today, we have adopted recycling strategies to greatly reduce the amount of waste going into landfills. The strategies required changes in policy, technology, administration, management, industry, and behavior in every home and business.

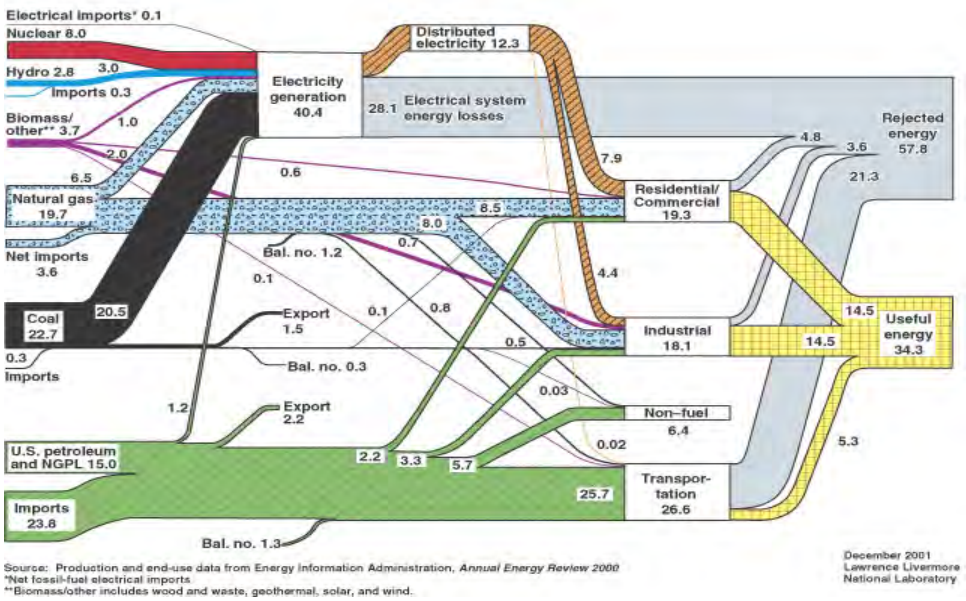
Creating a sustainable energy future requires the same level of integration into our society. The diagram shown below suggests the process necessary to plan and implement an integrated energy strategy. Similar to waste management, we need new information and tools to embark on a sustainable resource path.

Energy Planning Process

PROCESS	ASSESS		DECIDE	IMPLEMENT	EVALUATE
PRODUCTS	Trends, Issues & Strategies Report - Public input Energy Technical Report Methodology, data , background	Strategic Energy Plan Prioritized Targets & Strategies	CWP Update Energy goals, objectives, policies and strategies	Business Plan Work plan for managing, funding and implementing strategies	Status Report Progress Trends & Issues Recommendations
TASKS	Develop methodology & collect data	Analyze impacts & identify decision Criteria	Integrate & adopt policies, targets & strategies	Develop a work plan for implementing strategies	Measure, evaluate & modify programs
TOOLS & INFORMATION	Energy Sources & Uses Local Resources Demographics Trends & Issues: Local & External Public Opinion & Participation Impact variables & indicators Policies & Strategies	Impact-based criteria: Environmental, Economic, Equity, Magnitude, Multiple benefits Feasibility-based criteria: Technical, Economic Jurisdictional, Market, Administrative System Impacts Relationship to transportation, water, land use, etc.	Impact Analysis Prioritized targets & strategies Plan Elements Natural Systems Built Environment Economy, Equity & Culture System Impact Tools Place3s, GIS	Target Markets End-use Sectors New/Existing development High impact markets (3E's) Implementers County & city agencies Special Districts Utilities Public/private partnerships Regional collaborations Resources Technology, funding, suppliers, technical assistance, training,	Indicators Energy, economic, demographic & environmental data Feedback Surveys, evaluations, focus groups, measurement, hearings Trends & Issues Changes & Impacts Barriers & Opportunities

Where Are We Today?

Figure 1. U.S. Energy Flow Trends 2000 (in Quads)[1]

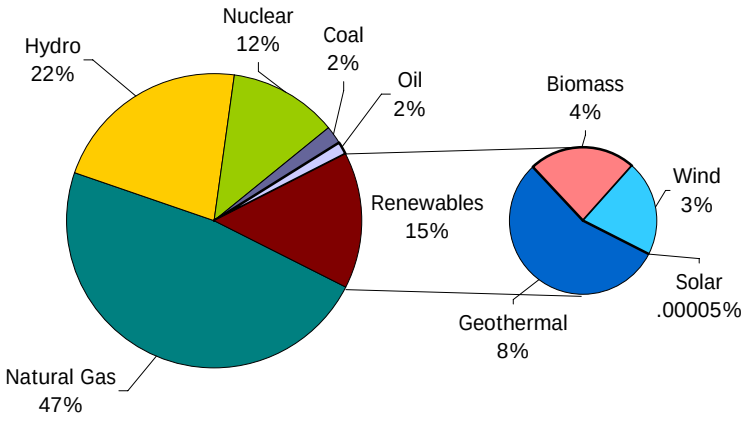


[1] The diagram shows the flow of energy in the United States from the sources of energy to the uses. A Marin County-specific flow chart could also highlight what energy we import and from where, the dollar flow out of the community, and the environmental impacts flowing from generation and other activities. At this time, insufficient data is available to create a similar flow chart for Marin County.

Where Our Energy Comes From:

Marin County meets virtually all of its electricity and natural gas needs through imported resources[2]. Pacific Gas & Electric (PG&E) is the sole distributor and principal supplier of electricity and natural gas[3]. California supplies only 16% of its natural gas needs from in-state production. Eighty-four percent of the State's natural gas is imported: Canada (28%), the Southwest (46%) and the Rockies (10%)[4]. California has insufficient pipeline capacity to meet its wintertime peak demands and utilities have compensated by stockpiling natural gas in the summertime.

Figure 2. PG&E Energy Sources, 1999



Source: 1999 California Energy Commission

PG&E generates or purchases electricity generated from a variety of resources. Natural gas (47%), hydroelectric (22%), nuclear (12%), and renewable energy (15%) account for 96% of the generation. The principal sources of PG&E's renewable energy are geothermal, biomass and wind.

Since deregulation in 1998, PG&E sold most of its steam generation facilities and has only retained ownership of plants that meet less than half the electricity demand in its service territory. PG&E's remaining plants include Diablo Canyon Nuclear Power Plant, its hydroelectric facilities[5], and steam combustion turbines in San Francisco and Humboldt Bay. The remainder is made up of purchased power, including all of the renewable generation[6].

[2] Other resources including propane, wood, solar electric contribute less than 1% to Marin's supply mix.
[3] Some electricity is supplied under contracts with Energy Service Providers (ESP) but is still distributed by PG&E. Such contracts were let under the now-suspended Direct Assess rules established by California's restructuring legislation.
[4] Data: California Energy Commission.
[5] Because of adverse environmental impacts associated with large dams, hydroelectric power plants are defined as "renewable" only if the plants are under 30 megawatts or certified as "low-impact hydro" by the Low Impact Hydro Institute.
[6] Deregulation changed the reporting requirements for our sources of energy in California. PG&E only provides generation source information for PG&E owned facilities. Sources of power sold to the utility from independent producers (known as Qualifying

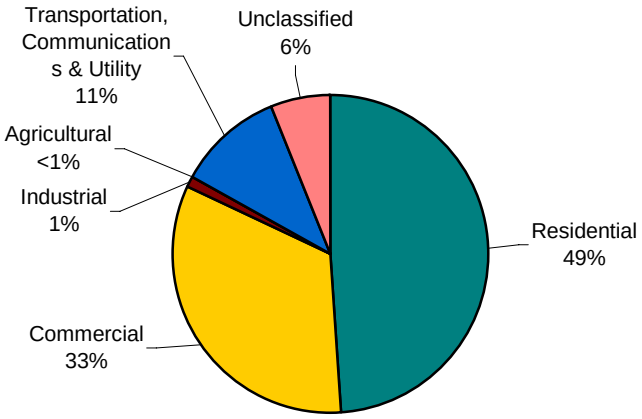
Since Marin has no electricity generation within the County, the unique geographic isolation of Marin requires all electric power to be transmitted from the North and the East via the Solano/Napa/Sonoma areas to the PG&E Ignacio substation. Natural gas is also transported through a single pipeline through Marin. Having no alternatives for any of our electricity and natural gas supplies leaves Marin extremely vulnerable to supply disruptions that could result from either natural or unnatural events.

Where Our Energy Goes

1. Energy Use by Sector

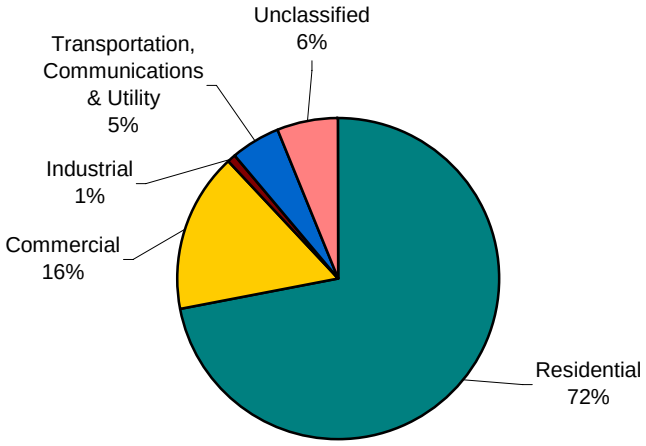
Marin's residential sector uses 49% of the electricity and 72% of the direct natural gas. The commercial sector uses 33% of the electricity and 16 % of the natural gas. Together they account for over 80% of the energy use in the built environment. Adding to that electricity used for water and sanitation pumping accounts for over 90% of the electricity use.

Figure 3. Marin Electricity Use, 2000



Facilities or QFs) and from the ISO (Independent System Operator) are no longer reported on a utility system basis, only a statewide basis. The most current information available is from 1999.

Figure 4. Marin Natural Gas Use, 2000



2. Energy Use by Jurisdiction

The following charts show year 2000 energy use in Marin County by jurisdiction. Novato and San Rafael account for 54% of the electricity and 47% of the natural gas used in the County. Only 9% of the electricity and 4% of the natural gas use is in the unincorporated areas of the County.

Figure 5.
Electricity Use by Jurisdiction

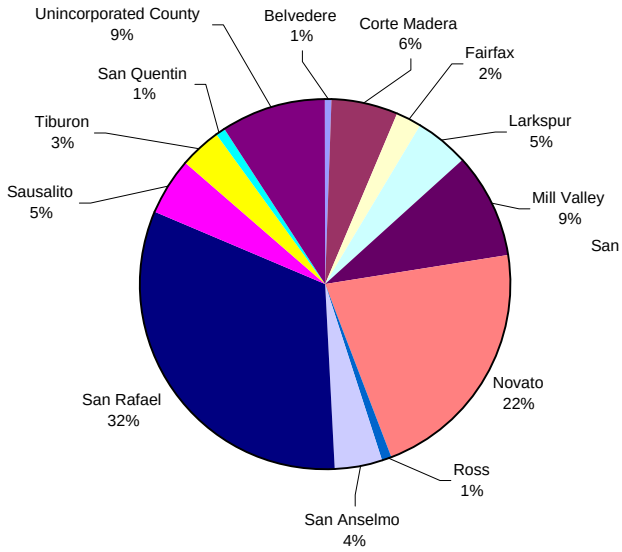
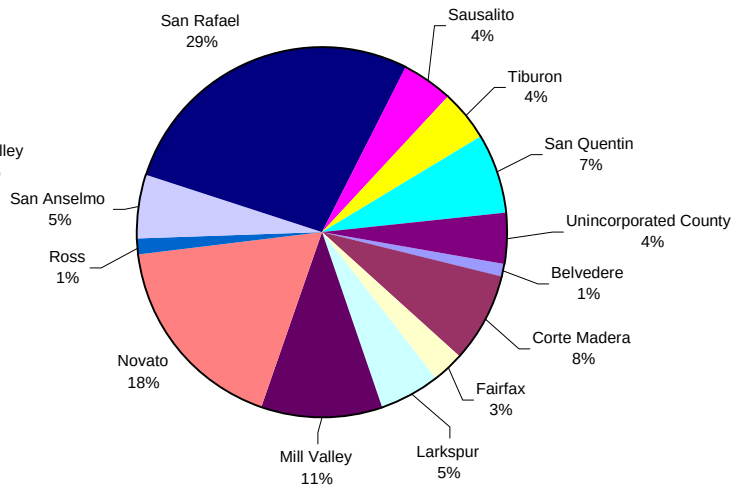


Figure 6.
Natural Gas Use by Jurisdiction



One category of energy use not presented here is called "embodied energy" or "net energy." These terms refer to the energy required to produce and deliver the goods we buy here but are made elsewhere. "Green building" policies and strategies (such as the LEED building standards) are an

example of a method to address this form of energy consumption[7]. Attempting to quantify the embodied energy and impacts of local goods consumed is beyond the scope of this report but should be explored as the planning process continues.

3. Energy Use by End-use

Residential and commercial buildings account for over 80% of electricity and natural gas use in Marin. The charts below show U.S. total energy use by end-use in residential and commercial buildings.

Nationwide in the residential sector, space heating (33%) is the largest end-use of energy followed by water heating (15%) and space cooling (10%). In the commercial sector, lighting (24%) is the largest end-use of energy followed by space heating (16%) and cooling (12%). Local planning and building codes and initiatives can have the greatest impact on reducing space heating and cooling loads of new and existing buildings.

Figure 7.

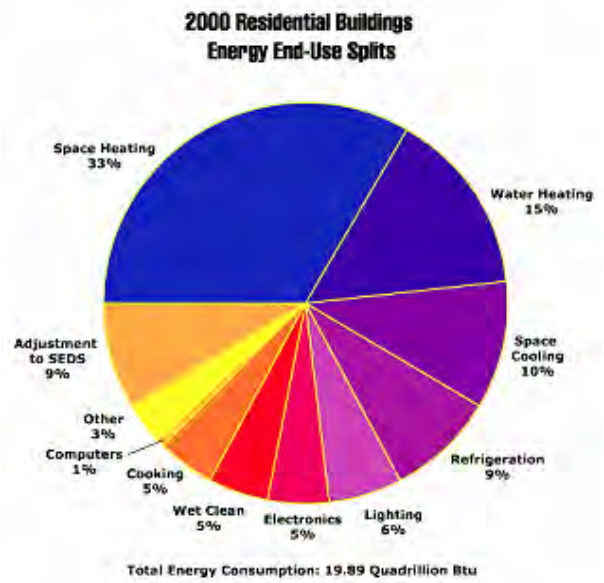
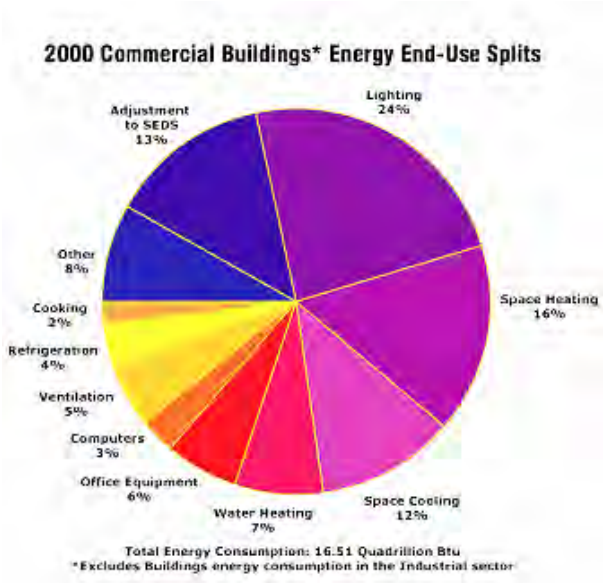


Figure 8.



What Energy Costs Us

Energy use affects us directly through what we pay for the energy we use in our homes and businesses, and indirectly through goods and services, jobs, income, environmental/health impacts and other

[7] For example, the manufacturing of Portland cement is very energy intensive. Any action we take to reduce the amount of Portland cement used in construction (such as increase the use of fly ash in the concrete mix) will save energy and reduce any related environmental impacts.

external costs[8]. The impacts are not equitably distributed. Energy price hikes have greater negative impacts on low income, small and energy intensive businesses. Air pollution resulting from electricity generation directly affects people living close to the generator. However, increases in greenhouse gas emissions affect everyone. This section introduces the societal (economy, equity, environment) impacts that can be considered when prioritizing policies and programs for the County.

Quantifying the societal costs associated with different sources of energy is very complicated and has been the subject of much research and debate through the years. For purpose of local policymaking, understanding the issues and relative costs associated with different sources of energy is more useful than struggling to accurately quantify them. The marketplace (and public policy) often prices goods and services on perceived value rather than actual cost. (Otherwise, people wouldn't pay thousands of dollars more than they need to for cars and other goods.) Therefore, understanding the scope of impacts may be sufficient to guide policy.

1. Economic Impacts

Energy is an essential commodity to every sector of our economy. Since Marin County imports nearly all of its energy, nearly all of the expenditures for energy flow out of the County, providing little local economic benefit. The dependence on energy imports also can impose a severe economic penalty to the community if energy prices quickly rise as they did in 2000-2001 costing Marin businesses and citizens an extra $60 million in one year. Conversely, investment in energy efficiency and local renewable supply can greatly benefit the local economy and provide some control on price fluctuations.

Marin's collective energy bill for natural gas and electricity was about $214 million in 2000 and we spent $142 million for electricity in 2000 and $170 million, in 2001 -- nearly $28 million more in 2001 even though actual consumption dropped by 6.6%. The actual loss to the local economy is much greater since virtually all of the additional cost left the County. Conversely, a California Energy Commission study reported that every dollar invested in energy efficiency returned $2 dollars to the community. Prices are forecasted to remain about 30% higher than 2000 prices for the rest of the decade but could spike periodically if natural gas shortages occur again. This could result in a direct economic loss to Marin's homes and businesses in excess of $500 million over the next 8 years.

2. Equity Impacts

Low-income households are particularly vulnerable to rising energy costs for several reasons:

- energy consumes a larger portion of total income
- homes tend to be older, not weatherized, and have older less efficient appliances
- they lack the means to invest in energy saving appliances and weatherization

[8] External costs exist when the "private calculation of benefits or costs differs from society's valuation of benefits or costs". For example, pollution represents an external cost because damages associated with it are borne by society as a whole and are not reflected in market transactions. For more information, see Jonathan Koomey and Florentin Krause, *Introduction to Environmental Externality Costs,* Energy Analysis Program, Applied Science Division, Lawrence Berkeley Laboratory, 1997. The quote is from Griffin, James M., and Harry B. Steele. 1986. *Energy Economics and Policy*. 2nd Orlando, FL: Academic Press College Division

- renters are in tough position between wanting to make improvements, but not wanting to invest in a home or apartment that they do not own
- building owners are resistant to make changes since they often do not pay the energy bills

3. Environmental Impacts

Electricity generation from fossil fuels (coal, oil, natural gas) is the single largest contributor to greenhouse gas emissions. The adverse environmental impacts extend much further when the entire process is considered, from exploration to end use. All fossil fuels contribute CO_2 , CH_4 , N_2O, NOx , CO, Reactive Organic Gases, hydrocarbons, particulates, trace metals, and thermal pollution. Oil and coal add major sources of sulfur dioxide pollution and ash waste. The environmental and social costs include drilling, refinery, pipeline and tanker accidents and spills[9].

A comprehensive analysis of the societal costs of pollution and other externalities associated with energy production is extremely difficult. Even if you can measure the pollution at the source, tracing the pathways to predict the impacts and translating those into societal costs is complicated at best[10]. Traditionally, we have accounted for these costs through regulation. For example, government requirements for air pollution controls on sources of emissions establish a cost as the price of pollution control. Regulations that set limits on pollution (e.g., air district rules, the Kyoto Protocol) have created markets for trading emission credits (e.g. carbon credits, renewable trading credits) in which the market determines the price of pollution. Neither system captures all the societal costs.

Like other local governments, Marin County is currently using statewide emissions coefficients to determine the County's contribution to greenhouse gas emissions. While this may lack accuracy, at least the data is available and allows the County to establish a relative benchmark to determine if it is moving in the right direction in future years.

Where Are We Headed?

Introduction

The sustainable energy objective is to reduce energy demand and increase the supply of local and imported renewable energy. Another objective is to improve the local economy, the environment, social justice, and the quality of life in Marin's communities. Therefore, general trends that impact local energy demand and supply need to be examined in addition to energy trends that impact the local economy, the environment and society. In addition, there is a need to understand trends and issues that may impact the effective implementation of local energy initiatives.

[9] Appendix D lists the kinds of pollution and other adverse impacts that can occur from exploration to end-use for various sources of energy.

[10] To understand environmental impacts translate into costs, consider the case of sulfur dioxide. SO2 is emitted from oil and coal combustion as a gas. Some of the SO2 is converted through chemical reactions in the atmosphere, to sulfuric acid, some of which then falls in rain into lakes and watersheds. Some of this sulfuric acid is neutralized by buffering actions in the water and soil. The altered acidity of the lakes is the stress. The costs (social, economic, and environmental consequences) are the destruction of fish and other wildlife, mobilization of aluminum, damage to trees, and reduction in recreational value of the forest.

Identifying and assessing relevant trends and issues is fundamental to the planning process[11]. There are numerous demographic, economic, environmental and social indicators to guide land use planning, housing, health care, economic development, and environmental quality. There are indicators for energy on a macro scale (region, state, federal) but there is not a coherent set of tools for local energy planning. This section provides a first step in identifying and organizing trends and issues relevant to Marin County.

Trends and Issues that Impact Local Energy Demand

1. Population Growth, Residential and Commercial Development

The key drivers of energy demand in Marin County are population growth, and residential and commercial development. The County's agricultural and industrial base is small, accounting for only about 2% of the County's energy demand, and is not expected to grow significantly. The population is expected to grow by only 12% by the year 2020. While this level of growth is relatively low compared to other Bay Area counties, it still represents an increase in the demand that will have to be met by imported resources if current energy use is not reduced and local resources are not developed.

Every new resident increases energy demand, even if the new resident is a new addition to an existing household. Every new residential and commercial building establishes a *minimum* new energy demand for end uses such as space and water heating independent of the number of people occupying the building. New development may require additions to community facilities such as water and sanitation that will increase energy demand as well. Land use policies and building standards will determine how much energy new development will require.

Policymakers have many opportunities to limit the demand for new resources and increase the use of local renewable resources to accommodate the new growth. These opportunities include energy efficient land use planning and better building standards that are discussed in the strategies section of this report. The regional "Smart Growth"[12] planning initiative, principally motivated to enhance multi-modal transportation options, creates multiple energy efficiency benefits as well. More infill and higher housing densities reduces the per unit demand for electricity and natural gas. Smart Growth modeling data captures the energy impacts of the land use options.

2. Other Trends Affecting Demand

Other local trends that may have an impact on energy demand and need to be examined in more detail include:

[11] Trends indicate the general direction, movement or prevailing tendency of a course of events. Fewer but larger dairies, more cars per household, and larger more expensive homes are some examples of possible trends. Issues are topics of concern to the community. Key issues may involve unmet needs or may be subject to dispute. Protection of agricultural lands, traffic congestion, and high cost of housing are examples of issues.

[12] "Smart Growth" has no single definition but common considerations include development that revitalizes central cities and older suburbs, supports and enhances public transit, promotes walking and bicycling, and preserves open spaces and agricultural lands. Smart Growth seeks to revitalize the already-built environment and, to the extent necessary, foster efficient development at the edges of the region with the goal of creating more livable communities with sufficient housing for the region's workforce.

- location of new residential development in warmer microclimates,
- size of new homes,
- increasing number of energy using appliances, and
- the shift to an older population.

Location trends: New residential development may be in hotter summertime microclimates where new homes would have air conditioning and high water use for landscaping. The extra cost of installing air conditioning in new homes is small. Air conditioning (A/C) may be installed in an increasing number of homes even though it may be largely unnecessary. If it is installed, the potential for A/C to be used during the summertime peak demand could be very high.

Home size trends: The CDA has identified a trend toward increasing home sizes and the Board of Supervisors adopted a performance standard to limited the energy demand in new homes over a certain size. Since over 80% of the housing stock in Marin is already built, increasing home size from remodeling is another potential trend to examine.

Appliance trends: The new trend, even among moderate-income home buyers, is to "upscale" their appliances. Even though new appliances may be more efficient, a larger refrigerator or television set can equal or exceed the energy consumption of an older, smaller appliance.

Age trends: Marin's trend toward an older population that spends more time at home may increase residential energy use.

In summary, increasing demand for energy can be caused by trends that are not immediately obvious. While some of these trends do get captured in the California statewide demand forecast, Marin County may have unique conditions that will not be apparent and captured in statewide forecasts. What is presented here is a starting point and there are still many questions to be answered. As with the identification of any trend, correlation does not necessarily mean causation. This is particularly true for energy use since this type of analysis may be unfamiliar to most planners.

Trends and Issues that Impact Energy Supply

1. Introduction

Since Marin County currently imports nearly all of its energy supply, the trends affecting supply are largely external to the County. Historically, the responsibility to provide sufficient, reliable and affordable energy lay with the monopoly utilities and the regulators. The County's role has been limited to the siting of transmission and distribution lines for electricity and pipelines for natural gas[13]. This will change as the County pursues more local renewable supply and the market for distributed generation grows.

[13] The County adopted ordinances over 20 years ago to allow and protect customer-side of the meter supply options such as solar and wind generation, but few systems have been installed in the intervening years, largely due to the low-cost of utility provided energy and the high cost of alternative systems.

For the built environment the two primary forms of energy supply are electricity and natural gas. Marin County meets virtually all of its electricity and natural gas needs through imported resources. Pacific Gas & Electric (PG&E) is the sole distributor and principal supplier of electricity and natural gas[14].

2. Natural Gas Trends

California began deregulation of natural gas in 1992-93 by allowing non-core gas customers (large industrial users and power plants) to buy natural gas in an open market, essentially to get "cheaper" prices. These customers were also no longer required to maintain storage of gas to meet their wintertime requirements. This was significant because California imports 84% of its natural gas and lacks sufficient pipeline capacity to meet winter demand.

Following the restructuring of the electric power industry in 1997, PG&E sold its gas-fired power plants. By 2000, 80% of such plants had been sold by California utilities. Many of the new power plant owners choose not to pay the extra cost to store natural gas. When a restricted gas market forced prices higher in the winter, they were allowed to charge the ratepayers for the increased cost of generation. A combination of events occurred in the winter of 2000-2001 that caused a severe shortage in the supply of natural gas and a tripling of its retail price.

While prices have settled down and some of the issues leading to the natural gas shortages have been resolved, the market remains volatile. Uncertainty in natural gas prices and supply can be expected in the years to come.

The largest end-uses for natural gas in Marin are space and water heating. There is no near-term energy substitute planned for natural gas although substitute fuels have been developed. Conversion of biomass into natural gas can provide a renewable alternative. The most significant action that can be taken to reduce the impact of gas price fluctuations is to reduce consumption of natural gas through efficiency and renewable end-use options, such as climatically appropriate design and solar water heating.

3. Electricity Trends

Recent and dramatic changes in the structure of the electric industry (as evidenced by the recent energy crisis) are forcing local governments into a new energy planning and policy role. The changes include a shift in the structure of the energy industry from highly regulated to highly volatile markets, and a shift from centralized power production to clean distributed generation.

The change in the structure of the energy industry has led to uncertainty in the supply, reliability and affordability of energy -- issues that, in turn, create new adverse local economic and social impacts. State policymakers have responded with many new laws that will affect energy supplies and can create problems and opportunities for local governments.

The shift to decentralized generation creates new land use, health and safety issues and also creates opportunities for increasing local renewable supply. Understanding these trends is critical to defining

[14] Some electricity is supplied under contracts with Energy Service Providers (ESP) but is still distributed by PG&E. Such contracts were let under the now-suspended Direct Assess rules established by California's restructuring legislation.

the new role the County must play and identifying the opportunities to move toward a sustainable future.

Electric Industry Restructuring: Almost everyone is aware of the California "energy crisis" from the front page headlines since 2000. For local policymakers, it is useful to understand the legislative and regulatory changes that led to the crisis, as well as the impact those changes will have on price and supply stability in the future[15]. Appendix A provides a more complete summary of events leading to the crisis. Many of the underlying causes of the crisis are still present and critical institutional issues have no resolution in sight. The notable trends affecting communities include:

- uncertainty in the future supply and reliability of electricity and natural gas;
- higher electricity prices for the next several years to pay off utility and state energy debt and for long term power purchase contracts;
- continuing fluctuations in the price of electricity and natural gas;
- continuing conflicts between state and federal policies, and market interests;
- increasing difficulty in electricity demand forecasting;
- reduced investment in new supply-side options due to the aforementioned market uncertainties.

For the foreseeable future there will be increasing energy costs without any compensating benefits. The adverse impacts of higher costs and supply uncertainties will continue to ripple through the local economy.

Shift From Centralized Power Production To Clean Distributed Generation: The electric utility industry is undergoing another transformation that affects local planning. The old era was characterized by economies of scale achieved by large centralized power generation. The new one is characterized by economies of manufacturing leading to cleaner and smaller distributed generation.

Clean distributed generation (DG) includes such technologies as fuel cells, gas-fired cogeneration, biomass, solar, and wind. DG systems can be placed on the customer's side of the meter and can thereby reduce the customer's demand for energy and even allow a customer to sell power back to the utility. Larger distributed generation systems may serve multiple customers such as in an industrial park, a subdivision, or a commercial zone. Some of these technologies are commercially available today while others are expected to be commercial within the next five to ten years, well within the timeframe of the Countywide Plan update. A common characteristic of these technologies is that they are small-scale and locally sited. Planning and approval for distributed technologies will be largely within the jurisdiction of Marin County and cities.

The County addressed some DG issues in the past, such as protecting solar access and establishing requirements for small wind energy systems. However, the Countywide Plan should address new and emerging issues such as:

[15] While the issues leading up to the energy crisis are subject of much research, debate and litigation, and predicting future impacts is fraught with uncertainty, understanding the changes in policy that led to the crisis, and which of those policies is still in place will provide some measure of understanding of the importance of local action. "How We Got Into The California Energy Crisis" by William Marcus and Jan Hamrin, Center for Resource Solutions, Feb.,2002, provides a good summary of the events leading up to the crisis. It can be downloaded at www.resource-solutions.org.

- policies to promote and approve fuel cells and other small-scale clean generation systems in commercial and industrial applications, in new development and redevelopment areas;
- increased efficiency measures in new and existing buildings;
- code changes to make provisions for and lower the cost of installing new technologies in new and renovated buildings, facilities, and communities.

While Marin's projected growth is low, the County should examine the impact of projected growth on the transmission and distribution infrastructure and identify the potential for distributed generation.

Some of the adverse impacts of not addressing DG issues include localized dirtier air from micro-turbines, more dollars leaving the community in higher energy costs, higher capital costs to retrofit new technologies, and fewer local options as new technologies emerge.

Marin's lack of local infrastructure and community energy capabilities is a natural consequence of the manner in which the energy industry was structured in the last century. The changing structure of the energy industry requires the pursuit of local solutions to protect and advance the quality of life in Marin's communities.

Changing State and Federal Laws and Regulations: State and federal energy laws and regulations have been in a constant state of flux since deregulation and no resolution is expected anytime soon. Many of the short-term solutions, such as a financial bailout of the utilities, long-term power purchase contracts, recovery of alleged fraudulent overcharges, the PG&E bankruptcy, new Federal Energy Regulatory Commission (FERC) rules, are the subject of so much fractious political debate and so many lawsuits that no clear resolution is predictable.

California did adopt a Renewable Portfolio Standard (RPS) in 2002, mandating an increase in the amount of electricity provided from renewable energy sources. The RPS requires each utility to provide at least 20% of its electricity supply from renewable generation by 2010. As of 1999, PG&E reported that about 15% of its supply was from renewable sources. Therefore, PG&E has to add only about 5% more to meet the requirement. Meeting the goals of the RPS will help the County achieve part of its sustainable energy goal.

The State also passed legislation (AB117) that would allow local governments, alone or jointly, to aggregate the retail electric customers in their jurisdictions (defined as "community aggregators") for the purpose of purchasing power. Local governments may not take over the local distribution system but may enter into contracts to provide the energy component of the electric bill. The utility would still do billing and remain the default provider should any customer choose to "opt out" of a community aggregation program. Community aggregators cannot escape state and utility debt obligations resulting from the energy crisis and the long-term power contracts. At this time, it is unclear whether or not community aggregators could buy power less expensively than the utilities. One reason for local governments to consider community aggregation is that it provides a means by which local governments could choose to increase the use of renewable resources above what the utilities are required to buy.

AB117 also allows local governments, or other entities, to apply to administer energy efficiency programs in their jurisdictions. The CPUC is directed to develop a plan and procedure under which local governments could apply by July of 2003.

Trends & Issues that Impact our Community

1. Increasing Cost of Energy

Energy price trends impact the economy, the environment, and social equity both directly and indirectly. Higher energy prices directly reduce the amount of money available to purchase other goods and services. Nearly all the additional money paid for imported energy leaves the County and thereby reduces local spending and, in turn, business income, investment, tax revenue and jobs. Higher energy prices both locally and across the state increase the cost of the goods and services, further reduce spending power, and compound the adverse impact on the local economy.

The economic impacts on different market segments will vary and are not equitably distributed. For example, low or fixed income end users (residents, public institutions, small businesses); energy-intensive uses (restaurants, domestic and agricultural water pumping); and least efficient facilities (older buildings, appliances, processes) are being hurt the most by higher prices. Low- income residents tend to have the least efficient appliances and live in older, less efficient homes. Higher energy prices do not simply reduce disposable income but cut into essential purchases. While the County as a whole will benefit from any local reduction in energy use, this inequitable and severe economic impact on some sectors suggests that an energy efficiency program priority should be placed on the financially hardest hit markets.

The energy crisis by some estimates will cost Californians at least $40 billion (including repayment of debt, high cost long term power contracts, utility bailouts, etc.). Many impacts are not included in this amount. One significant adverse impact on the County sustainability goal results from the loss of capital for renewable energy projects. This problem manifests in multiple ways: the direct loss of potential investment dollars, the state policy to meet the short term generation needs with natural gas-fired plants; hostile state and utility policies toward independent renewable generators; unreliable demand forecasts, and the flight of investment capital resulting from the financial collapse of the energy industry. This issue affects new large scale renewable generation projects in California in the near term.

2. Decreasing Reliability of Supply

While cost is one factor affecting businesses' choice of location, the reliability of the energy supply is a significant factor for some desirable business sectors, such as many of the high tech processes and computer facilities. As the electric grid becomes less reliable, these companies are exploring ways to secure or generate their own reliable and high-quality power. Enhancing and/or providing clean distributed generation opportunities may be a useful tool in retaining or attracting businesses to the extent desired.

3. Continuing Erratic State and Federal Policy

The trend toward continued uncertainty in state and federal policy affects the choice of local energy strategies. No one can predict if and when the current fractious and contradictory nature of state and federal energy policies and regulations might find some resolution. The current flux in public policy makes it very difficult for local governments to know what they can count on as they plan local programs.

For example, in the last few years, the electricity market was opened up to retail customers (allowing them to choose different electric suppliers providing green power and lower cost power), then closed (returning most customers to the original utilities), then partially opened again (allowing retail customer aggregation). Recently introduced legislation may close the door again. One new state bill with powerful sponsors calls for a return to the original system of regulation.

Since most bills are amended many times as they move through committees, currently proposed legislation will most likely have changed by the time this is being read. Therefore, the trend is less about the energy policy content or direction than the continuing uncertainty in energy policy. The trend suggests that the unreliability of current state and federal policy should be an important criterion for assessing local sustainable energy strategies.

Trends Affecting Implementation of Local Energy Initiatives

1. Historical Energy Issues and Strategies in Marin's Planning Process

In 1979, the Marin County Board of Supervisors created an Energy Advisory Committee and directed the County Planning Department to prepare an Energy Element for incorporation into the Countywide Plan. The Energy Element was intended to provide a rationale and guidelines for saving energy and increasing the use of renewable energy sources. In 1980 the Board adopted an Energy Element as part of the Countywide Plan and established the goal of creating a sustainable energy future for Marin County. The Plan further specified that the County should reduce energy use by 50% by the year 2000, an ambitious goal that the county did not achieve. Electricity and natural gas use per capita fell only slightly between 1980 and 1987. Petroleum use increased between 1980 and 1987 because of increased vehicle miles traveled and use of vehicles with lower fuel efficiency.

The adopted 1980 Energy Element included a number of policies directing the County to establish mandatory energy conservation programs. In 1982, when implementation programs proposed by staff reached the Board of Supervisors for approval, the Board declared that the County should not require private investments in energy conservation and thereby shifted County policy away from mandatory towards voluntary conservation programs. The County did develop programs and ordinances to implement some of the goals and policies contained in the Energy Element. The County Board of Supervisors adopted a solar access ordinance in 1982 and a wind energy conversion ordinance in 1983. From 1982 to 1984 the County Planning Department employed an energy coordinator who organized conferences and training programs to educate Marin residents about energy conservation techniques. However, these implementation activities fell short of the comprehensive system of energy conservation programs for homes and businesses envisioned in the 1980 Energy Element.

When the Countywide Plan was updated in 1994, staff recommended and the Board of Supervisors adopted a Plan that deleted all energy goals and policies deemed unlikely to be implemented, that eliminated a separate Energy Element, and that rolling surviving energy goals and policies into the other elements of the Plan. The stated goal at the time was to “preserve a focus on energy and natural resource conservation...[and strengthen] the County's energy policies by incorporating them into elements of the Plan, which are the focus of ongoing implementation activities.” The staff felt that the

shift in policy from mandatory to voluntary conservation prevented the implementation of many Energy Element policies. Since the California Government Code requires local plan policies to be linked to implementation programs, staff reasoned that energy policies that could not be implemented should be removed from the Countywide Plan.

2. Local Energy Planning: Coming Full Circle

From the point of view of 2002 it may be hard to understand why the County backed away from implementing its ambitious sustainable energy goals in the 1980s and eliminated many of the conservation policies in the 1994 CWP update. A short review of events from the 1980s to the present may help place the County's actions in context and provide the rationale for again becoming more active in working toward energy sustainability.

Responding to an earlier "energy crisis" in the late 1970s and early 1980s, many California communities hired staff and set up offices dedicated to implementing energy efficiency and renewable energy. By the early 1980s, over 120 local governments -- Marin included -- had established energy offices and programs that actively pursued energy savings and alternative energy options. When energy prices declined in the mid-1980s, energy issues faded from the headlines. Proposition 13 had also been taking a heavy toll on local government finances. Most local governments closed their energy offices so that only a handful of communities were left with local expertise to face the energy crisis of the past few years[16]. There was also great opposition from some stakeholder groups like builders and realtors to mandatory programs that they perceived to hinder their businesses. Energy resource planning had not been a local planning function and had no built-in constituency. With only a handful of exceptions, local energy planning was moved to the back burner.

Over the past 25 years, many communities have included energy policies in General Plan updates but have failed to implement them. In fact, California's Subdivision Map Act requires the design of a subdivision to provide for future passive or natural heating and cooling opportunities (Sec. 66473.1) but few local governments have complied. A lack of good supporting data and a local constituency reduces the political will to enforce energy policies when they conflict with other planning, development and economic interests. Tight local government budgets have also forced limited staff resources to be focused on mandates that are enforced with penalties such as low-income housing and solid waste reduction. Achieving the sustainable energy goal will require unambiguous policies backed up by strong implementing programs for impact assessment, training and enforcement integrated into the normal planning process.

3. Global Warming/Reducing Greenhouse Gas Emissions

On April 23, 2003, the Marin County Board of Supervisors adopted a resolution recognizing both the gravity of global warming and the responsibility for local action. The resolution committed the County to assessing current countywide contributions to greenhouse gas emissions, committed to reducing such gases, and implementing policies and programs necessary to achieve the reductions. Meeting this

[16] There have been a few notable exceptions: Berkeley, San Diego, San Francisco, San Jose and Santa Monica, for example, maintained their capacity to develop and implement energy efficiency programs to benefit their communities. Some among this small group of local governments have been able to respond effectively to the more recent 'energy crisis', and to access State funds made available to further develop local programs.

commitment requires addressing energy efficiency and renewable energy goals and strategies in the CWP update. Electricity generation is the single largest contributor to greenhouse gas emissions in the United States.

4. Energy Intensity Trends and Economic Indicators

Energy intensity is a relative measurement of the amount of energy required to produce a unit of activity such as economic output (goods and services) or end use (heating and cooling). Like worker productivity, it provides a relative indicator of a trend toward greater or lesser efficiency. For example, total electricity consumption in Marin divided by the gross domestic product (GDP) of Marin provides a measure of the Kwh required to produce each $1 of GDP. Viewed over time, this indicator can show whether the local economy is getting more or less energy intensive. For example, California's residential, commercial and industrial sectors have become less energy intensive (more energy efficient or productive) from the 1970's to the present. However the rate of efficiency gains has decreased since about 1990, which correlates to a reduction in spending on utility energy efficiency programs during the same period. As suggested earlier, the trend toward more efficient electrical appliances can be offset or surpassed by a trend toward larger and more appliances. A better understanding of the energy intensity trends in Marin's residential and commercial sectors is needed to optimize sustainable energy strategies.

5. Public Opinion Trends

Public opinion can affect the relative success or failure of some energy strategies, especially those that require a certain level of awareness to implement. Public opinion can also weigh heavily on the cost of implementing certain programs. For example, the media attention to the continuing energy crisis that started in 2000-2001, combined with rising energy costs and a massive statewide advertising campaign for conservation, greatly increased the public awareness of and interest in energy efficiency and renewable energy. Local programs that might not otherwise have been possible without such awareness can now be implemented.

Current events coupled with public information campaigns can dramatically affect the consumption of energy as well. Such campaigns are most effective when coordinated with initiatives to institute permanent reductions in use through hardware changes such as replacement of old inefficient appliances, weatherization and permanent retrofits with energy efficient lighting. (Screw-in compact fluorescent lights are not included because they can be replaced with less efficient and less expensive incandescent lights once they burn out).

The energy crisis of the 1970s, which led to price hikes and shortages, generated much press and led to major energy conservation public information campaigns from the late 1970s through the mid-1980s. A combination of state and federal energy efficiency regulations and the public response led to decreasing per capita energy consumption during these years. The easing of the crisis and lower gas and stabilized electricity prices from the mid-1980s through the 1990s led to a slowing of the energy efficiency trend. Energy conservation attributed to behavioral changes may also have declined in the 1990s. The energy crisis of the past few years brought a return of supply shortages, price hikes, news headlines, and massive public information campaigns. Consumers, showing the significance of behavior-induced conservation, voluntarily reduced electricity consumption in the summer of 2001 by 15 to 20% statewide. Electricity consumption declined 6.6% in Marin County between 2000 and 2001. The significant decline can be attributed to public awareness of the energy crisis, significant price increases,

and a massive statewide public information campaign asking people to conserve energy. In contrast, residential electricity consumption increased 18.5% from 1995 to 2000 with only a 0.7% growth in population.

Strategies that depend, in part, on public awareness and willingness to conserve may be easier and less costly to implement in the near term than major changes in energy sources.

Public Preference for Meeting Electricity Needs Favors Efficiency and Renewables.

The California Power Authority has examined and summarized the technology preferences of Californians for meeting future electricity needs. The opinions expressed at Marin County visioning workshops summarized in the Key Trends, Issues, and Strategies Report support, if not go beyond, the statewide preferences for clean generation and renewable sources of energy.

The Gallup polling organization produced the following report dated November 27, 2001, which discusses the energy preferences of Californians and compares them with the current sources of energy in the state:

> Californians, like others across the country, are concerned that adequate new power plants be built to meet their energy needs. Indeed Gallup polls throughout this year[17] indicate that a majority of people (81%) favor investing in new power plants to deal with projected energy shortages. In addition, the Gallup polls indicate that a larger number (91%) favor an investment in renewable sources of energy such as solar, wind and fuel cells rather than conventional sources (such as nuclear at 42%). Indeed, mandated energy efficiency (e.g., more efficient appliances at 85%) and increased transmission lines (it scored higher in May during the peak of energy shortage concerns[18])..These polls indicate that the people prefer efficiency and especially renewables as a way to address our energy shortages.
>
> It is important to remember that many of California's fossil power plants are over 30 years old and are very inefficient and therefore highly polluting even with controls. They will need to be replaced over the next decade. The issue is whether they will be replaced by renewables and demand side projects or still more gas fired plants.
>
> Based on public preferences, we believe the answer is to replace these old natural gas-fired plants with geothermal, wind, solar and biomass. If only 10% of these natural gas-fired plants are closed down, it will create a 3,000 MW for renewable which is within our goal for the next four years. We urge public policy to make this happen.

[17] "Americans Favor Alternative Energy Methods to Solve Shortages", Gallup News Service, http://www.gallup.com/poll/releases/pr011127.asp.

[18] In a Gallup Poll in May, 2001 conventional options less controversial than nuclear power were tested. For example, 69% of people favored more electrical transmission lines. However, efficiency measures (e.g., mandating more efficient appliances) were favored by more people (87%) and renewable sources (solar, wind and fuel cells) were favored by even more people (91%).

> Reducing demand via energy efficiency is a highly cost-effective strategy. Nationally, utilities have saved 25,000 to 30,000 MW annually, the equivalent of 100 large power plants, over the past five years through energy efficiency programs. These programs averaged 2.8 ¢/kWh, a cost that is less than that of most new power plants.[19]

The energy resource mix of today stands in sharp contrast to people's preferences. Fossil fuels and nuclear power supply 75% of California's energy today, a level of dependence that has serious implications for national security. An additional 16% comes from hydroelectric power, most of which is from large dams. Hydroelectric power brings with it a much larger share of the risk associated with traditional generation because of the annual uncertainty of the water availability. This uncertainty can have significant consequences in the capacity capability and the energy availability between one year and the next. Another 2% comes from biomass, much of which is from direct combustion waste-to-energy plants. Only 7% of the energy comes from the cleanest renewable sources – geothermal, wind, and solar energy.

New plants that have come online since 1999 or are currently under construction are powered from the following sources: 96% natural gas, 2% wind, 1.2% geothermal, 0.6% biomass, and 0.1% hydro. Continuing in this direction will further increase risk and insecurity in the California electricity market, contrary to the preferences of Californians.

The challenge to the energy policy makers is finding a way to meet the people's preferences for renewable energy and efficiency in today's uncertain market situation. Moreover, diversifying the energy mix reduces dependence on natural gas and provides a greater hedge to volatile prices from natural gas fired power plants and greater security from terrorist activities.

Where Do We Want To Go?

Energy Strategies for the Countywide Plan

Introduction

Achieving a sustainable energy future requires three elements:

- use energy efficiently and wisely;
- produce as much energy as is feasible with local renewable resources; and
- import energy from renewable resources for needs that cannot be met locally.

To achieve these goals, we must establish a practical and reliable means to measure and evaluate where we are now, where we want to go, and how we are doing. Simply put, we can't control what we don't measure. Since this function with respect to energy has not been a traditional part of the planning process, establishing a practical and permanent means of energy assessment must be a goal of the current CWP update as well.

[19] Energy Foundation, *National Energy Policy Factsheet: Utility Energy Efficiency Programs*, downloaded from www.ef.org/national/FactSheetUtility.cfm, 28 September 2001.

To serve the needs of the CWP update, the strategies have been organized into the "goal, policy, implementing program" format for the general plan.

Energy initiatives are classified under three goals:

1. **Assessment (Strategic Energy Planning)**: Assess current and forecasted energy demand and supply, assess impacts, and develop programs. This includes measurement and evaluation programs.
2. **Reduce Energy Use:** Reduce energy use and peak electricity demand through efficiency and conservation (often referred to as "Demand-side management" or "DSM". This program area includes all sectors and all end-uses of energy, both new and existing.
3. **Increase Renewable Energy Use:** Develop local renewable energy resources and shift imported energy needs to renewable energy resources. Develop local generation options in the short term that use imported non-renewable resources more efficiently.

Energy policies and implementing programs are also defined by common methods of implementation:

1. **Standards and Regulations:** mandatory measures requiring compliance justified by social good, cost-effectiveness, need, and equity
2. **Incentives:** price, financing, tax, rebate, market and process incentives providing some form of benefit beyond what the energy product or service alone would provide also justified by social good, cost-effectiveness, need, and equity
3. **Information/Education:** public awareness campaigns for any sector, market segment and demographic, including schools, using any means or media, usually in conjunction with incentive or proscriptive programs.

Goals, Policies, and Programs

Goal 1

Assessment: Establish and maintain a strategic planning process to assess, prioritize, implement, measure, evaluate and modify energy policies and implementation strategies over time. This process includes ongoing assessment of current and forecasted energy demand and supply, relevant issues and trends; technical, economic, and institutional feasibility of strategies; policy and program development; and establishing performance targets and measurements.

Description: Achieving the long-term vision for a sustainable energy future requires the integration of energy policies and programs into the normal business planning and day to day operations of the county. Policies should be unambiguous and defensible. Implementing programs should have performance targets, be measurable, linked to day-to-day operations, describe required resources (financial, human, information), create accountability, and indicate required organizational and legislative changes.

Policy

1.1 **Energy Planning.** Integrate energy resource planning and program implementation into the advanced and current planning functions of the CDA and other related agencies.

Description: If we are to prevent new non-renewable electric generation from being built to meet Marin's demand for electricity, both the county and the state must be able to measure and count on local demand reduction and renewable resource development. As we transition to smaller scale distributed generation, the role of local governments increases dramatically making local resource and impact assessment ever more important.

Current State and Federal Policies and Programs: The U.S. Department of Energy and California Energy Commission do extensive supply and demand forecasting and assessment of energy efficiency and renewable energy potential and realized savings. However, such assessments rarely provide the county and municipal data necessary to assess local potential and design local programs. As of this writing, very little funding is available from state or federal programs for local assessment and strategic energy planning.

The CPUC released a proposed rulemaking (July, 2003) that would require PG&E to provide more detailed energy use and demand data by jurisdiction and sector upon request. Such data will be useful for assessment, program design, and implementation.

Current Local Policies and Programs: The county has received a grant from the DOE "Million Solar Roofs" program to assess solar resources, and identify and address local institutional and market barriers to promote solar development. The county is currently developing a Solar Resources Geographic Information System (GIS) Map of Marin. This will enable the county to locate and quantify the physical potential for solar energy[20]. Wind and biomass will also be analyzed for potential hybrid installations. The county is also planning to install a Weather Station and Data Acquisition System (DAS). Real-time weather stations will be installed to gather data on Marin's microclimates providing a more accurate data for assessment of EE and RE potentials, and corroborate the Solar Resources GIS map data.

Programs

1.1.a *Prepare a "Strategic Energy Plan."* Develop the appropriate tools and methodology; assess current energy use and demand, potential for energy efficiency and local renewable resources; forecast future energy needs based on business-as-usual and sustainable energy scenarios; assess impacts; evaluate and adopt strategies.

1.1.b *Prepare an "Operating Plan."* Develop an operating or business plan to implement the strategies and meet the targets and timeframe outlined in the strategic plan. Work with the government and non-government stakeholders to determine the necessary resources and priorities identify and integrate additional resource and financing requirements and opportunities into the county budget process.

[20] Analysis will include solar insulation in combination with parameters such as topography, vegetation, local weather patterns and microclimates, and building footprints.

1.1.c *Progress Reports and Strategic Plan Updates.* Establish a process and format for periodic reporting on the progress of energy programs and progress toward the overall objectives. Integrate energy indicators into other appropriate documents such as *Marin Profile*.

1.1.d *Renewable Resources Feasibility Assessment.* Assess the physical, technical, economic, and programmatic feasibility of renewable energy resource potential. Incorporate into the planning process the periodic reassessment of each feasibility factor and identify what strategies should be implemented to protect and facilitate renewable resource use. Examples include:

- The county adopted a solar access ordinance to protect a homeowner's right to the solar resource if and when the homeowner chooses to use it.
- While capital cost may be a major limiting factor to the extensive use of solar today, requiring appropriate orientation and stub outs for PV and solar domestic water heating to the roof of new homes may help to lower the cost of such installations in the future.
- The county may have significant potential to exploit tidal power along its bay shore. However, the technology may not be commercially available until the 2010 to 2020 timeframe. The county should identify the land use issues that could prohibit or facilitate tidal power development if and when it becomes feasible and take the necessary steps to preserve the resource option.

1.1.d.1 Map renewable resources in a solar resource Geographic Information System (GIS); map the electric and gas transmission/distribution system, community growth areas requiring new energy services, zoning, energy intensity, and other data useful to deployment of distributed generation (DG) technologies, such as fuel cells, cogeneration, solar, wind, and biomass.

1.1.d.2 Assess issues critical to mitigating potential adverse impacts and creating new opportunities for distributed generation and economic development in the county. Request assistance from state and federal agencies in identifying local siting issues relevant to distributed generation technologies such as fuel cells, small cogeneration systems, and emerging concepts such as the microgrid and "hydrogen economy."

Policy

1.2 **Evaluation, Monitoring and Verification.** Institute a process for data collection and analysis to evaluate program impact and modification to meet sustainability targets.

Program

1.2.a *Evaluation, Monitoring and Verification.* Develop a plan for the ongoing monitoring, evaluation and verification of implementing programs. Include in the initial plan guidelines for monitoring, evaluation and verification of energy programs and

requirements for specific programs in the CWP. Incorporate the resources requirements for monitoring, evaluation and verification into the Operating Plan.

Goal 2

Reduce Energy Use: Reduce energy use and peak electricity demand in all sectors and all end-uses of energy, both new and existing through energy efficiency, conservation and peak load reduction.

Description: Demand-side energy use generally refers to all energy uses on the customer's side of the meter. Energy efficiency, conservation, and peak load reduction are collectively called demand-side management or DSM. Renewable technologies such as solar water heating, passive solar design, solar-electric generation, and wind energy conversion systems (WECS) on the customer's side of the meter are sometimes considered demand-reducing technologies since these activities lower the demand for energy[21]. DSM strategies are implemented in all sectors.

Standards and Regulations

Land Use

Description: Energy and land use are mutually dependent. The availability and affordability of energy resources affect land use patterns and development. Land use patterns and development, in turn, affect energy use. Subdivision and zoning regulations can either hinder or promote the efficient use of energy and local renewable resources. Sustainable energy strategies for land use generally overlap sustainable strategies for transportation, housing and community facilities. Since transportation and housing issues drive the push for "smart growth" strategies much more than energy and are well-documented in the literature, compatible land use strategies are listed here but not discussed in detail[22]. Policy topics include: mixed-use development, infill and redevelopment, compact development and clustering, full utilization of existing infrastructure, street and parking design, multi-modalism, urban forestry and landscaping, open space, climatically-appropriate design and solar access, recycling, location & design of community facilities. These topics are addressed under the housing, transportation, community design, community facilities elements. The PLACES3 software used in the "Smart Growth" planning process also accounts for the energy impacts of land use choices.

Building Design Standards (Residential and Commercial Buildings)

Description: Building energy use includes all activities commonly associated with the operation of the building including space heating and cooling, domestic water heating, lighting, appliances and other miscellaneous uses. This includes the design of the building envelope that affects the ultimate heating/cooling and lighting loads.

[21] For example, a recent study found solar water heating has the greatest technical potential to reduce natural gas consumption in the commercial sector. "California Statewide Commercial Sector Natural Gas Energy Efficiency Potential Study," Prepared for Pacific Gas & Electric Company, Prepared by KEMA-XENERGY Inc., May 14, 2003

[22] For further information on land use and energy issues, see "Energy Aware Planning Guide," from the Calif. Energy Commission, January 1993 (Publication No. P700-93-001) available online (www.energy.ca.gov), and "Energy: Preparing an Energy Element for the Comprehensive Plan," by the So. Carolina Energy Office, November 2000, available online (www.state.sc.us/energy), and other documents available from CDA.

Current Programs-State:

1. California law requires minimum energy efficiency standards (Title 24) for all new and remodeled (with limitations) residential and commercial buildings. The original standards were adopted in 1978 and have been updated 4 times, the last in June 2001. The standards are adopted by the California Energy Commission and enforced by local building departments.

2. Solar Access: State law requires protection of solar access but enforcement is also local.

Current Programs-Local:

1. Performance standard: Marin County adopted the Single Family Dwelling Energy Efficiency Ordinance (Ordinance 3356) in 2002 requiring all new and remodeled homes larger than 3500 square feet to meet the Title 24 requirements of a 3,500 sf home. This can be achieved with energy efficiency and/or renewable energy. The impact of this ordinance is limited to homes built in the unincorporated areas of the County.

2. Solar Access: Marin County adopted an ordinance in 1982 to protect passive or active solar design elements and systems from wintertime shading by neighboring structures and trees.

3. Marin Municipal Water District (MMWD) adopted three ordinances to reduce water use. Water efficiency programs reduce energy use as well because water requires significant amounts of electricity for pumping and treatment. Measures that reduce hot water use such as low flow showerheads and faucets further reduce energy use (mostly natural gas in Marin). MMWD ordinances are effective across all jurisdictions within their district. The ordinances are:

a. Water-efficient landscaping plans submitted and approved for new or upsized meters - residential
b. Low-flow toilets and showerheads retrofit upon change of ownership – residential

4. North Marin Water District has an adopted an ordinance requiring homes built after January 1, 1992 to have low-flow showerheads and faucets upon change of ownership. NMWD also has a cash for grass program to encourage customers to limit the water use of lawns, and a toilet rebate program.

New Policies and Programs:

Policy

2.1 **Supplemental Building Standards:** Adopt standards for new and remodeled buildings that exceed current State standards.

Description: Building design standards offers great potential for conserving energy and reducing energy use. Marin can adopt higher standards than those of the State of California that better reflect local conditions, criteria and goals. Buildings account for most of the electricity and natural gas consumption in the county. The initial design and construction of a building will impact the energy efficiency of the building over its lifetime (easily 50 to 100 years or more). Optimizing for energy efficiency and

renewable resources in the initial design costs less and results in the greatest benefits over the building's lifetime.

Programs

2.1.a *Supplemental Commercial Building Standards.* Develop and implement building standards that exceed Title-24 for commercial buildings based on appropriate criteria for the county's specific climate zones, sustainability goals and other appropriate criteria. For example, the LEED (Leadership in Energy and Environmental Design) green building rating system could be adopted as a local standard.

2.1.b *Supplemental Residential Building Standards.* Develop and implement building standards that exceed Title-24 for Residential buildings based on appropriate criteria for the county's specific climate zones, sustainability goals and other appropriate criteria. Establish technical and financial feasibility criteria by which the standards can be periodically improved. For example, a pre-established payback threshold could be established so that new technology could be adopted as the costs come down below the threshold.

2.1.c *Single Family Dwelling Energy Efficiency Ordinance.* Continue to implement the single-family dwelling energy efficiency ordinance that requires all new and remodeled homes larger than 3,500 square feet to meet the State of California Title 24 requirements of a 3,500 square foot home. The requirements can be achieved with energy efficiency and/or renewable energy.

2.1.d *Solar Access.* Continue to implement provisions of Title 22 (Marin County Development Code) to protect passive or active solar design elements and systems from wintertime shading by neighboring structures and trees.

2.1.e *Green Building Rating System.* Adopt a green building rating system for residential remodels and new construction. Fast track design review process could be offered for those that obtain a certain rating.

2.1.f *Existing Building Standards (Change of Ownership).* Adopt standards for existing residential and commercial buildings that require retrofit at change of ownership.

Description: Retrofitting existing buildings offers the greatest opportunity for reducing energy use in Marin. Requiring an energy retrofit at the time a building is sold provides one of the best opportunities to increase energy efficiency. An energy audit and installation of efficiency measures can be combined with existing inspections, financing, and data collection activities. Implementation can be made compatible with MMWD's and NMWD's water conservation ordinance that already requires inspections and installation of water saving measures.

2.1.g *Building Standards Enforcement.* Improve compliance with existing laws.

Description: Standards only achieve the projected energy savings if they are implemented effectively. Enforcement and compliance requires good training of both builders and inspectors, and a process for ongoing assessment.

2.1.h *Professional Green Building Certification.* Adopt minimum green building certification standards for architects and contractors.

Description: Green building design, materials and building techniques require certain knowledge most architects, engineers and contractors did not get through their initial education and training. While many excellent free seminars sponsored by AIA, PG&E and other organizations are offered that quickly teach the basics, only a limited number of contractors and architects will ever take the time to attend. Continuing education is standard practice and a requirement of some design professions. Adopting minimum certification standards in green building as a requirement for issuing building permits could significantly advance awareness and use of green building practices. Many compliance options can be provided including free training seminars, self-study and testing. The industry can be given ample time to comply to reduce any perception of hardship created by a certification requirement.

2.1.i *Public Buildings Supplemental Standards.* Adopt higher standards for public buildings to provide leadership and promote innovation in green design and efficient energy use. The LEED (Leadership in Energy and Environmental Design) Silver certification standard or higher can be used for all new public buildings over a certain size.

Description: Public buildings provide great opportunities to demonstrate and promote the best green design practices as well as reduce government costs. Green buildings are also healthier for those working in them and can increase worker comfort and productivity. The County can adopt the highest LEED standard to guide design and commissioning of new facilities. The State of California and Cities of Los Angeles, Portland, and Seattle, have adopted the LEED Silver standard to be applied to all new civic buildings. The County could also provide leadership in green building by adopting an ordinance declaring that any new County facility will have a minimum rating of LEED Silver.

Incentives For Energy Efficiency and Renewable Energy

Description: Incentives include price, financing, tax, rebate, market and process measures providing some form of benefit beyond what the energy product or service alone would provide. Incentives are justified by social good, cost-effectiveness, need, and equity.

Current programs—Non-local: California has offered various incentive programs including tax credits, rebates, low-interest loans, and technical assistance for building measures and appliances exceeding Title-24 standards. These programs change over time and are administered through multiple entities (CEC, CPUC, PG&E and the private sector). State and federal law specifically mandates funding for special need programs such as low-income weatherization. These fall into the incentive category because they are optional for the end-user and vary greatly in how well they are utilized on the local level.

Current Community Development Agency Programs:

- BEST-Building Energy Efficient Structures Today. Fast track permitting and fee waivers for projects that either:
  - Exceed title 24 by 20%,
  - Install a renewable energy system that meets 75% of building's needs
  - Comply with the BEST Checklist
- Over-the-counter approval of solar electric and water heating systems if the collectors are at the flush mounted to the roof.
- Technical assistance for energy and green building design based on the LEED rating system, Alameda County *Green Building Guidelines* and Environmental Building News' *Green Spec*.
- Rebates for installation of specific energy efficiency and renewable energy measures. This program was in place from January 1, 2002 to January 31, 2003. Over $52,000 in rebates were awarded for energy star appliances, Low-E windows, increased insulation, solar electric and water systems, efficient furnaces, and lighting. This program will save over $100,000, and 920,000 lbs. of CO_2 per year.

Current MMWD and NMWD Programs: MMWD and NMWD has offered various rebate programs for retrofitting residential and commercial buildings with water conserving appliances.

New Policies and Programs:

Policy

2.2 **Energy Efficiency/Renewable Energy Incentives.** Promote sustainable energy practices and support standards and informational programs with appropriate incentive programs for both public and private sector.

Programs

2.2.a *Fee Reductions and Expedited Permit/Approval Processing.* Evaluate and implement opportunities for supporting new programs with fee reductions and expedited processing. Evaluate the impact and value of existing incentives and continue, modify or eliminate as appropriate.

2.2.b *Tax Exemptions and Credits.* Evaluate and implement opportunities for supporting new programs with tax benefits such as property tax exemptions, sales tax rebates and other such locally controlled financial options.

2.2.c *Technical Assistance.* Provide energy efficiency and green building technical assistance for building retrofits and new construction.

2.2.d *Sustainable Energy Financing.* Evaluate and implement opportunities for supporting new programs and promoting sustainable energy practices through financing mechanisms such as pooled project financing, low-interest loans, local government joint ventures.

2.2.e *Affordable Housing Weatherization.* Implement an affordable housing weatherization program to provide technical assistance and weatherization.

2.2.f *Energy Efficiency Program Administration.* Establish a program to administer Public Utility Commission Public Goods Charge funding for energy efficiency programs and rebates for Marin County.

2.2.g *Regional Energy Collaboration.* Establish a regional collaboration among local governments, special districts and other public organizations to share resources, achieve economies of scale, and develop plans and programs that are optimized on a regional scale.

Energy Information/Education

Description: Public awareness campaigns can be for any sector, market segment and demographic, including schools, using any means or media. While information programs can stand alone, they are often used in conjunction with incentive or proscriptive programs.

Current Non-local Programs: California has offered various information/educational programs and materials including public information campaigns using all forms of media. These programs change over time and are administered through multiple entities (CEC, CPUC, PG&E, non-profit groups and the private sector).

Current Local Programs: As of this writing Marin County CDA has offered five trainings for county and city staff, building professionals, and the general public. Approximately 300 people have attended these sessions. Two solar energy workshops will be held in the spring of 2003 was attended by approximately 120 home and business owners and building professionals.

The BEST Library is located in the Reference section of the Civic Center Library. This section includes over 50 books and/or periodicals on energy efficiency, green building, and sustainable living.

The Green Building Resources Exhibit displays green building materials and techniques. It has samples of various materials and where you can find them locally. This exhibit can be found at the Civic Center planning and building counter and at a variety of local events.

Information on the County's programs, valuable educational resources, and links to other sites can be found at www.maringreenbuilding.org and www.marinsolar.org.

The Alameda County *Green Building Guidelines* have been reprinted to provide building professionals, homeowners, and businesses on the values, materials, and techniques of green building.

The Marin County Green Business Program offers technical assistance and marketing opportunities for business that:

- Demonstrate compliance with environmental regulations.
- Conserve energy, water, and other materials.

- Prevent pollution and waste generation.

MMWD has offered various information programs for water efficiency, conservation and water-efficient landscaping.

Policy

2.3 **Green Building Information and Education.** Establish and maintain programs for information, marketing, training and education on green building and sustainable design.

Description: Buildings generally have long lives (50-100+ years). The initial design, materials used, and construction quality will limit how resource efficient that building can be over it's lifetime. Green building materials and practices have grown rapidly in the past 5 years but it is still a relatively young field. The building industry is one of the slowest industries to adopt new technologies and methods. Marin's goal of a sustainable future requires it to stay ahead of the curve by adopting a proactive strategy toward sustainable building. CDA needs to continuously update and train its building staff, and the building industry as the green building movement grows and matures. Since buildings create such a long-term impact on Marin's resource needs, a reasonable impact fee could be adopted to pay for the green design assistance program. Fees could be waived for those submitting their projects to green design review. A variety of incentive and fee structures should be examined.

Programs

2.3.a Design Assistance & Training. Establish a permanent green building design assistance program to promote sustainable design practices and educate building professionals.

2.3.b *Green Building Certification.* Support the National Association of the Remodeling Industry's green building certification program for contractors. List contractors who are NARI certified on the County's website.

2.3.c *Green Building Residential Design Guidelines.* Include green building guidelines in the County's Residential Design Guidelines.

2.3.d *LEED Rating System.* Promote the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating system. Maintain Marin County's membership in the USGBC.

2.3.e *Multi-Sector Technical Assistance for existing buildings.* Provide assistance in increasing energy efficiency for existing residential, commercial, and industrial buildings.

2.3.f *Information, marketing & Support.* Develop informational/training programs on an as-needed basis to support other standards and incentive programs.

2.3.g *Sustainable Marin Curriculum.* Promote the development and implementation of a sustainability curriculum in schools and community colleges.

Policy

2.4 **Energy Legislation.** Track important federal and state energy legislation. Adopt resolutions supporting legislation that promotes energy efficiency and renewable energy.

Process Energy (Sectors: Industrial, Agricultural, Commercial, Infrastructure)

Description: Process energy is generally defined as energy used in the process of producing, moving and storing goods. This excludes end uses associated with building operations such as space heating and cooling, domestic water heating, and lighting, but includes refrigeration of goods, pumping, and any industrial or agricultural process.

Industrial and agricultural sector energy use accounts for only about 2% of energy use in the County. However, such energy use may create greater adverse impacts or opportunities that may be worth addressing. For example, financially marginal but locally important agricultural operations can be hurt by high energy costs, price and supply uncertainties, but may also have good opportunities for efficiency and renewables. It is beyond the resources available for this report to examine these sectors in any detail. Generally, there are many opportunities for energy efficiency and renewable resource use in process energy, and many State, utility and private sector initiatives are available to help.

Processes vary too greatly in type, scope and design to establish a set of standards similar to building standards. Within certain types of businesses such as restaurants, supermarkets, and laundries, energy efficient best practices have been developed. Assuring best practices have been considered as a condition for any government approval may be practical to implement and consistent with current requirements for impact analysis and mitigation.

New Policies and Programs:

Policy

2.5 **Process Energy Efficiency**. Evaluate and implement appropriate standards and other requirements to improve energy efficiency, reduce waste, and increase use of renewable resources in commercial, industrial and agricultural processes.

Description: Any new commercial, industrial, agricultural or infrastructure process that requires approval from the County could be required to assess the potential for cost-effective energy efficiency and renewable energy opportunities. For example, a company requesting a variance or conditional use permit for a large commercial laundry could be required to provide an energy analysis prepared by a certified energy professional recommending or attesting to the use efficient and cost-effective process technology (e.g., heat recovery, solar water heating).

Programs

2.5.a *Process Energy Assessment.* Assess the needs and opportunities for recommending specific energy efficiency measures for process energy in the affected sectors. Implement specific initiatives identified by the assessment.

2.5.b *Process Energy Mitigation.* Require an energy efficiency analysis for any new process that needs County approval.

Goal 3

Increase Renewable Energy Use: Develop and provide incentives for local renewable energy resources and shift imported energy needs to renewable energy resources. Develop local generation options in the short term that use imported non-renewable resources more efficiently.

Description: Supply-side energy is generally defined as energy provided to customers or energy provided on the utility side of the meter. Examples, include large central generating facilities such as coal, oil, nuclear, hydroelectric,[23] gas-fired generation; centralized renewable generation from wind, geothermal, biomass, tidal and solar; distributed generation[24] from renewable sources (wind, solar, geothermal, biomass, and small hydroelectric facilities[25]); and distributed generation from non-renewable sources such as natural gas fired cogeneration, microturbines, and diesel. Marin currently has no supply-side generation and no non-renewable generation sources are planned.

Opportunities for local renewable energy resources include:

- solar electric (principally on the customer's side of the meter[26])
- solar domestic water, pool and space heating (offsetting gas or electricity use[22])
- wind turbines (either on the customer or utility side of the meter)
- small hydroelectric
- biomass
- tidal power

[23] For state and federal policy, hydroelectric projects are classified as renewable or non-renewable based on their size, type and ecological impacts.

[24] Distributed generation (DG) is electric generation connected to the distribution level of the transmission and distribution grid usually located at or near the intended place of use. DG systems can be sized to meet a facility's total electrical requirements or they can be sized to partially replace or supplement electrical service from the grid. DG systems typically range in size from less than a kilowatt to tens of megawatts.

[25] Some measures like cogeneration can provide both supply-side and demand-side benefits. They can best be defined by their primary task. For example, cogeneration facilities sized to produce and sell excess electric power can be considered supply-side options even though they are also increasing the efficiency of energy use on the customer's side of the meter.

[26] For purposes of the CWP, solar thermal and photovoltaic (PV) systems installed on the customer's side of the meter that principally supplement or meet the needs of the customer are considered demand reduction technologies. PV systems under 10KW are subject to Net Metering laws that allow a customer to turn their meters backwards when generating more electricity than using and take back from the grid when not. Net metered customers do not get paid for any excess power delivered to the utility so systems are generally sized to the customer's load.

Cogeneration – the combined use of electricity and waste heat - is typically powered by natural gas but can also be powered by biomass. Natural gas fired cogeneration can provide a cleaner more efficient near-term option than traditional centralized power generation.

Fuel cells operate much like a battery by transforming chemical energy into electrical energy directly without a combustion process. Fuel cells are fueled by hydrogen produced from natural gas or electricity. Since the electricity may be produced by renewable or non-renewable resources, fuel cells are not inherently renewable, but provide a means to store energy (in the form of hydrogen) from intermittent renewable sources like solar and wind. Similar to cogeneration, fuel cells powered by natural gas can achieve high efficiencies if the waste heat is utilized on site.

Standards and Regulations

Description: The land use and building code issues associated with solar technologies, such as subdivision design and solar access, have been addressed in the current CWP and in the consultant report on barriers in the current plan and codes. This section focuses on distributed generation (DG) technologies that have not been addressed in other sections of the CWP update.

Emerging DG technologies such as fuel cells are becoming commercially viable but have limited market penetration. While natural gas fired cogeneration is an old technology, scaling it down to the size to meet the load of an apartment building or single home is relatively new. Some DG technologies like natural gas fired micro turbines, while relatively clean, still raise air quality concerns. Diesel-fired generators have clear adverse air impacts. While the need to develop guidelines for local government land use and permitting issues has been identified by state and federal agencies, little work has been done toward that end. New DG technologies that have not been addressed in the planning and building codes may be subject to conditional use permits, variances and other unnecessary and costly requirements. Current codes also may not protect DG resources and technology from conflicting uses or simple set asides that would make DG more practical and cost-effective. For example, in a redevelopment area, land may need to be set aside with access to utility interties and easements to deliver hot water or steam to multiple buildings in a district. In a home, space may be needed next to the water heater with gas stub outs appropriate for a fuel cell generator that would heat water as well as generate electricity.

Other than solar access protection, California currently has no laws to protect major energy resource sites nor provides guidance on planning for DG. Oregon does mandate local renewable resource protection and we can look to their laws for some guidance. The CWP should adopt a policies to protect major renewable energy resource sites in Marin, promote appropriate DG technologies and commit to adopting rules and regulations to protect and facilitate their use when sufficient information is obtained to do so.

Policy

3.1 **Promote Clean Distributed Generation (DG) and Enhance the Opportunities for Future Distributed Generation Technologies.** Promote the use of clean distributed generation through planning and building codes, and permitting processes that facilitate the siting and use of distributed generation in buildings and communities.

Programs

3.1.a *Develop Land Use Regulations to Facilitate Use of Clean Distributed Generation Technologies.* Develop appropriate guidelines and codes for utility easements, rights of way, land set-asides, and other appropriate measures to ensure that available and planned DG technologies can be effectively incorporated into new developments and redevelopment areas. Develop and adopt clear and uncomplicated rules to permit specific clean DG technologies in new and existing buildings.

3.1.b *Develop Building Codes to Facilitate Use of Distributed Generation in Residential and Commercial Buildings.* In conjunction with the appropriate code organizations, review and modify existing building codes (electrical, mechanical, fire, etc.) to remove barriers to use of emerging distributed technologies.

Policy

3.2 **Protect Development of Future Indigenous Renewable Energy Opportunities.** Preserve opportunities for future development of renewable energy sources such as tidal, biomass, and small hydroelectric.

Description: Marin County has potential for indigenous renewable energy resources such as solar, wind, tidal, biomass, and small hydro. Only policies to protect solar and small wind-electric applications have been adopted to date. Development of the other resources may be limited by current and future land use policies. For example, Marin is estimated to have a potential for at least 100MW of tidal power. One technology is anticipated to be tested in the San Francisco Bay by 2006 and may be commercially viable by 2010. While commercial development is still some years away, the location and scale of land-based facilities required to exploit the resource is known. The county should take steps to ensure that the possible future use of this resource is not precluded by current development policies.

Programs

3.2.a *Identify and Assess Significant Indigenous Energy Resources and Potential Conflicting Uses.* Identify significant energy resources such as tidal power and wind; identify and assess conflicting uses and land use, interconnection, environmental, economic and other issues affecting their development.

3.2.b *Develop and Adopt a Plan to Protect Significant Indigenous Resources.* Develop and adopt appropriate policies and procedures to limit conflicting uses and protect indigenous renewable resources. Establish utility easements, rights of way, land set-asides, and other appropriate measures to protect the future use of these resources.

Incentives For Clean Distributed Generation

Description: Incentives include price, financing, tax, rebate, market and process measures providing some form of benefit beyond what the energy product or service alone would provide. Incentives are justified by social good, cost-effectiveness, need, and equity.

Current programs -Non-local: California has offered various incentive programs for DG including tax credits, rebates, low-interest loans, and technical assistance. These programs change over time and are administered through multiple entities (CEC, CPUC, PG&E and the private sector).

New Policies and Programs:

Policy

3.3 **Renewable Energy Incentives.** Promote sustainable energy practices and support standards and informational programs with appropriate incentive programs for both the public and private sectors.

Programs

3.3.a *Fee Reductions and Expedited Permit Processing.* Evaluate and implement opportunities for supporting new distributed generation programs with fee reductions and expedited processing. Evaluate the impact and value of existing incentives and continue, modify or eliminate as appropriate.

3.3.b *Tax Exemptions and Credits.* Evaluate and implement opportunities for supporting new programs with tax benefits such as property tax exemptions, sales tax rebates and other locally controlled financial options.

3.3.c *Technical Assistance.* Provide technical assistance on distributed generation as part of the green building technical assistance program.

3.3.d *Identify, Finance and Develop Distributed Generation Opportunities in Local Government.* Provide leadership and set an example by financing and installing innovative DG technologies using tax-free low interest loans and other available financial options.

Policy

3.4 **Imported Renewable Resources.** Identify, evaluate and recommend options for purchasing renewable resources for that portion of Marin's energy demand that is met by imported energy.

Programs

3.4.a *Evaluate the Feasibility of Purchasing More Renewable Energy Through Community Choice Aggregation.* Evaluate the feasibility of becoming a community choice aggregator to purchase more renewable energy on behalf of citizens and businesses than the state has mandated.

3.4.b *Renewable Energy Certificates.* Evaluate the feasibility of purchasing renewable energy certificates to reduce Marin County government's contribution to greenhouse gas emissions.

Appendices

Appendix A:
A Methodology for Prioritizing Energy Strategies

This report began with a simple definition of a sustainable energy future: "At the highest level, Marin homes, businesses, and industry would endeavor to use resources efficiently and all sources of energy would be renewable, clean, affordable, and equitably produced... The ideal is not a precise target but a process that allows learning and adaptation as the environment changes over time. Interim targets will be defined by a starting point and what is technically, economically, and culturally feasible to achieve within a defined timeframe." An initial set of strategies is proposed in the "Key Trends, Issues, and Strategies Report" issued in January 2003. Other strategies are culled from successful initiatives that other communities have pursued. The next task is to screen these strategies for effectiveness within the timeframe and resource parameters of the CWP update. The screening process can be broken into three components:

1. Choose and weight the criteria for assessing the strategies based on local conditions.
2. Do an initial screening to eliminate, combine and modify the strategies to narrow the field to those that best reflect the criteria.
3. Rank the strategies and use the highest ranking strategies to set the objectives, define the policies and implementing programs.

The first two steps can be achieved quickly with a small team meeting to roughly assess and choose a manageable and targeted set of strategies for further ranking. Additional available information needed to help assess the smaller set of strategies can be gathered next. Finally, the strategies can be ranked and chosen by a second meeting of the team.

Establishing Assessment Criteria

The purpose of assessment criteria is to identify strategies with greatest net benefits and the most likely to be effectively implemented. Based on the guiding principles, the screening criteria might include:

- Energy-use reduction potential
- Renewable energy supply potential
- Rate of energy-use reduction or supply increase
- Ability to quantify impacts
- Environmental impacts
- Equity impacts
- Economic impacts (cost-effectiveness to the public)
- Technical feasibility
- Financial feasibility (cost-effectiveness to the individual)
- Security impacts
- Enforceability

The California Energy Commission developed a simple ranking system using similar criteria for the Southern California Association of Governments[27] . First, a weight or importance is assigned to each criterion. Every strategy is then rated for each criterion. The following sample matrix provides a means for a team to quickly prioritize strategies:

Sample Scoring Matrix For Strategies

Title:

Description:

Scoring:

CRITERION	WEIGHT	X	RATING	=	SCORE	COMMENTS
1. Energy-use reduction potential	4	X	5	=	20	
2. Renewable energy supply potential	4	X		=		
3. Rate of reduction or supply	3	X	1	=	3	
4. Ability to quantify impacts	2	X	1	=	2	
5. Environmental impacts	4	X	3	=	12	
6. Equity impacts	4	X	3	=	12	
7. Economic impacts (cost-effectiveness to public)	2	X	1	=	2	
8. Technical feasibility	3	X	5	=	15	
9. Financial feasibility (Cost-effectiveness to individual)	3	X	5	=	15	
10. Security impacts	1	X	1	=	1	
11. Enforceability	3	X	5	=	15	
TOTAL SCORE					77	

Weight: 1-4 with 4 most important Rating (positive impact): low=1, medium=3, high=5

Once all strategies have been rated and sorted by rank, the team can determine how many of the top strategies should be adopted. Existing policies can be compared to the prioritized strategies; then recommendations for modifications, additions or deletions can be made.

[27] Regional Energy Reference Document (Staff Draft), December 1993

Appendix B:
The Shifting Structure of the Energy Industry: A Summary of the Events Leading to the California Energy Crisis and the Implications for Local Government Policy

While almost everyone is aware of the California "energy crisis" from front page headlines since 2000, far fewer understand the legislative and regulatory changes that led to the crisis, and the impact those changes will have on price and supply stability in the future[28]. Much analysis of the "California deregulation experiment" has been and continues to be written. While far from complete, this summary of events attempts to frame the issues relevant to local governments moving forward.

A. The Natural Gas Market

Deregulation in the energy industries began in the early 1990's with the natural gas market. In 1992-93 California began allowing non-core gas customers (large industrial users and power plants) to buy natural gas in an open market, essentially to get "cheaper" prices. These customers were also no longer required to maintain storage of gas to meet their wintertime requirements. This was significant because California imports 84% of its natural gas and lacks sufficient pipeline capacity to meet winter demand. Utilities had been required to build up stores of natural gas in the summertime to meet wintertime demand. The new rules let the non-core customers choose to pay for storage or not. At the time, large industrial users and power plants had the option of shifting to oil if natural gas was not available. New air quality rules in the 1990's restricted most the non-core customers to natural gas. As long as the utilities owned the power plants it was assumed they would do the prudent thing and store sufficient gas to meet their needs.

California initiated the restructuring of the electric power industry in 1997. The investor-owned electric utilities (IOUs), whose profit historically was based on a percentage of their capital investment in power plants, were shifted to a profit based on a percentage of kilowatt-hours sold. Depending on who is telling the story, they were permitted or encouraged to sell off their gas-fired power plants. By 2000, 80% of such plants had been sold by California utilities. Many of the new power plant owners choose not to pay the extra cost to store natural gas. They didn't care if a restricted gas market forced prices higher in the winter since they were allowed to pass increased cost of generation through to the ratepayers.

[28] While the issues leading up to the energy crisis are subject of much research, debate and litigation, and predicting future impacts is fraught with uncertainty, understanding the changes in policy that led to the crisis, and which of those policies is still in place will provide some measure of understanding of the importance of local action. "How We Got Into The California Energy Crisis" by William Marcus and Jan Hamrin, Center for Resource Solutions, Feb.,2002, provides a good summary of the events leading up to the crisis. It can be downloaded at www.resource-solutions.org.

A combination of events occurred in the winter of 2000-2001 that caused a severe shortage in the supply of natural gas leading to skyrocketing prices: a colder winter, a pipeline accident reducing the El Paso pipeline to 85% of capacity (a 5% statewide reduction in supply), lack of storage by power plants and large industrial users (only 11% of gas stored in prior years), the Federal Energy Regulatory Commission had removed all price caps for short-term sales of gas pipeline capacity in the spring of 2000 and allowed the pipeline company to sell off excess capacity to out of state distributors.

California natural gas prices rose to unprecedented heights, from typical levels of 25-50 cents/MMBtu. to a range from $15 to greater than $60/MMbtu. All of that money went to the owners of pipeline capacity. The prices served the economic function of rationing demand down to meet the supply -- closing one industrial customer after another across the west coast. While California spot gas prices finally settled somewhat by Christmas of 2000 they remained volatile and ranged from $2-$8/MMbtu higher than national prices.

B. The Electric Market

On the electric side, talk of deregulation first began about 1993 with large industrial customers pushing for an open market to obtain lower prices. The utilities in turn began posturing to protect their markets. The environmental community was frustrated with the slow response by regulators to environmental problems caused by electricity generation. Independent energy producers were frustrated by a lack of regulatory support for cogeneration and renewable energy facilities. Consumer groups generally felt consumers were the losers in the regulatory balancing act. The California Public Utilities Commission (CPUC) and the Federal Energy Regulatory Commission (FERC) at that time felt state regulation was reducing efficiency in the electricity sector and an open market would reduce prices. In April of 1994 the CPUC released a plan for electric utility industry restructuring and began hearings. The plan was modeled after a British plan for privatizing the power industry (which ultimately led to widespread profit-taking and subsequent new price controls.) The CPUC's proposal was widely viewed as onerous to all but large industrial users and the utilities, and led the state legislature to become involved. The legislature, in a hurried attempt to appease all parties, guided by inaccurate state forecasting data, and failing to understand the complexity of the issues, passed AB 1890 (the state restructuring bill) in 1997.

State officials were also lulled into a false sense of security by optimistically low electricity demand forecasts from the California Energy Commission (CEC). The CEC, which had historically forecast lower demand than predicted by the utilities, made some faulty assumptions in 1995 that proved disastrously low in 2000. These included:

- Almost 1400 MW of renewable and cogeneration capacity (that was to be acquired through an auction ordered by the CPUC) was never purchased because the utilities petitioned the FERC to kill the auction[29].
- Nearly 2300 MW of excess capacity from Northwest and Southwest sources was optimistically projected in the CEC forecast. In the year 2000, very little excess energy was available

[29] Edison claimed that it did not need power until 2004. One month later, SCE cancelled the energy efficiency programs on which that forecast was based. California spent $90 million of ratepayer money in AB 1890 (the state restructuring bill) to offset liability costs incurred by the utilities for killing these contracts and didn't get a single kilowatt-hour.

- Over 2000 MW of energy efficiency was forecast that the private utilities never acquired[30].

Thus, a projected surplus in the year 2000 became a 2000 MW deficit.

Turning over power production in the State's fossil fuel plants from the utilities, which had historically been charged with keeping the lights on, to unregulated companies, which have no responsibility for ensuring the public interest, created a host of other problems that exacerbated the crisis. For example, the utilities maintained service schedules that would ensure the power plants would be available during times of critical summer peak demand. The emerging evidence suggests that at least some of the new owners scheduled downtime whenever they chose and could cause prices to rise by keeping plants off line at critical times. Additional evidence suggests that energy traders were able to "game" the market to push prices up and reap profits.

Rules to protect residential customers from price hikes (enacted as part of the restructuring legislation) also created shortfalls between what utilities had to pay for wholesale power and what they could recover from residential customers. Inaction at the federal level (FERC) allowed prices to run wild for many months. Power suppliers refused to sell to cash poor California utilities. The State rushed through new legislation allowing it to step in and purchase wholesale power (through the Department of Water Resources). The State also rushed to negotiate and sign long-term power purchase contracts during the peak of the crisis for prices significantly higher than 2002 market prices. They are now attempting to renegotiate these contracts. The State is also pursuing recovery of alleged overcharges by the major power generators and trading companies through FERC and lawsuits.

The State negotiated financial bailouts with the utilities. PG&E chose to file for bankruptcy rather than work with the State and, through bankruptcy, is attempting to further reduce the State's regulatory oversight. SCE did negotiate and accept a bailout proposed by the CPUC, which is subject to a lawsuit. Neither case is resolved as of this writing. The State moved to spend hundreds of millions to promote new energy efficiency initiatives, fast tracked power plant siting, and issued bonds to help pay for past debt and future long-term power contracts. The final cost to Californians of the 2000-2002 energy crisis is estimated to be about $40 billion. That does not take into account the economic ripple effect from loss in sales, business investment, jobs, etc. created by high energy prices and rolling blackouts.

While the factors contributing to the energy crisis are more numerous and complex that described here, the above summary may be sufficient to convey the complexity, the magnitude, and the impact of the structure of the energy industry affecting our community. Most importantly, while the energy crisis may have dropped from the headlines, many of the underline causes of the crisis are still with us and critical institutional issues have no resolution in sight. The following excerpt from "Clean Growth:

[30] PG&E and Edison were projected to acquire 100-150 MW per year each, at the same time as they were cutting their budgets in response to performance-based ratemaking incentives and acquiring only 40-70 MW per year each. Even with the lower energy efficiency budgets, the utilities did not spend what they had been allocated. Every megawatt of unpursued conservation equals about 1.2 MW of needed new power plants with reserves and system losses.
Additional note: 2500 MW of interruptible service contracts were signed with large commercial and industrial customers by Edison as a method of inducing large customers to stay with the Company through attractive multi- year contracts. Though many customers claim they were told they would never actually have to be interrupted, Edison asserted to the CEC, CPUC and FERC that these contracts were as good as new power generation.

Clean Energy for California's Economic Future," the draft Energy Resource Investment Plan from the California Power Authority (CPA) released January 17th, 2002 states the case succinctly:

> The uncertainty in California's energy future may be much greater than some expect. A CEC staff report has said that in the summer of 2003 the capacity available to cover peak demand and minimum operating reserves could theoretically vary from a 17000 MW surplus to a 17000 MW deficit.
>
> We see the significant uncertainty in the future supply of electricity continuing for several reasons.
>
> a. In recent months, credit ratings of power suppliers have faltered and plant cancellations or postponements have become common.
> b. Private, essentially unregulated, generating companies can build or fail to build plants as they choose based solely on whether it fits their financial balance sheet. As a result, plants rise or fall with the price of electricity.
> c. Generating companies also have the legal right to sell power from their California plants out of state.
> d. Generators may spend as little as they wish on maintenance.
> e. Suppliers have no responsibility to have any reserves at all. It is, at present, not their responsibility to "keep the lights on." Furthermore, the generating companies know perhaps better than we that keeping us on short rations mean higher prices for them, while a surplus means lower prices and lower profits for them.
>
> Forecasting the demand for electricity in the future has also become very difficult:
>
> a. The surge in conservation by Californians continues to reduce consumption below historic levels. Energy consumption, even in the winter, is running up to 5% below a year ago. However, the degree to which conservation will continue into the future is uncertain.
> b. In addition, the long-term effects of the recent increase in electric rates have yet to be quantified.
> c. Energy saving technologies are better known, are affordable, and will continue to be acquired by consumers as appliances and equipment are replaced.

In the new market structure, with no one responsible for capacity assurance, and after the market meltdown, with the prospect of continuing sky-high prices and inflated returns, power plant expansions were announced with great fanfare. The CEC informed us that some 30,000 MW of new natural gas-fired plants were in the permitting and construction pipeline. And indeed some 3,000 MW were added in 2001.

Since later 2001, power plant additions and constructions projects are being canceled and delayed with alarming regularity. It is now doubtful that any of the planned generating company projects, except those nearly completed, will be built unless they have a guaranteed market - namely a long-term contract with the DWR (or in the future with the distribution utilities). The 30,000 MW may suddenly become 3,000 or at most 6,000 MW.

Appendix C: Marin Energy Use Data

2000 Residential Energy Use

Jurisdiction	Customer Count	Natural Gas 1,000 Therms	Electricity 1,000 Kwh	Percent Natural Gas	Percent Electricity	Percent of Customers	Natural Gas by Customers	Electricity by Customers
Belvedere	1,068	1,065	9,123	1.7%	1.4%	1.0%	997	8,542
Corte Madera	4,120	2,481	22,709	4.1%	3.5%	4.0%	602	5,512
Fairfax	3,867	2,315	20,937	3.8%	3.2%	3.8%	599	5,414
Larkspur	6,185	3,189	33,555	5.2%	5.1%	6.0%	516	5,425
Mill Valley	13,009	8,570	80,620	14.1%	12.3%	12.6%	659	6,197
Novato	21,293	12,582	140,320	20.7%	21.5%	20.7%	591	6,590
Ross	873	1,148	10,835	1.9%	1.7%	0.8%	1,315	12,411
San Anselmo	6,291	4,301	40,143	7.1%	6.1%	6.1%	684	6,381
San Rafael	27,796	16,185	161,825	26.6%	24.7%	27.0%	582	5,822
Sausalito	6,075	2,931	30,849	4.8%	4.7%	5.9%	482	5,078
Tiburon	4,938	3,608	35,740	5.9%	5.5%	4.8%	731	7,238
Unincorporated County	7,527	2,548	67,213	4.2%	10.3%	7.3%	339	8,930
County Total	103,042	60,922	653,869	100.0%	100.0%	100.0%	591	6,346

2000 Non-Residential Energy Use

Jurisdiction	Customer Count	Natural Gas 1,000 Therms	Electricity 1,000 Kwh	Percent Natural Gas	Percent Electricity	Percent of Customers
Belvedere	92	38	965	0.1%	0.1%	0.6%
Corte Madera	740	4,755	59,320	14.4%	7.4%	4.4%
Fairfax	399	331	10,925	1.0%	1.4%	2.4%
Larkspur	847	1,617	38,068	4.9%	4.8%	5.1%
Mill Valley	1389	1,461	50,962	4.4%	6.4%	8.3%
Novato	3522	4,239	173,602	12.8%	21.7%	21.2%
Ross	126	134	2,159	0.4%	0.3%	0.8%
San Anselmo	711	806	19,377	2.4%	2.4%	4.3%
San Rafael	5961	9,771	307,828	29.6%	38.4%	35.8%
Sausalito	1306	1,160	45,003	3.5%	5.6%	7.8%
Tiburon	514	497	14,662	1.5%	1.8%	3.1%
San Quentin	11	6,591	12,896	20.0%	1.6%	0.1%
Unincorporated County	1027	1,596	65,568	4.8%	8.2%	6.2%
County Total	16645	32,998	801,333	100.0%	100.0%	100.0%

2000 Total Energy Use

Jurisdiction	Customer Count	Natural Gas 1,000 Therms	Electricity 1,000 Kwh	Percent Natural Gas	Percent Electricity	Percent of Customers
Belvedere	1,160	1,103	10,088	1.2%	0.7%	1.0%
Corte Madera	4,860	7,235	82,029	7.7%	5.6%	4.1%
Fairfax	4,266	2,646	31,862	2.8%	2.2%	3.6%
Larkspur	7,032	4,806	71,623	5.1%	4.9%	5.9%
Mill Valley	14,398	10,031	131,581	10.7%	9.0%	12.0%
Novato	24,815	16,822	313,921	17.9%	21.6%	20.7%
Ross	999	1,281	12,994	1.4%	0.9%	0.8%
San Anselmo	7,002	5,107	59,520	5.4%	4.1%	5.9%
San Rafael	33,757	25,956	469,653	27.6%	32.3%	28.2%
Sausalito	7,381	4,091	75,851	4.4%	5.2%	6.2%
Tiburon	5,452	4,105	50,402	4.4%	3.5%	4.6%
San Quentin	11	6,591	12,896	7.0%	0.9%	0.0%
Unincorporated County	8,554	4,144	132,781	4.4%	9.1%	7.1%
County Total	119,687	93,919	1,455,202	100.0%	100.0%	100.0%

Appendix D: Environmental Impacts from Fossil Fuels

Table I. Environmental Insults From Fossil Fuels

	All Fuels	Natural Gas	Oil	Coal
Exploration/Harvesting	CO_2 , CH_4 , N_2O NOx , CO, ROG, HCs, particulates, trace metals, thermal pollution	drilling accidents, drilling sludge disposal	drilling accidents, SO_2, drilling sludge disposal	mining injuries, land degradation, SO_2
Processing/Refining	CO_2 , CH_4 , N_2O, NOx , CO, ROG, HCs, particulates, trace metals, thermal pollution	refinery accidents, refinery waste disposal	SO_2, refinery accidents, refinery waste disposal	SO_2
Transport/Distribution	CO_2, CH_4 , N_2O, NOx , CO, ROG, HCs, particulates, trace metals, thermal pollution	pipeline accidents, LNG explosions	pipeline and tanker accidents, oil spills, SO_2	train accidents, SO_2
Conversion/Marketing/ End Use	CO_2 , CH_4 , N_2O, NOx , CO, ROG, HCs, particulates, trace metals, thermal pollution		ash disposal, SO_2	ash disposal, SO_2

ROG = Reactive Organic Gases, HC = hydrocarbons

Table II. Environmental Insults From Existing Nuclear Power, Hydroelectric, and Wind Generation

	Nuclear Power	Hydro-Electric	Wind
Exploration/Harvesting	mining accidents, radioactive tailing disposal, land degradation, indirect fossil fuel emissions (from fuel used in harvesting)	N/A	
Processing/Refining	processing accidents, indirect fossil fuel emissions	N/A	
Transport/Distribution	truck accidents, risk of proliferation, indirect fossil fuel emissions	N/A	
Conversion/ Marketing/ End Use	Risk of catastrophic accidents, creation of low and high level radioactive wastes	may inhibit fish migration	may kill birds; noise pollution
Decommissioning	disposal of low and high level radioactive wastes[31], indirect fossil fuel emissions	concrete disposal	

31 All U.S. nuclear reactors are charged an annual fee to cover decommissioning and disposal of radioactive wastes. However, neither a disposal site or disposal method has yet been chosen, and no large reactor has ever been decommissioned. It is therefore unknown if the actual costs will correspond to the value of this fee.

APPENDIX 1-I

FINAL TRANSPORTATION BACKGROUND REPORT, MARCH 2003, UPDATED NOVEMBER 2005

MARIN COUNTYWIDE PLAN

Transportation
Technical Background Report

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Updated November 2005

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I. MARIN COUNTY TRANSPORTATION TODAY

A. MAJOR HIGHWAYS AND ARTERIALS

1. U.S. 101

U.S. 101 is Marin County's primary roadway, which varies between two and five lanes in either direction and forms a north-south corridor along Marin's eastern edge.

U.S. 101 is highly congested because it is the primary surface link to San Francisco, the Bay Area's financial base, which draws large numbers of workers each day. The highway also intersects with other important highways, such as Interstate 580, which provide important inter-county and inter-regional links. U.S. 101 is also vital in connecting communities within the County for everyday activities such as shopping, riding to school, and recreation. The HOV Lane Gap Closure project, which is now entering its final phases, will improve congestion for drivers and transit users by adding a dedicated traffic lane on U.S. 101 and providing a continuous HOV lane through Marin.

a. Golden Gate Bridge

The Golden Gate Bridge is the only direct surface link between San Francisco and Marin, following the path of U.S. 101. Although all day traffic volumes across the Bridge have not appreciably changed in over a decade, peak periods have spread out, creating congested conditions for more hours each day. Additionally, weekend travel has increased, so that Sunday afternoon traffic exceeds some weekdays, creating extreme traffic congestion pressure in Southern Marin on U.S. 101, Highway 1, and other highway approaches. The Golden Gate Bridge has six reversible lanes; four lanes are provided in the peak direction during commute hours, with two lanes provided opposite the peak travel direction.

2. Interstate 580

Interstate 580 is a four-lane east-west highway that enters Marin County from the East Bay. Interstate 580 terminates in San Rafael at the U.S. 101/I-580 interchange. The Interstate absorbs and diffuses traffic among northbound and southbound motorists on U.S. 101, and westbound and eastbound motorists on Sir Francis Drake Boulevard.

a. The Richmond-San Rafael Bridge

Marin County's position as a job center continues to fuel travel demand over the Richmond-San Rafael Bridge, with over 75 percent of all AM trips entering Marin County from the bridge destined for locations within the County. The vast majority (78 percent) of eastbound evening Interstate 580 trips begin in Marin County, as workers employed here head home to the East Bay. The bridge is 5.5 miles long (including approaches) and supports two lanes of traffic in each direction. Some of the 78% eastbound evening Interstate 580 trips are residents of northwest Contra Costa County, returning home from work in San Francisco.

3. State Route 1 (Shoreline Highway)

State Route 1 is a two-lane highway that runs north to south in West Marin. With the exception of its access point from US 101 at Tamalpais Valley, Route 1 follows the east side the Golden Gate National Recreation Area and the entire recreational corridor of West Marin for the duration of its length through the County. There is relatively little development surrounding State Route 1. The corridor is used primarily for intercommunity travel within West Marin or by visitors to the County.

4. State Route 37 (Highway 37; Novato Boulevard)

State Route 37 in Marin County is a four-lane highway that runs primarily east-west and borders the City of Novato, intersecting U.S. 101 in the southern limits of the city. The highway feeds into Novato Boulevard to the west. In addition to being an important link to U.S. 101, State Route 37 (Highway 37) creates a loop with San Marin Drive and Atherton Avenue to provide circulation within Novato to serve Marin County's fastest growing and most densely populated city.

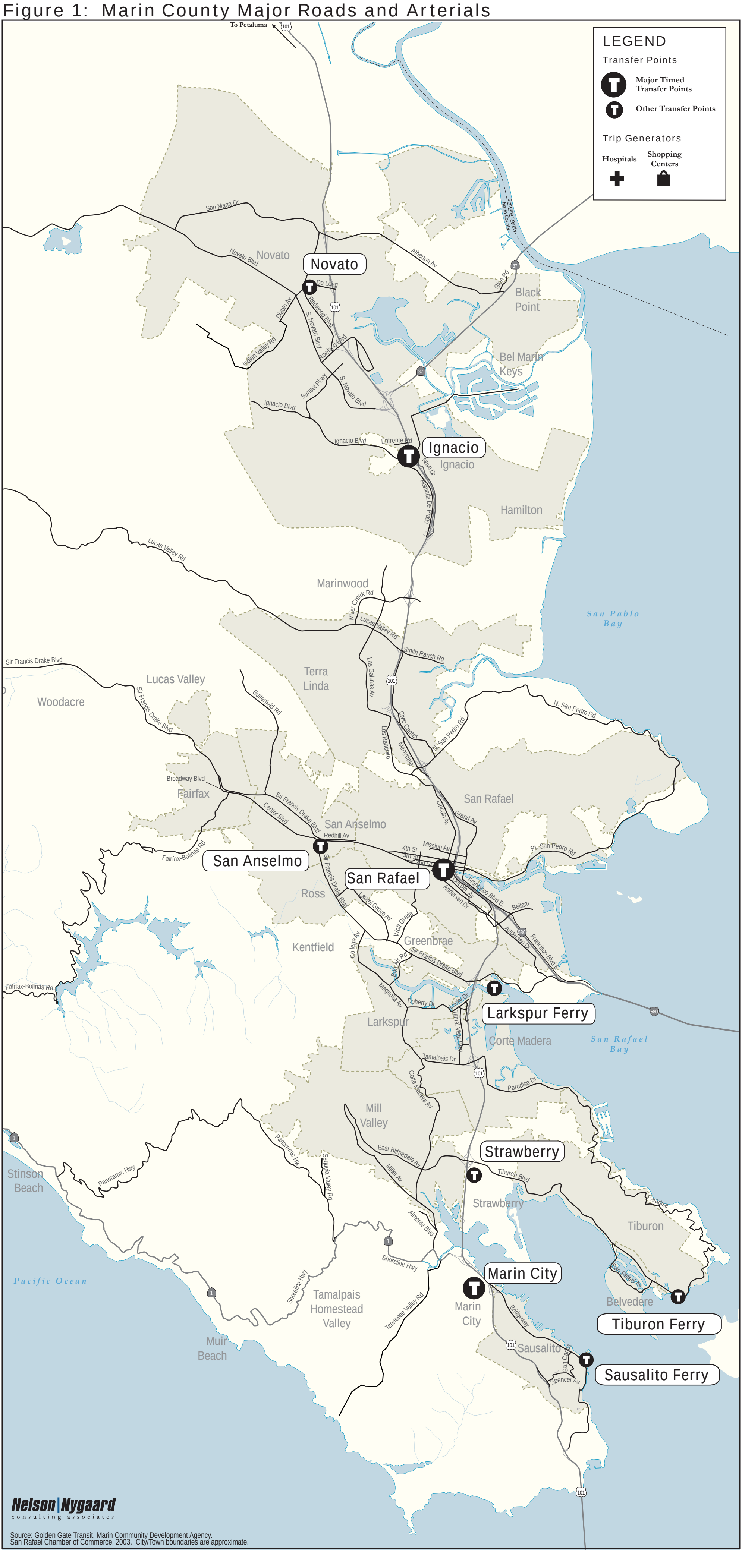
5. State Route 131 (Tiburon Boulevard)

State Route 131 is a four-lane highway that stems off of U.S. 101 and runs northwest-southeast in Marin County's southeast section. The highway is locally known as Tiburon Boulevard, which serves the Tiburon Peninsula, connecting with ferry service. The peninsula is moderately developed and provides recreation opportunities for residents and visitors.

6. Sir Francis Drake Boulevard

Sir Francis Drake Boulevard is an important arterial roadway that runs primarily east-west, linking U.S. 101 to State Route 1. Much of the suburban segment between U.S. 101 and State Route 1 is primarily a four-lane rural highway. The roadway widens to six lanes approaching Larkspur Landing east of U.S. 101 and thins to two lanes as it extends west beyond Fairfax, curving north along the southern portion of Tomales Bay and then turning southwest towards the Point Reyes Peninsula. Sir Francis Drake Boulevard is the primary east-west corridor in Marin County.

Figure 1: Marin County Major Roads and Arterials



Nelson|Nygaard consulting associates

Source: Golden Gate Transit, Marin Community Development Agency.
San Rafael Chamber of Commerce, 2003. City/Town boundaries are approximate.

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B. TRANSIT SERVICE AND ALTERNATE MODES

1. Marin County Transit District

The Marin County Transit District (MCTD) was formed upon a vote of the Marin County electorate in 1964 to develop, finance, and provide local transit service within Marin County. MCTD provides local fixed route services which operate throughout the day within Marin County, supplemental school services which operate during school bell times only, rural and recreational services, that operate both all year and seasonally, depending on the type of service, and paratransit services which provide specialized service to individuals with disabilities.

MCTD does not directly provide services with its own drivers or vehicles, but rather contracts with operating agencies to provide service. MCTD's responsibilities include managing and monitoring all service, including setting route alignments, establishing fare and transfer policies, setting service frequencies and hours of operation and providing funding for all local routes and services.

There are currently two primary operators providing transit service under contract to MCTD. Golden Gate Transit(GGT) provides local fixed route bus services, including all day and school service which begin and end within the county. Whistlestop Wheels, operated by the Marin Senior Coordinating Council, provides rural fixed route and specialized paratransit service for eligible elderly and disabled individuals. .

MCTD is funded by the recently approved transportation sales tax (43%), property taxes (18%), fares (18%), and Transportation Development Act (TDA) and State Transit Assistance funds (21%). The fare is $2.00 per trip on all MCTD local fixed routes.

Figure 2 below shows the MCTD system map.

a. Local Service

As of May 1, 2006, MCTD will be fully responsible for 13 regular local routes, which are provided by MCTD through a contract with Golden Gate Transit. For the District's Fiscal Year ending June 2005, Marin local service (routes 15, 21, 22, 23, 29, 33, 35, 36, 53, 55, 57, 59, 71) carried about 3,000,000 patrons.

b. School Service

There are twelve supplemental school routes that provide service at bell times or to schools not served by a regular local route. In FY 2005, school services carried approximately 307,000 annual riders. School services are also provided under contract to Golden Gate Transit.

c. Rural and Recreational Service

Whistlestop Wheels is the contract operator for the West Marin Stagecoach, which provides four round trips on weekdays from Bolinas-Stinson Beach to Mill Valley-Marin City and from Inverness to San Anselmo. Feeder service is also available for qualified transit-dependent riders with hardships in reaching the Stagecoach routes. The adult cash fare is $2.00 per trip, and since implementation of Stagecoach shuttle service in June 2002 ridership has been robust with an average of over 80 riders carried per day, or approximately 21,500 annual passengers.

Recreational service is limited to two routes, both provided under contract to Golden Gate Transit. Route 63, serves park and recreation areas between Marin City and Stinson Beach in West Marin. Buses operate Saturday and Sunday between the hours of 9:00 AM and 6:00 PM. Connections are made with other bus routes at selected stopping points. Currently, 10 roundtrips are made carrying approximately 100 patrons per weekend.

In addition, a demonstration project providing service between Marin City and Muir Woods began operation during the summer of 2005. This service operated during summer weekends between park and ride lots near Highway 101 and Muir Woods. During its first year, ridership averaged over 300 passengers per service day.

d. Paratransit Service

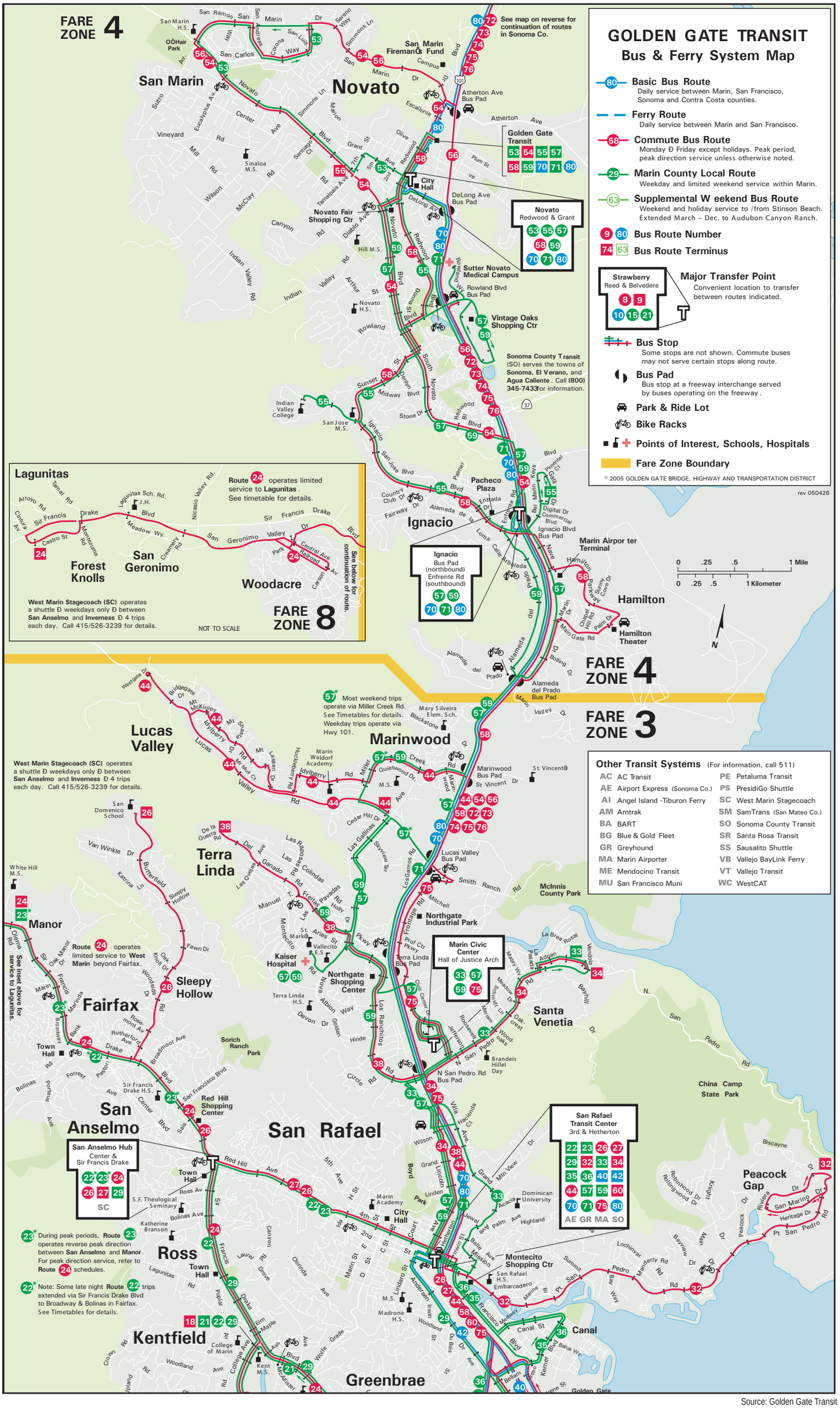
Paratransit service is provided to persons with disabilities meeting the eligibility criteria established by the American's With Disabilities Act. Service is provided throughout the County, with priority given to trips within the service area mandated by ADA. Whistlestop Wheels is the contract operator for this service, which carried 83,000 riders in FY 2004-05

2. The Golden Gate Bridge, Highway and Transportation District (The District)

In 1969, the State of California passed legislation allowing the Golden Gate Bridge Highway and Transportation District (The District) to provide public transit bus and ferry services to keep traffic congestion levels down; through its transit division, Golden Gate Transit (GGT). The District has an important influence on transportation planning and funding in Marin County. The District controls toll revenue from the Golden Gate Bridge, which it uses to subsidize both its ferry and regional bus transit services. The District's general priority is to serve longer distance travel, focusing on commutes that end in San Francisco. By law, the District is prohibited from using toll revenue to subsidize local bus service within Marin County, which is fully supported with local funds. Golden Gate's regional bus service supplements and coordinates with the local system by allowing Marin County passengers to ride locally on regional buses operating on the Highway 101 corridor, and by maximizing connections between the local service area and regional destinations.

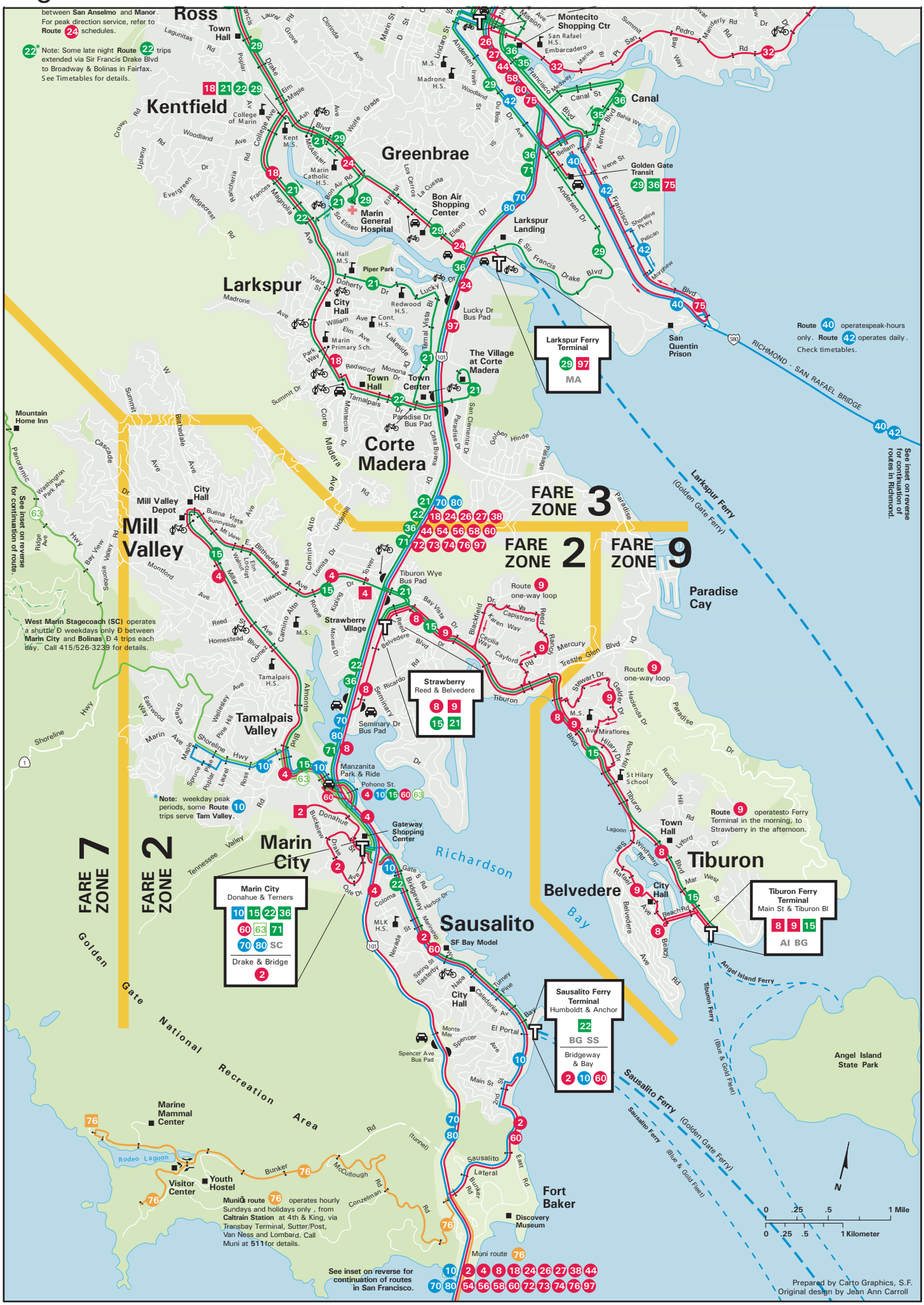
Figure 2: MCTD Transit System Map - Existing Local Routes

Figure 3: Golden Gate Transit



Source: Golden Gate Transit

Figure 3a: Golden Gate Transit



Source: Golden Gate Transit

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The District's regional services are not subsidized by local sales tax measures or dedicated general funds and does not have the authority to levy taxes. The current operating and capital budget is funded by: 35.2% tolls; 34.1% government funds; 13.1% Bus and ferry fares; 6.2% from other District sources (Bridge Gift Center & Café, transit rents, concessions and advertising). Regional services include bus services that cross county lines and ferry services from Marin County to San Francisco.

The Golden Gate Bridge, Highway and Transportation District presently consists of three operating divisions – Bridge, Bus and Ferry – and an administrative District Division. The District provides six types of transit service: Basic Regional, Commute, Recreational, Local, and Special. Details of these services are provided below.

a. Basic Regional Service

Basic Regional service consists of five fixed routes (Routes 10, 40/42, 70, and 80) that operate along the Highway 101 and Interstate 580 corridors seven days per week, between the hours of 5:00 AM and 4:00 AM. What distinguishes these routes from local service is that they service more than one county and are subsidized with toll revenue. Fares are $2.00 for travel within Marin County, and up to $7.60 for destinations outside of Marin. Currently, 182 weekday runs and 131 weekend runs are made along these five routes.

b. Commute Service

Passengers are also carried on Golden Gate Transit commute bus routes that primarily link Marin County with San Francisco. Twenty two routes operate during peak hours, in the peak direction. Commuter routes carried 6,800 daily passengers during the 2005 fiscal year.

c. Ferry Service

The Golden Gate Bridge, Highway and Transportation District offers ferry service from Larkspur and Sausalito to the Ferry Building terminal in San Francisco. The Golden Gate service departing from Larkspur carried a weekday average of 4,482 passengers and Sausalito carried a weekday average of 1,085 passengers during fiscal year 2005.

3. Specialized Transit

a. Greyhound Lines, Inc.

Greyhound Lines, Inc. provides interregional bus service from its terminal in San Rafael. There are two northbound and two southbound departures each day with an additional departure in either direction during the summer months. The northbound buses originate in San Francisco and terminate at Crescent City, Vancouver and Seattle. The southbound buses originate in Crescent City, Vancouver, and Portland, and terminate in San Francisco. Each departure from San Rafael receives an average of two passengers.

b. Ferries

The Blue and Gold Fleet provides commuter and recreational ferry service between Tiburon and San Francisco, and between Sausalito and Fisherman's Wharf in San

Francisco. The Angel Island-Tiburon Ferry provides weekend service between Tiburon and Angel Island and limited, special-request-only, weekday service between Tiburon and Angel Island.

c. The Marin Airporter

The Marin Airporter provides regularly scheduled service to and from the San Francisco airport. Buses operate on 30-minute headways from San Francisco International Airport and 30- and 60-minute headways from Marin between 4:00 a.m. and 11:00 p.m. The Marin Airporter is based in Larkspur Landing and provides service to Hamilton, San Rafael, Larkspur Landing, Mill Valley and Sausalito. Ridership averages between 25,000 and 30,000 passenger trips per month.

Transportation Demand Management

Transportation Demand Management includes all modes of transportation services that fall between conventional transit (buses and trains) and the private automobile. The goal of Transportation Demand Management measures is to reduce peak period congestion by encouraging commuters to use higher capacity modes of travel, or to avoid the peak period using techniques such as telecommuting, and flexible work schedules. Other TDM measures include vanpool and carpool matching services and incentives, employer shuttles connecting to regional transit services, subsidized transit passes, guaranteed ride home programs, parking cash-out and a host of education programs designed to foster awareness of transportation alternatives.

Currently, the 511 Regional Rideshare Program offers support to commuters in the nine Bay Area Counties, including assistance with carpool and vanpool matching. Individual employers may also offer TDM programs to reduce their impact on the peak period commute. The County of Marin is a model employer, offering many commute incentives including subsidized transit passes, and carpool subsidies and incentives. A guaranteed ride home program provides "insurance" to employees who may be willing to try an alternative mode but require "insurance" that they will not be stranded if they have an emergency that requires them to miss their planned commute option. The County reports substantial increases in the use of alternative modes since implementing its program. In the first 18 months of the program, carpool use increased by 108% and transit ticket sales increased by 26%. The County continues to enhance and develop its program with plans to add telecommute options and increased transit incentives for County employees.

The Marin County Transit District recognizes the relationship between transit service and other Transportation Demand Management options. In its Bus Transit Futures Plan, the District proposes operating a Marin Office of Mobility Management (MOMM) to assist commuters and employers in offering and expanding Transportation Demand Management options. Implementation of this plan depends on enhanced funding.

4. Bicycle and Pedestrian Travel

The 2000 U.S. Census indicates that 4% of work trips in Marin County are made by bicycle and pedestrian modes. A survey conducted by the Regional Rideshare agency, RIDES, to gauge perceptions of commute conditions and options showed that 18% of commuters see bicycling as a viable commute alternative. Bicycle use for commutes within Marin County is lower than might be expected due to inadequate or non-existent connections between communities, particularly over hilly terrain.

C. AIRPORT FACILITIES

Marin has one general aviation and one small craft airport; Gnoss Field, north of Novato (general aviation), and Marin Ranch (small craft) in northern San Rafael. Gnoss Field has a 3,300 foot asphalt runway that accommodates small private aircraft up to 18,500 pounds. It is classified by the Federal Aviation Administration as a "B-1" facility and a "reliever" airport. Gnoss Field has capacity for 320 aircraft, currently accommodating 301. The airport currently handles 60,000 takeoffs and landings per year.

Marin Ranch Airport is a private airport with 2,180 feet of runway. The airport houses 100 aircraft and accommodates commuter, recreational and emergency response activities.

D. COUNTY PROFILE

1. Households and Population

The following table provides 1990, 2000, and 2005 population totals for California, the San Francisco Bay Area, and Bay Area counties.

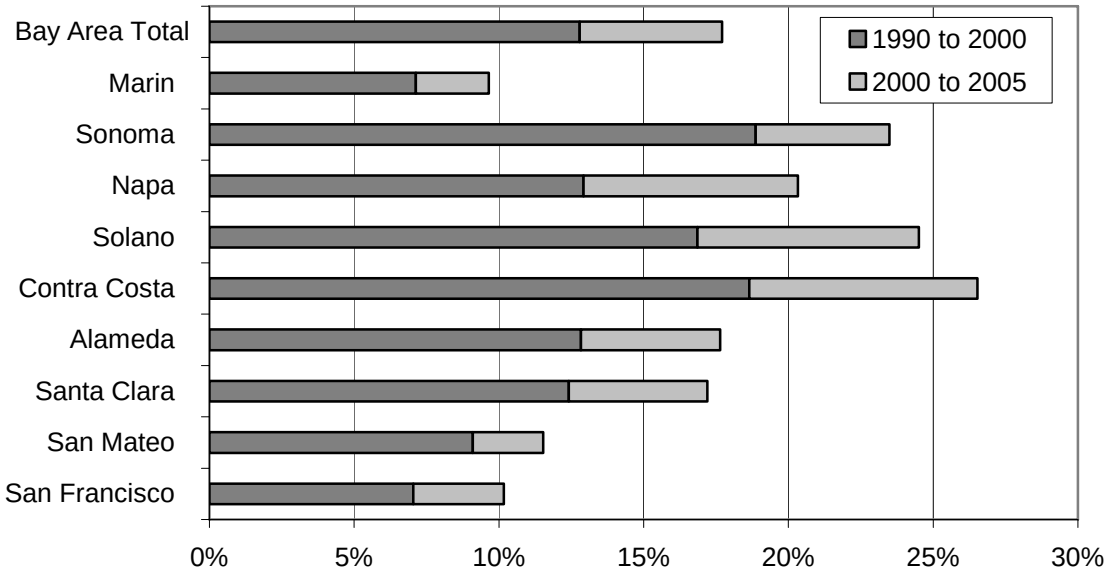
Figure 4. Area Population: 1990, 2000, and 2005

City	1990	2000	2005
San Francisco	724,000	775,000	799,263
San Mateo	647,400	706,300	723,453
Santa Clara	1,493,800	1,679,200	1,759,585
Alameda	1,274,700	1,438,300	1,507,500
Contra Costa	797,600	946,300	1,020,898
Solano	335,200	391,700	421,657
Napa	109,900	124,100	133,294
Sonoma	384,700	457,300	478,440
Marin	229,900	246,300	252,485
Bay Area Total	5,997,200	6,764,500	7,096,575
California Total	29,816,591	33,871,648	35,893,799*

** Estimate of 2004 population, US Bureau of the Census*
Sources: State of California, Department of Finance, Demographic Research Unit.; and US Census Bureau for California populations figures

The following graph shows population growth for California, the San Francisco Bay Area, and Bay Area Counties for the period between 1990 and 2005.

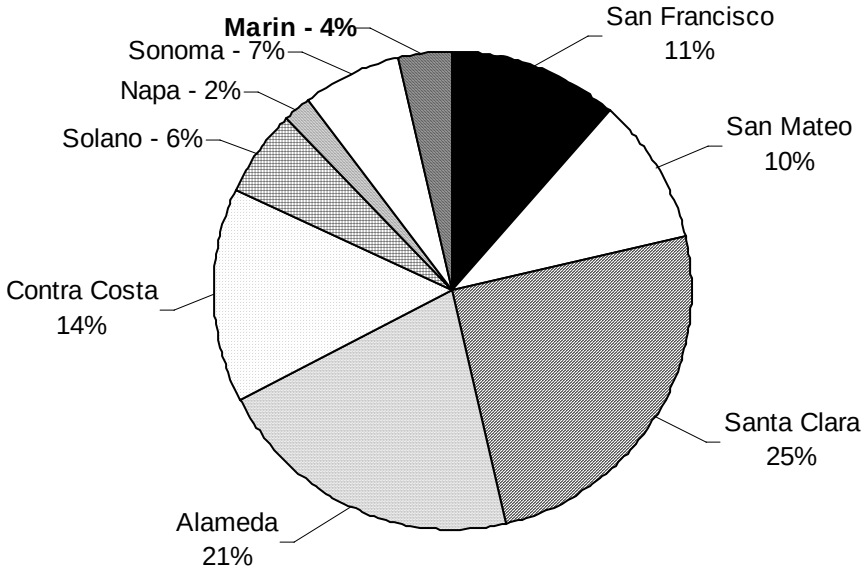
Figure 5. Change in Population, 1990-2005



The growth rate for population in Marin County was the lowest of the nine Bay Area Counties, excepting San Francisco, and far lower than either the state or regional population growth rates.

The following graph presents population distribution among Bay Area counties.

Figure 6. Population Distribution, Bay Area Counties, 2005



Between 1990 and 2005, the population distribution among Bay Area counties (in terms of percent

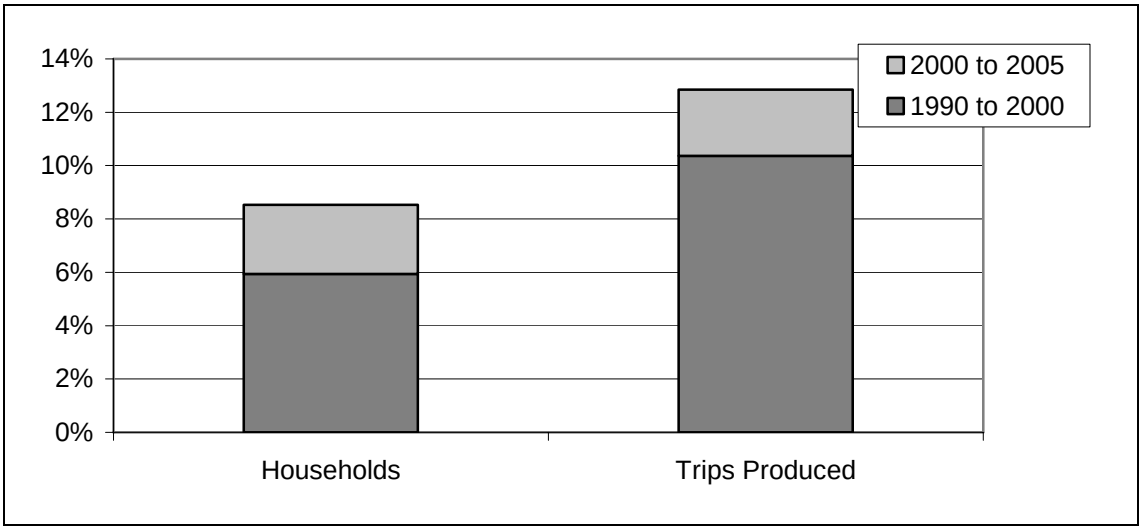
of total population) was essentially maintained. Santa Clara and Alameda Counties account for the largest shares (25 and 21 percent, respectively), amounting to 46 percent of the entire Bay Area population. Contra Costa, San Francisco and San Mateo Counties combined comprise 35 percent of the total population (14%, 11%, and 10% respectively). Sonoma, Solano, Marin and Napa Counties remain the Bay Area's least populated with a combined 19 percent share.

Marin County residents are "on the move". People who live in the county will have made over 772,000 trips per day in 2005, up by 13 percent since 1990. Over 80 percent of those trips were made to destinations within Marin County.

This growth in trip making is far outpacing the growth in households in Marin County. While the number of trips made in Marin County grew by about 13 percent between 1990 and 2005, the number of Marin County households grew by only about 8.5 percent. In fact, during this period, Marin County experienced slower growth than any other county in the Bay Area outside of San Francisco, while experiencing increasing congestion.

This increase in trip generation, and subsequent congestion experienced in the County outpaces household growth and is a direct result of our increased mobility.

Figure 7. Household and Trip Growth, Marin County, 1990-2005



Source: US Census and MTC regional travel forecasts based on ABAG's Projections 2003 socio-economic data (January 2005), Marin County Travel Model, based on ABAG Projections

2. Other Demographics Affecting Transportation

Marin County is a "graying county," with the median age of the County at 43 and rising. Fourteen percent of Marin's population is over the age of 65 and 20 percent is under the age of 18. The Association of Bay Area Governments (ABAG) estimates that over 20 percent of Marin's population will be over the age of 65 by the year 2020.

While trips are made throughout the day, congestion in Marin County is at its worst from six to nine in the morning and from four to six in the evening. Congestion county-wide peaks in the morning, when almost 2/3 of the trips being made are trips to work and over 20 percent of all trips are being made between home to school. The impact of school trips in the morning peak is dramatic – while school trips make up only six percent of all trips made in the county, they make up over 20 percent of the trips in the morning peak. This explains the phenomenon experienced in Marin County during school breaks – when the schools are closed, the congestion is significantly reduced.

3. Job Base

Marin County's economy is characterized by small- and medium-sized businesses. Services account for 39% of the County's total employment. Retail comes in second, accounting for nearly 22% of total employment. The County of Marin is Marin's largest employer, with 2,100 employees. The City of San Rafael provides the most developed job market, hosting some of the County's major employers, including Autodesk, Children's Discovery Center, Fair Isaac, Industrial Light & Magic, Lucas Digital, Quadra Med, and Westamerica Bancorporation. These employers provide jobs in the areas of investment, accounting, data processing, public relations, and motion picture production.

The City of Corte Madera is host to two major shopping centers and three of the County's major employers, including Restoration Hardware, a home furnishings retailer, and Constellation Concepts and Il Fornaio, two restaurant-related businesses. Other major employers are found in Novato (Fireman's Fund Insurance), Mill Valley (S & P Co Holding Offices), and Greenbrae (Marin General Hospital).

There were 130,000 workers in Marin in 1990 and 136,000 in 2002. The unemployment rate for the first half of 2002 ranged between 3.6% and 4%. This rate of unemployment comes after a 5-year period from 1997 to 2001 where the unemployment rate was as low as 1.4% and did not exceed 3.3%. Nonetheless, the County has enjoyed an unemployment rate lower than that of the state since 1996.

The Association of Bay Area Governments (ABAG) projected that 20,000 new jobs will be added between 1997 and 2004. Occupations with the fastest anticipated growth rates are reservation, transportation and ticket agents, expected to grow by 107%, and taxi and limousine services, expected to grow by 58%. Jobs for light-duty truck drivers are expected to increase by 37%, and 26% for heavy-duty truck drivers.

Sonoma County's job base is developing significantly, posing new transportation challenges in the effort to alleviate Marin's congestion problems. While fewer Sonoma residents will need to come to and through Marin County to work, their jobs will ultimately attract Marin residents north, creating a "reverse commute."

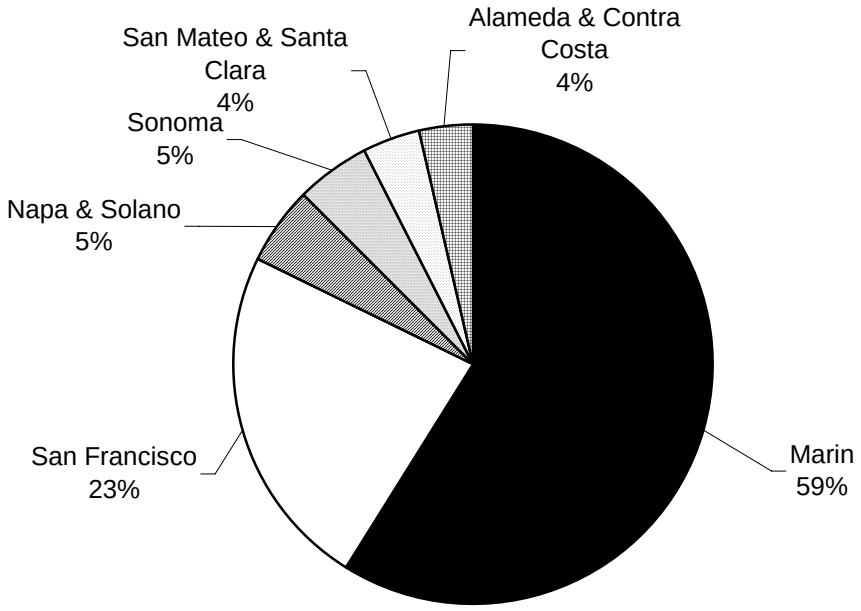
E. TRAVEL BEHAVIOR

1. Trip Distribution

Marin County is not only a very desirable place to live and recreate, but also an important part of the Bay Area's economic engine. Over the past decade, commute patterns in the County have changed dramatically in response to new jobs becoming available in the County and an increase in the number of workers per household.

It is not too surprising that over 80 percent of all trips that begin in Marin County, end within the County. The vast majority of shopping and recreational trips, as well almost all school trips are made entirely within the County. While most people recognize that they make their non-work trips close to home, a common assumption is that people who live in Marin County work outside the county, especially in San Francisco. But today, almost 60% of all work trips made by Marin County residents are to jobs here in the County. And, while just under a quarter of Marin County's work trips are still destined for San Francisco, the Marin-San Francisco commute is well served by transit. While only about five percent of all trips in Marin County are made on transit, over 25 percent of Marin-San Francisco commute trips are transit trips, minimizing the impact of those trips on our roads.

Figure 8. Distribution of Home-based Work Trips by Marin Residents, 2005



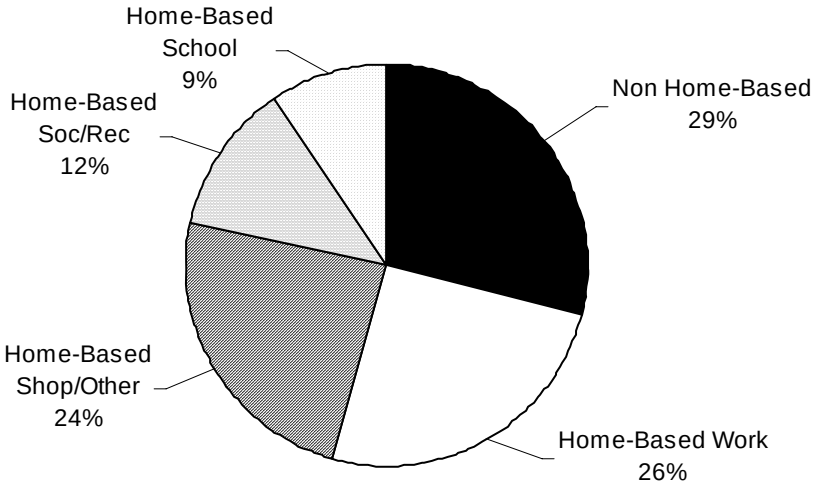
Source: Marin County Department of Public Works, 2005

2. Trip Purpose

Looking at all of the trips generated throughout the day by residents of Marin just over 25 percent are trips between home and work, and almost 30 percent are for trips that are not home based.

About another quarter of all trips are between home and shopping destinations and 12 percent are for trips between home and social or recreational destinations. Nine percent of all trips are trips between home and school.

Figure 9. Trip Purpose by Marin County Residents, 2005



3. The AM Peak Factor

While trips are made throughout the day, congestion in Marin County is at its worst from six to nine in the morning and from four to six in the evening. Congestion county-wide peaks in the morning, when almost 2/3 of the trips being made are trips to work and over 20 percent of all trips are being made between home to school. The impact of school trips in the morning peak is dramatic – while school trips make up only six percent of all trips made in the county, they make up over 20 percent of the trips in the morning peak. This explains the phenomenon experienced in Marin County during school breaks – when the schools are closed, the congestion is significantly reduced.

4. The Recreational Factor

Marin is unique because of its large number of natural attractions that are of regional and national significance. These important recreational destinations include Golden Gate National Recreation Area, Mt. Tamalpais State Park, Muir Woods National Monument, Point Reyes National Seashore, Samuel P. Taylor State Park, and Tomales Bay State Park. These are certainly treasures for Marin and are often a main reason that residents cite for living in Marin.

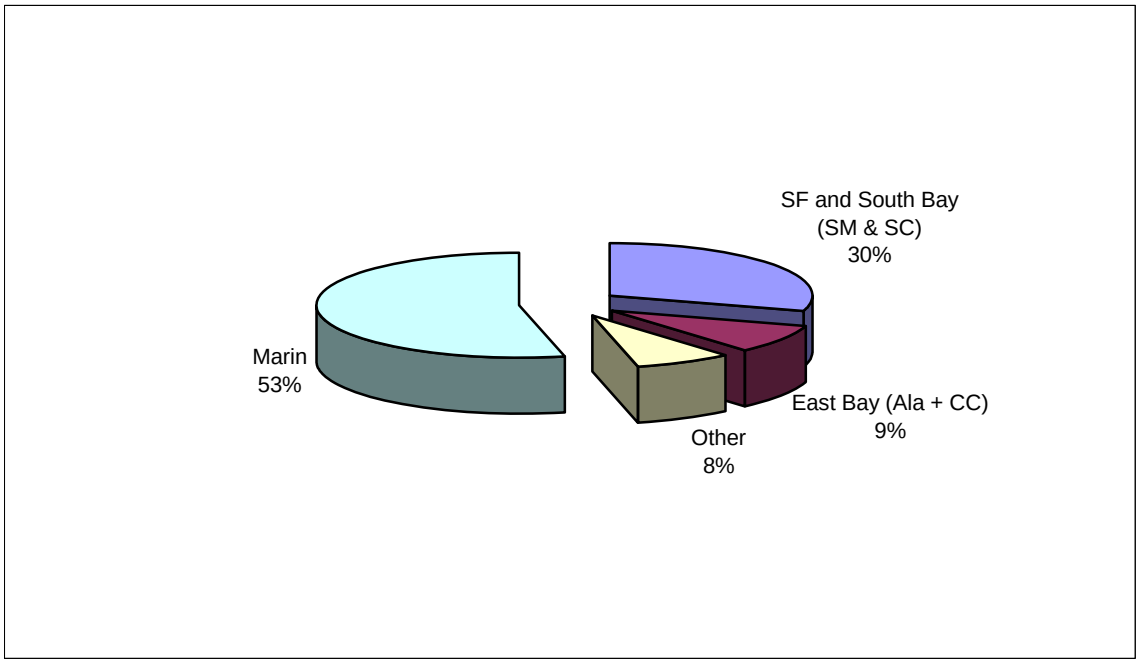
The drawback of hosting such important recreational uses is the traffic generated by visitors to them. This traffic is exacerbated by the limited number of access points on narrow roadways and the fact that many visitors must travel through residential areas of Marin to access the various parks. Congestion on weekends in many areas of the county rivals and even exceeds weekday tie-ups.

Additionally, recreational travel demand is more difficult to serve with alternatives compared to commuter travel.

5. The Sonoma Factor

Historically, Marin residents believed Sonoma County to be the source of their congestion, alleging that Sonoma residents were traveling through Marin to access jobs in San Francisco. The following chart shows that 53 percent of southbound morning commute hour traffic from Sonoma is destined for Marin, while 30 percent of those trips are destined for San Francisco or points south. Only about 9 percent of southbound trips from Sonoma are destined for the East Bay via Interstate 580 and the Richmond-San Rafael Bridge in Marin's southeast section. An increase in the number of jobs in Sonoma may be slightly relieving southbound U.S. 101 travel, especially during the morning commute hours.

Figure 10. Destination of Morning Commute Traffic Entering Marin from Sonoma, 2005

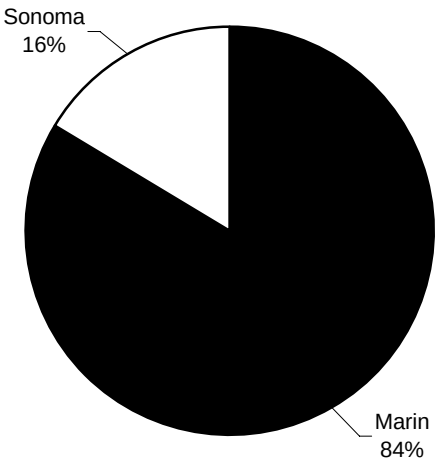


Note: Vehicular trips crossing the Sonoma County Line, on U.S. 101 Southbound. Trips destined for Sonoma travel through Marin to southeast Sonoma.
Source: Transportation Authority of Marin (TAM) - Marin Travel Model (MTM), 2005

6. Trips Entering Marin from the East on Interstate 580, AM Peak

The following chart shows that 84 percent of trips entering Marin County from the East Bay on Interstate 580 during the AM peak hours are destined for Marin County while the balance of 16 percent are destined for Sonoma.

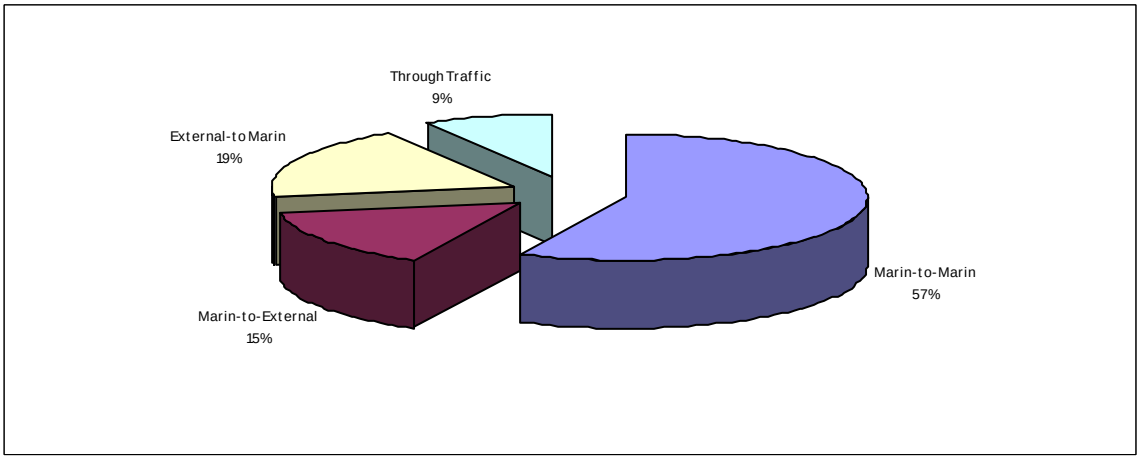
Figure 11. Destination of Trips Entering Marin from I-580 West, 2005



Source: Transportation Authority of Marin (TAM) - Marin Travel Model (MTM), 2005

The overall composition of vehicle trips on Marin roads during the morning peak is shown in Figure 12.

Figure 12. Composition of Vehicles on Marin Roads during the AM peak, 2005



Source: Transportation Authority of Marin (TAM) - Marin Travel Model (MTM), 2005

II. LEVEL OF SERVICE

With a road system of a given capacity, the volume-to-capacity ratio is the primary indicator of the transportation system's performance. Volume-to-capacity is a measure of demand and supply, and is equal to: the number of vehicles assigned to a segment divided by the vehicular capacity of that segment. For example, if the assigned volume is 1,500 vehicles and the segment capacity is 2,000 vehicles, the volume-to-capacity ratio is 0.75. This ratio is converted to a letter grade called Level of Service (LOS).

The LOS is identified with a letter from A through F, and is described in terms of speed and travel time, freedom to maneuver, interruptions, comfort, convenience, and safety. The letter A represents free traffic flow with few vehicles and easy maneuverability while the letter F represents severe congestion with bumper-to-bumper traffic at slow speeds. LOS is key to all modes since all modes depend on streets and related facilities for access and in many cases for direct operations. Figure 13 shows the relationship between LOS grades and volume-to-capacity ratios.

Figure13. Level of Service, Volume-to-Capacity Ratio Formula

For Freeways		*For Local Streets*	
Level of Service	**Volume-to-Capacity Ratio**	**Level of Service**	**Volume-to-Capacity Ratio**
A	0.00 - 0.33	A	0.00 - 0.60
B	0.34 - 0.55	B	0.61 - 0.70
C	0.56 - 0.75	C	0.71 - 0.80
D	0.76 - 0.89	D	0.81 - 0.90
E	0.90 - 1.00	E	0.91 - 1.00
F	1.00+	F	1.00+

Source: Transportation Research Board, Highway Capacity Manual, Chapter 3; Transportation Research Board, Circular 212

The design of an intersection is the key determinant in an arterial's ability to handle the flow. Design components include such elements as the number of lanes, special turn lanes, signal phasing, length of red and green cycles, and "right turn on red."

Generally, LOS E is associated with traffic flowing near the capacity of a road. Speeds are low and unstable; maneuvering is difficult; comfort and convenience levels are poor; user frustration is high. When the freeway is at capacity, the vehicle density per lane mile is 67 vehicles. Freeway speeds fall below 30 miles per hour. If more vehicles are added to the road, breakdowns or stop-and-go traffic is experienced (LOS F).

It is important to note that capacity is reached for only a short time during the commute period in urban areas. Fifteen highway and arterial roadway segments operated at LOS F when the CMP was adopted in 1992 and qualified as "grandfathered" segments, which means these segments were already operating below the LOS standard. Because levels of service E or F are unacceptable to most motorists, local officials choose LOS D as the minimum standard on congested local roads, and LOS E as the minimum standard on congested highways. (LOS D is accepted as a standard for suburban street operations nationwide.) At LOS D, maximum freeway lane volume is 1,850 vehicles per hour, vehicle density per lane mile ranges from 30 to 42 vehicles, and speeds range from 46 to 54 miles per hour. Marin County's Congestion Management Program has established

LOS D as a standard for principal arterials and conventional highways in Marin; however, a local jurisdiction may establish higher standards. LOS E is the minimum standard for Highway 101, Interstate 580 and State Route 37 (Highway 37).

The 2001 Congestion Management Program (CMP) evaluated 24 road segments along three freeways and rural expressways, and seven arterial roadways. The following sections discuss the CMP's reported LOS for each of the two categories.

A. HIGHWAYS

Six northbound segments on U.S. 101were reported to be operating at, or below, the standard of LOS E during PM peak hours. These segments that fail come at points where there are high on-ramp volumes.

Figure 14, below, presents segments of Marin's highway and rural expressways.

Figure 14. Marin Highway Congestion Level of Service Observed During PM Peak Hours, 2005

Screen Line / Segment	Dir.	Y 2005 Existing Conditions Tot. Vol. MFL HOVL	V/C	LOS
U.S. 101				
1. Golden Gate Bridge (Link: 7316-7800)	N/B	7,195	0.90	D
2. Alto Hill		7,498		
from SR 131 to Paradise Dr.	N/B	6,259	0.89	E
(Link: 7838-7845)		1,239	0.62	C
3. Cal Park Hill		7,044		
from SFD Blvd. To I-580	N/B	7,044	1.01	F
(Link: 7858-625)		N/A		
4. n/o I-580		7,496		
From I-580 to 2nd Street	N/B	7,496	1.07	F
(Link: 634-652)		N/A		
5. s/o Lucas Valley Rd.		7,333		
Freitas Pkwy. To LV Rd.	N/B	6,040	0.86	E
(Link: 646-647)		1,293	0.65	C
6. Pacheco Hill		7,269		
From Miller Creek to Nave Dr.	N/B	5,985	0.86	E
(Link: 678-649)		1,284	0.64	C
7.Sonoma County Line	N/B	4,317	1.08	F
(Link: 754-832)				
8. Interstate 580	E/B	3,377	0.84	D
Richmond Bridge	W/B	2,768	0.69	C
9. Interstate 580	E/B	2,062	0.52	C
SFD Blvd. to Bellam Blvd.	W/B	1,905	0.48	B
10. State Route 37	E/B	3,275	0.82	D
U.S. 101 and Atherton Ave.	W/B	1,295	0.32	A

*** Capacity is the lane capacity multiplied by the number of lanes in that segment.*
Source: Transportation Authority of Marin (TAM) - Marin Travel Model (MTM), September 2005

U.S. 101 runs north to south along the east side of the County, where development is most dense between Mill Valley and Novato. All segments monitored on Highway 101 scored poorly with LOS of E or F, except the Golden Gate Bridge that had an LOS of D. LOS F was reported on two segments between Sir Francis Drake Boulevard and Interstate 580 and between 580 and Second Street in San Rafael, as well as at the Sonoma County Line, with V/C ratios ranging between 1.03 and 1.12. Interstate 580 feeds traffic west across the Richmond-San Rafael Bridge and branches out into U.S. 101 and East Sir Francis Drake Boulevard in Marin County. Interstate 580 traffic has improved and does not demonstrate an LOS of E or F on any of the segments surveyed. Below standard LOS ratings were reported primarily in the southeastern portion of the County, where traffic must filter through more developed areas surrounding the Richmond-San Rafael Bridge, which is a major commuter gateway to and from the East Bay.

B. ARTERIALS

Arterials are signalized streets that primarily serve through traffic and provide access to adjacent property. They may be two to six lanes wide depending on the volume of traffic they are designed to carry. Although the number of lanes, on-street parking and intersecting driveways affect traffic flow on arterials, intersections have the greatest influence on traffic flow. When an arterial intersects another arterial or collector street, there are usually traffic lights or stop signs to regulate vehicle flow.

Four segments on Marin's arterial roadways were reported to be operating below standards at LOS E and F during PM peak hours. Figure 13 below presents segments of Marin's arterial roadways the Marin travel model reported at a LOS that is below Marin County standards.

Figure 15. Marin Arterial Roadway Congested Level of Service Observed During PM Peak Hours, 2005

Screen Line Segment	Dir.	Y 2005 Existing Conditions		
		Tot. Vol. (vph)	V/C	LOS
Major Arterial				
11. Bridgeway Blvrd.	N/B	1,202	0.63	A
Gate 5 & Gate 6 Rd.	S/B	998	0.52	A
12. State Route 1	N/B	1,220	1.53	F
U.S. 101 to Almonte Blvd.	S/B	764	0.96	F
13. State Route 131	E/B	1,813	0.94	E
U.S. 101 & Strawberry Dr.	W/B	1,341	0.70	C
14. E. Sir Francis Drake B.	E/B	947	0.49	A
East of U.S. 101	W/B	1,151	0.60	A
15. Sir Francis Drake Blvd.	E/B	2,207	0.92	D
West of U.S. 101	W/B	2,492	1.04	F
16. Bel Marin Key B.	E/B	526	0.27	A
U.S. 101 to Commercial B.	W/B	1,365	0.71	C
17. South Novato Blvd.	N/B	329	0.41	A
U.S. 101 to Sunset Parkway	S/B	261	0.33	A

*** Capacity is the lane capacity multiplied by the number of lanes in that segment.*
Source: Transportation Authority of Marin (TAM) - Marin Travel Model (MTM), September 2005

Segments of Marin's arterial roadway network that had reported substandard LOS ratings include westbound Sir Francis Drake Boulevard west of U.S. 101, and State Route 1 between U.S. 101 and Almonte Boulevard, with a V/C ratio of 1.46 for the northbound direction and 1.03 for the southbound direction. State Route 131 between U.S. 101 and Strawberry Drive is also operating poorly in the eastbound direction at LOS E. Most of these segments were operating unacceptably in 1992 and grandfathered.

Figure 16 below presents annual LOS data from 1995 through 2001 (excluding 2000) compared to the 2005 data for U.S. 101 and Interstate 580 segments with sustained or worsening LOS since 1995. The most notable worsening in LOS occurred along Interstate 580 between East Sir Francis Drake Boulevard and the Richmond-San Rafael Bridge, where LOS was C from 1995 through 1999, dropping to a reported LOS F in 2001. Other segments stagger, with LOS reaching an acceptable D only to return back to E and F in the following year.

Figure 16. LOS of Marin Highway Segments , Select years 1995 to 2005

Road	Road Segment from	to	Direction	1995	1996	1997	1998	1999	2001		2005
U.S. 101	State Route 131	Paradise Dr	NB	D	D	D	E	E	F		E
	Sir Francis Drake Blvd	Interstate 580	NB	E	F	D	D	D	F		F
	Interstate 580	2nd Street	NB	F	F	F	F	F	D		F
	Freitas Parkway	Lucas Valley Road	Mixed Flow NB	E	D	D	D	E	F		E
	Sonoma County Line		NB	F	E	F	E	F	E		F
I-580	Sir Francis Drake Blvd	Bellam Boulevard	EB	C	C	C	C	C	F		C

Source: Marin County 2001 Congestion Management Program, 2001 Draft Monitoring Program, Prepared for Marin County Congestion Management Agency by DKA Associates, June 2001, Transportation Authority of Marin (TAM) - Marin Travel Model (MTM), September 2005

C. HIGHWAY SYSTEM IMPROVEMENTS

Marin's Congestion Management Agency regularly prepares a Congestion Management Program that prioritizes highway projects. The most recent CMP was prepared in September 2005. For the past decade, much of the attention and funding in the CMP has been focused on the "HOV gap closure" project – completing the HOV lane system through San Rafael and Larkspur, connecting to Corte Madera. This project is now mostly completed, allowing the County to develop new priorities. The latest Congestion Management Agency funding priorities distribute funds proportionately to all under-funded projects, including highway improvements, interchanges, transit, local road improvements and maintenance, and pedestrian and bicycle facilities.

The highest priority projects for highway improvements are intended to provide "spot relief" for major bottlenecks in the highway system. Critical bottlenecks occur in the Sonoma-Marin Narrows area and at critical interchanges throughout the County. In addition, accidents and incidents are often concentrated in these "choke points" where the system slows down dramatically due to spot congestion. The CMP attempts to resolve these bottleneck and safety problems.

Caltrans is currently drafting an environmental document with alternatives for improving the Sonoma-Marin Narrows area by completing the HOV lane system throughout the County. This project will have the special benefit of making transit service in this area more competitive by improving travel times, while at the same time encouraging carpool and vanpool services.

In addition, improvements are envisioned at critical interchanges throughout the County, where safety and congestion are a particular concern. Six interchanges have been identified as high priorities for future projects. The exact nature of these projects will be determined through further study by a partnership of the Congestion Management Agency, Caltrans and local stakeholders. The high priority interchanges are:

- U.S. 101/E. Blithedale
- U.S. 101/Greenbrae
- U.S. 101/Tiburon
- U.S. 101/Lucas Valley Road
- U.S. 101/Tamalpais
- U.S. 101/Atherton
- U.S. 101/Sausalito (Alexander Avenue)

III. THE FUTURE OF TRANSPORTATION IN MARIN COUNTY

A. PROJECTS AND STUDIES UNDER WAY

1. Moving Forward: A Transportation Vision for Marin County

The "Transportation Vision for Marin County" represents the first step towards making significant and lasting change in the Marin's transportation system. It represents a synthesis of over three years of study and provides a vision for a multi-modal future, in which all modes of transportation combine to manage and minimize congestion in the County. The Vision is not constrained by existing funding, but is designed to be reasonably achievable assuming cooperation at all levels in Marin. The Vision will provide many opportunities for public involvement as priorities are set.

2. SMART (Sonoma-Marin Area Rail Transit)

The Sonoma-Marin Area Rail Transit System (SMART) is intended to operate from Cloverdale in Sonoma County to San Rafael, with a planned ferry connection in southern Marin at Larkspur. Marin County stations would be sited in Novato (two locations) and San Rafael (two locations) close to the Civic Center area and downtown. Each of these stations would provide multi-modal transfer opportunities with extensive bus and shuttle services, bicycle facilities and pedestrian access. The ultimate connection to a ferry terminal will allow riders to make a seamless trip into San Francisco.

3. Marin County Bicycle and Pedestrian Master Plan

Adopted in May 2001, The Marin County Bicycle and Pedestrian Master Plan provides a blueprint for making bicycling and walking an integral part of daily life in Marin County. The 20-Year Plan calls for the completion of a countywide network of primary and secondary bikeways. It also calls for the completion of pedestrian improvements, both local and linear in nature. The long-term system is intended to connect all of the major destinations in the County as well as providing

continuous connections between communities. Along with specific physical projects, the Plan provides bicycle and pedestrian facility design standards and guidelines and provides recommendations for education, marketing, and other programs that will ultimately be implemented by public or private groups.

The Plan promotes inter-modal connections by providing direct and convenient bicycle- and pedestrian-ways to major transit stops. If fully implemented, the Plan would include significant investment in bicycle facilities at transit nodes, including both bus transfer points and rail and ferry terminals. A recent $25 million federal earmark for bicycle and pedestrian improvements in Marin County will allow many of these projects to be implemented earlier than planned.

The Countywide Plan is supplemented by individual local bicycle and pedestrian plans, prepared by each city in the County. It is also supplemented by an expanded Safe Routes to Schools Program, which addresses congestion problems in Marin County and has reduced auto use at schools 15% annually in its first two years. The Safe Routes to Schools program provides training to students and parents, and promotes engineering and construction projects that enhance bicycle and pedestrian safety around schools.

4. Marin Bus Transit Futures

Marin Bus Transit Futures is a comprehensive long-range effort to provide a vision and practical implementation strategies for improving the range of public transportation choices for local Marin County trips. The goal of the Plan is to enhance local mobility, create more livable communities and provide county residents and workers an alternative to the single occupant vehicle. The Plan seeks to improve intercommunity service within Marin, facilitate intermodal connections, expand paratransit to serve a growing senior population, and provide school shuttle services.

Transportation Demand Management (TDM), included in the Transit Futures Plan, will further improve the performance of all modes by shifting trips outside of the peak and encouraging the use of higher occupancy modes for commute trips. TDM strategies include carpool matching, telecommuting centers, "Guaranteed Ride Home" programs, and employer shuttles and transit passes.

5. Marin County Transit District Short Range Transit Plan

Currently in progress, this transit plan is the first to entirely focus on transit within Marin County. The plan includes a complete assessment of the current system and its riders, as well as a thorough identification of transit needs in Marin County and alternative techniques for meeting those needs. As of 2006, Marin County Transit District will be financially responsible for all local transit services within Marin County. With the Transit District's changing relationship to Golden Gate Transit (which currently operates most of the local transit routes within Marin County), the goal of the plan is the development of a financially sustainable transit system for Marin County riders that maximizes productivity and mobility for everyone who travels within the County.

6. Water Transit Authority Study- New Ferry Service for the North Bay

The Bay Area Water Transit Authority (WTA) was initiated through Governor Gray Davis' Transportation Congestion Relief Program. The WTA is currently evaluating terminal, service and technology enhancements to ferry services, which could greatly expand ferry service to the North

Bay. Potential new terminal locations at Port Sonoma and San Quentin are recommended for further study. Among the criteria being considered is the availability of multi-modal connections, including potential rail and bus transit services. Existing ferry harbors at Sausalito, Tiburon, and Larkspur are sufficient to handle current demand, although a new multi-modal facility at San Quentin could make the current Larkspur terminal redundant.

7. Transportation Demand Management (TDM)

TDM strategies manage the "demand" side of transportation needs by encouraging the use of higher capacity modes for work trips. This includes carpooling and vanpooling as well as transit use. As a large employer in Marin County, the County is a leader in Transportation Demand Management for County employees. The Local Bus Master Plan developed a preliminary TDM concept that would create Marin Office of Mobility Management, working closely with Marin employers to maximize the use of alternative modes for work trips in Marin County.

The Marin Employee Commute Alternatives Program offers such TDM strategies as:

- At-cost fuel and preferential parking for carpools and vanpools
- 60% bus ticket subsidies
- A Guaranteed Ride Home program
- Ridematching services
- Bicycle tune-ups and lunch certificates
- Telecommuting/teleworking program
- On-site services and facilities (cafeteria, ATM, credit union, bike storage and showers)

8. Park Access

A number of projects are being developed to improve access to Marin's recreational areas and reduce related congestion. The studies include participation of federal, state and local agencies and are being coordinated by both Marin County and the National Park Service.

a. Muir Woods Shuttle

The County of Marin developed a three-year pilot for a shuttle to reduce congestion and parking impacts at Muir Woods and on access roads leading to the park. The shuttle route carries passengers from park and ride lots near Highway 101 directly to Muir Woods during summer weekends. In its 2005 inaugural year, the shuttle was a success and further improvements are slated for the summer of 2006.

b. Marin Headlands Fort Baker Transportation Management Study

The Marin Headlands Fort Baker Transportation Management Study is a comprehensive study of alternative transportation options for the Marin Headlands and Fort Baker. Included within the Study are proposals for internal shuttles, park and ride shuttles, and transit improvements.

c. Southern Marin Parklands Comprehensive Transportation Management Plan (CTMP)

This study is a large scale planning effort intended to quantify current and future demand for park visitation and to identify broader strategies for reducing the number of vehicles accessing recreation areas and national and state parklands along State Route 1. The main strategy being studied is a satellite parking intercept facility, reservation, and shuttle bus system.

d. Tamalpais Transportation Improvements Project (TTI)

This involves two related construction projects designed to improve congestion, safety and circulation in, around and through the Tamalpais Valley, and provide alternative transportation access to the parklands. The two TTI projects are the Tennessee Valley Trail upgrade project to improve access for all users from the Mill Valley-Sausalito Bike Path to the GGNRA trailhead at the end of Tennessee Valley Road; and the Coyote Creek Bridge replacement project on Shoreline Highway to improve alternative access under the bridge and across the creek, as well as vehicle access across the bridge.

e. GGNRA Ferry Access Study

The study is examining land use, market data, and the existing transportation network surrounding the GGNRA in order to plan and implement better access to the recreation area with a ferry terminal at Horseshoe Bay in Fort Baker. The study identifies potential terminal sites that will support visitor flow, and facilitate transit linkages while remaining ADA compliant to create as seamless a transportation network as possible. Mode preference surveys have helped forecast ridership by trip purpose in order to develop routes that serve an identifiable market.

Both the capital costs of pier and landside facilities, and annual operations and maintenance costs are to be carefully compared with expected visitor flow and anticipated ferry revenue. Environmental considerations are being made along all federal, state and Bay Area regulatory guidelines, including tidal flow and range, dredging, and wave impact, wake erosion and noise pollution in the context of habitat. Other factors include tidal flow and range, depths around potential piers and the need for dredging.

f. National Park Service Transportation Demand Management Program (TDM)

The National Park Service is developing a TDM program for park tenants, which will reduce commute traffic generated by the headlands. The study focuses on the southern Marin Headlands and Fort Baker, and considers the area's connectivity with surrounding gateway communities while placing it, appropriately, in its regional context. The program promotes alternative transportation modes, and maintains special events guidelines to regulate events in Fort Baker. The program coordinates with Bay Area Discovery Museum and the retreat and conference center there to reduce single vehicle trips and to minimize parking demand.

APPENDIX 1. REFERENCES

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APPENDIX 1-J

FLOODING BACKGROUND REPORT, MARCH 2002, UPDATED NOVEMBER 2005

MARIN COUNTYWIDE PLAN

Flooding
Technical Background Report

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I. FLOODING

A. PURPOSE AND BACKGROUND

This Flooding Background report updates the previous Environmental Hazards Element Technical Report #1 – Flood Hazards in Marin which was prepared in 1991. That report described the existing hydrologic environment, the flooding regime and historical floods, applicable County regulations, the basis of the National Floodplain Insurance Program, the composition and responsibilities of the Marin County Flood Control and Water Conservation District (MCFCWCD), and the delineation and status of flood protection in the County Flood Control Zones, as well as an assessment of the County's performance via a vis the policies adopted in the 1994 *Marin Countywide Plan*. The dual focus of the current report comprises an assessment of the modifications to the flooding environment described in the 1991 assessment and an evaluation of the efficacy of current of County flood protection policies.

B. REGULATORY FRAMEWORK

Federal and local regulations have been promulgated to reduce both the exposure of the developed areas of the County to damaging flooding and the funds required to rebuild communities following such major floods. Until the early to mid-1980s, the flood control and reduction strategies that were typically applied in Marin and other Bay Area counties often had detrimental impacts on aquatic, riparian and wetland habitats. Federal and state agencies including the U.S Environmental Protection Agency (USEPA) and its sister agency, the California Environmental Protection Agency (CalEPA) and the state's regional water quality control boards were created, in part, to develop and enforce environmental regulations that would protect the integrity of streams, wetlands and sensitive habitats. Even the Corps of Engineers, which was the principal advocate of dam building, river regulation and large scale flood control works, added the Regulatory Branch to its organization in order to regulate the discharge of fill into streams and wetlands. In addition, growth in the understanding of the linkage between hydraulic and fluvial geomorphological processes caused a re-evaluation of some of the commonly applied flood control techniques, such as use of concrete channel lining, channel straightening and the elimination of functional floodplain areas. The current and evolving regulatory environment affecting flood control activities reflects this understanding of the stream channel and its contributing watershed as an integrated physical (fluvial) and biological entity.

1. National Flood Insurance Program and Related County Code Provisions

The National Flood Insurance Act of 1968 and the Flood Disaster Prevention Act of 1973 established the National Flood Insurance Program (NFIP) which is administered by the Federal Emergency Management Agency (FEMA). The NFIP provides insurance coverage to property owners within flood hazard areas that are delineated on published Flood Insurance Rate Maps (FIRMs) for both the 100-year and 500-year flood events. In order to quality for the program, candidate municipalities and unincorporated county areas must adopt local floodplain development policies and enforce flood control measures for new construction and redevelopment projects within their jurisdictions. FEMA prepares Flood Insurance Studies and associated FIRM maps to assist communities in local land use planning and flood control decision-making.

The County of Marin entered into the NFIP in 1982, the date the original FIRM maps were published for the incorporated area. Portions of the FIRM map coverage for Eastern Marin were updated in 1997. Exhibit 1 delineates the 100-year and 500-year flood hazard zones throughout the Countywide Plan area.

Relevant sections of the Marin County Code that address flooding issues and related development standards include:

- Title 11: Harbors and Waterways – regulates both the construction and repair of dams not regulated by the State and the diversion or obstruction of watercourses. Of particular interest regarding flooding are Sections 11.08.010 Interfering with water flow; and 11.08.050-060 Permit required for construction/Application-Fees. Section 11.08-010 prohibits the discharge of fill, debris, waste, bank stabilization materials into creeks if the discharge obstructs or impedes flow in the channel. However, it also exempts channel or bank modifications that improve or realign the channel, as long as natural flows are not diverted, obstructed or prevented. Sections 11.08.050-060 require that any property owner contemplating instream improvements such as channel realignment and bank protection measures secure a creek permit from the County Department of Public Works prior to construction.

  Chapters 11.24, 11.28 and 11.32 refer to design standards for harbors, marinas and related structures such as piers, gangways and floats.

- Title 22: Development Code – encompasses both Zoning and Subdivision Ordinances. Chapter 22.14 Special Purpose and Combining Districts contains Section 22.14.070 Primary Floodway District (F-1) and Section 22.14.080 Secondary Floodway (F-2) District – which establish Primary and Secondary Floodway Districts and regulates floodway encroachment. It also establishes requirements for site preparation, design and use of projects to satisfy the goals and objectives of the Countywide Plan, both within the City-Centered Corridor and the Coastal Recreational Corridor, which is subject to the permitting authority of the California Coastal Commission. The F1/F2 zoning designation should not be confused with other regulations and restrictions. They are not redundant they deal with different aspects of flooding.

  The defined floodway pertains to that portion of the channel/floodplain cross-section that is required to pass the base (i.e. design) 100-year flood. The F-1 District prohibits the construction of buildings or other structures in the floodway that would either increase flood water surface elevations or otherwise impede floodwaters. It does allow any property in the floodway zone to install a single floating boat dock.

  The F-2 District applies to the floodway fringe, as defined by the Federal Emergency Management Agency (FEMA). It encompasses the portion of the natural floodplain between the outer edge of the F-1 floodway zone and the limits of inundation during the design 100-year flood. This zone is subject to some inundation during the design flood, but flow depths and velocities are typically low. Encroachment by development is allowed therein only through an agreement with the MCFCWCD and is limited to a specified area. The remainder of the area must be available for storage of ponded waters during severe flood events. Provisions of the required agreement with MCFCWCD include ponding availability, dedication of F-1 (Primary Floodway) areas to the County or other maintaining public agency, drainage improvements to accommodate floodwater

ponding, and a performance bond, among others. The current section language allows for a release from the agreement if ultimate (i.e. 100-year) flood control improvements are implemented from the subject property to the mouth of the stream.

Sections 22.10.040 and 22.16.030 identify design requirements for projects zoned as Residential, Multiple Planned District (RMP), including those applied to site preparation, grading, roadway design, erosion control measures and site drainage. While the sub-section on Drainage discusses design measures to reduce the risk of erosion to adjacent properties, it does not mention the conversion of natural channels to storm drain systems.

Section 22.14.060, Bayfront Conservation (-BFC) Combining District, identifies the boundaries of environmentally sensitive areas along the shoreline of San Francisco Bay and restricts development therein. The BFC enhances the County's policy of encouraging regulatory flood control by discouraging development in sensitive baylands.

Article V, Coastal Zones was approved by the Marin County Board of Supervisors on June 24, 2003, however, this recent County Code update has not yet been approved by the California Coastal Commission (CCC). Pending approval by the CCC, land located within the coastal zone will continue to be regulated by relevant provisions of Title 22 of the Marin County Code that were in effect prior to the current Code. The Coastal Development Code describes development requirements, standards and conditions for developments in the Coastal Recreational Corridor. Many of these projects are subject to conditions of the Local Coastal Program (LCP) and must secure coastal development permits from thick. In nearly every case, the standards described in this section are much stricter than those governing development elsewhere in the County, i.e. outside the Coastal Recreation Corridor. Water supply, septic system design, sediment and erosion control, and stream and wetland resource protection are discussed in detail in this section. Two specific provisions relate to flooding for developments within or adjacent to blue line streams as identified on USGS 7.5-minute quadrangle sheets: 1) post-project peak flow rates shall not exceed those of the pre-project condition, and 2) development setbacks from stream channels shall be 100 feet from the nearest top of bank, or 50 feet beyond the edge of established riparian vegetation, whichever is greater.

Chapter 22.52, Tidelands Permits, pertains to land and water areas with elevations below the mean high tide (MHT). Construction, dumping, filling, excavating dredging and the placement of piers or other structures is prohibited in the defined tidelands. Applications for the installation of structures may be conditionally approved as long as they meet certain conditions, including not causing an increase in the likelihood of flooding on adjoining lands.

- Title 23 Natural Resources: Chapter 23.09 Floodplain Management – establishes the Special Flood Hazard Areas (SFHAs) as defined by FEMA for the base 100-year flood event as the standard definition of the channel floodplain covered by the section. It also establishes permit requirements for proposed floodplain construction projects, prohibits floodway encroachments and sets standards for construction, utilities and subdivisions. Special provisions for coastal high hazard areas are defined in Section 23.09.039.

  Sections 23.18.093 Best Management Practices for New Developments and Redevelopments and 23.18.094 Watercourse Protection – grant the Director of Public Works the authority to establish

temporary and/or permanent controls on the volume and rate of stormwater runoff from new developments and redevelopments; establishes creek maintenance responsibilities and guidelines for creekside property owners; controls unpermitted discharges, channel excavation and fill; and regulates unpermitted construction, modification or removal of existing structures within a watercourse.

- Title 24 Development Standards, Chapter 24.04 Improvements, VI. Drainage Facilities, VII. Subsidence, and VIII. Grading – set standards for the design and construction of channels, catch basins and conduits, and drainage setbacks; cites minimum elevations for garage floors and finished floors of structures for flood protection; and regulates the conduct of grading with no distinction between instream and off-stream environs.

  The Title 24 Development Standards specify minimum elevations for new construction, including roadways, garages and finished floors, allowing for ultimate ground settlement – normally interpreted over a 50 – to 100-year period. In areas immediately adjacent to tidal influence, minimum elevations for garages and finished floors of structures cited in the statute are +8.0 feet NGVD and +9.0 feet NGVD, after settlement respectively. These elevations reflect relatively recent increases due to consideration of the projected rise in sea level. Where stormwater inflows, wind and wave runup or other factors contribute to the flood risk, the minimum garage and finished floor elevations are increased accordingly by applying the appropriate hydraulic analyses. Similar standards apply to redevelopment and residential remodeling that exceeds 50 percent of the value of the structure. (Clearwater Hydrology conversation with John Wooley, MCFCWCD, ibid)

C. MAPPING SUMMARY

Exhibit 1 delineates the 100-year and 500-year flood hazard zones mapped by the Federal Emergency Management Agency and its contractors. These flood boundaries are determined through application of standard methodologies for the analysis of watershed peak flow rates, tidal magnitudes and frequencies, and flood water surface profiles. Dam inundation areas for major reservoirs in the County are also shown on the exhibit. These inundation areas represent the path and extent of floodwaters that would progress downstream in the unlikely event of a dam failure. Dam failures could occur in response to a catastrophic rainfall and flooding event or as the result of a severe seismic event. Finally, Exhibit 1 delineates the County Flood Control Zones and shows the locations of County-operated and maintained pump stations for floodwater evacuation.

D. SETTING

1. Historical Flooding

Damage-inducing flooding has occurred infrequently in the Countywide Plan area, primarily in the lower lying alluvial valleys and Bay plains of the City-Centered Corridor. From 1950 to 1970, major floods occurred in 1952, 1955, 1958, 1967 and 1970. Over the past 30 years, significant flooding has occurred in portions of Corte Madera, Larkspur, Greenbrae, Ross, San Anselmo, San Rafael and Novato in January 1982, January and December 1983, February 1986, January 1997 and February

1998. The 1982-'83, '86 and 1997-'98 periods were influenced to some degree by the El Nino climatic phenomenon. El Ninos involve a warming of offshore areas of the Pacific Ocean and an alteration in the normal weather patterns affecting Northern California. Typically, the associated weather is much wetter and storms more intense than during non-El Nino periods. High than normal tides are also associated with El Ninos due, in part, to the expansion of warmer ocean waters.

Two forms of flooding occur in the Countywide Plan area: 1) tidal flooding and 2) watershed flooding. Coincident tidal and watershed flooding can also occur. Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. Watershed flooding occurs in response to severe runoff-inducing rainfall over the tributary watershed of one of the region's stream channels. Major watershed floods are typically generated by rainstorms of 3-4 days duration that include nested periods of high intensity rainfall. Such rainstorms occur primarily during the wet winter season which normally extends from November through March. When watershed flooding occurs in conjunction with high bay tides, the extent and/or depth of overbank flooding or levee overtopping can increase due to an upward adjustment in the flood water surface profile.

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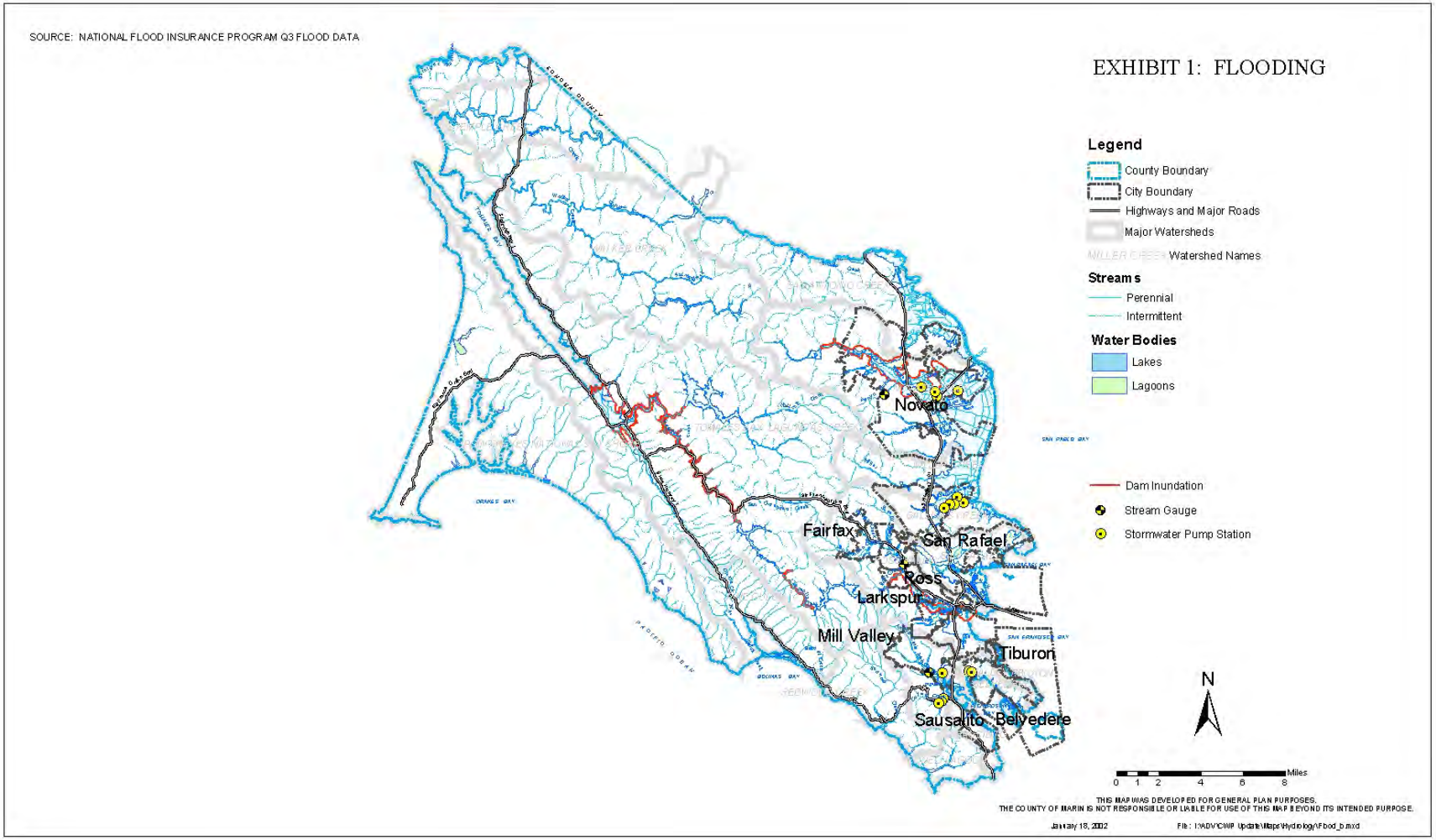
SOURCE: NATIONAL FLOOD INSURANCE PROGRAM Q3 FLOOD DATA
EXHIBIT 1: FLOODING
Legend
County Boundary
City Boundary
Highways and Major Roads
Major Watersheds
Watershed Names
Streams
Perennial
Intermittent
Water Bodies
Lakes
Lagoons
Dam Inundation
Stream Gauge
Stormwater Pump Station
Novato
Fairfax
San Rafael
Ross
Larkspur
Mill Valley
Tiburon
Sausalito
Belvedere
N
Miles
0 1 2 4 6 8
THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
THE COUNTY OF MARIN IS NOT RESPONSIBLE OR LIABLE FOR USE OF THIS MAP BEYOND ITS INTENDED PURPOSE.
January 18, 2002

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The filling of former baylands initially allowed for their development, as the higher land elevations protected the areas from tidal flooding. However, subsequent subsidence of the landward fills eventually reduced the level of flood protection. Levees were then constructed to segregate the subsided lands from tidal flooding. In addition, watershed runoff had to be evacuated from these low-lying areas using pump stations, maintained inlet channels and pipe networks.

Watershed flooding is commonly associated with the development of formerly active floodplains and an increase in the peak rates of watershed runoff. Peak flows increase due to increases in impervious surface coverage and the construction of storm drain systems, which reduce the time of concentration for runoff. When peak flow rates increase substantially and the altered flow regime is not accommodated using channel modifications, stormwater detention or diversion, and/or stream conservation zones, episodic flooding can ensue.

Since 1980, damaging watershed and/or tidal flooding has occurred at several locations within the Countywide Plan area. In the storm of January 2-5, 1982, watershed flooding on Corte Madera Creek produced floodplain inundation depths of 1-3 feet through the Towns of San Anselmo, Ross, Kentfield, and Greenbrae. The same storm produced damaging flooding in portions of the City of Novato along Novato Creek, Warner Creek and Arroyo Avichi. The community of Santa Venitia, which functions as an independent watershed due to its leveed segregation from Las Gallinas Creek, experienced flooding as watershed runoff and entrained hillslope debris obstructed inlet channels and pump station inlets. Nuisance flooding also occurred in San Rafael on the southern tributaries to San Rafael Creek, in the Bret Harte/Picnic Valley and Irwin Street neighborhoods, and on the eastern tributary (aka Sisters Creek) to Black Canyon Creek in the vicinity of Dominican College. Along the Pacific Ocean recreational corridor, the 1982 storm generated numerous catastrophic landslides and related flooding, as land debris obstructed or completely filled drainageways. In general, the watershed flooding in this portion of the Countywide Plan area produced minimal damage because of its low population density.

The Valentine's Day storm of February 1986 caused overbank flooding along the Corps of Engineers flood control channel on Corte Madera Creek, although the depths of floodplain inundation (1-2 feet) were less than those experienced during the January 1982 flood. Damaging flooding was avoided in the Town of Novato due to the 1985 expansion of reservoir capacity at Stafford Lake, which stores and regulates outflows from the upper Novato Creek Watershed.

Extreme high tides with recurrence intervals exceeding 100-years occurred in January and December 1983. Levee overtopping and the resulting tidal flooding was documented in the communities of Santa Venitia and Corte Madera (Lucky Drive), and historically susceptible low-lying areas of eastern San Rafael. Tidally induced flooding occurred again in the Lucky Drive area of Corte Madera in 1997 and 1998. Both Tamalpais Valley (Coyote Creek) and Santa Venetia survived the January 1997 and February 1998 El Nino floods and high tides, without serious flood damage. However, this was due to a lack of coincidence between watershed flood peaks and high Bay tides, rather than substantial improvements in flood control facilities. (Clearwater Hydrology conversation with John Wooley, P.E., MCFCWCD, Land Development Division, Sept. 2001)

2. Dam Inundation Flooding

Significant, even catastrophic flooding can occur in valley areas downstream of major dams in the event of a complete or partial dam failure. Such events are extremely rare due to the stringent design and

permitting requirements for dam construction and operation. However, in the active tectonic environment of the San Francisco Bay Area, the risk of a dam failure during a major earthquake remains a possibility. Dam failures can occur in response to full or partial structural collapse of the dam face (concrete arch dam) or embankment (earthfill dam) during a major earthquake. The dam could also partially rupture during an earthquake and fail completely sometime later due to leakage/seepage through the damaged embankment or dam face. In addition, a seiche (i.e. a long period, oscillating wave) generated over the reservoir surface in response to severe ground motion and stored water displacement could also cause overtopping of the dam. Overtopping by a seiche wave could trigger a structural failure of the dam.

Water supply dams are an integral part of the water resources environment in the Countywide Plan area. The Marin Municipal Water District (MMWD) and the North Marin Municipal Water District operate and maintain eight major dams for municipal water supplies within their jurisdictions. MMWD dams include Alpine Dam, Bon Tempe Dam, Lagunitas Dam, Phoenix Dam, Peters Dam (Kent Lake), Nicasio Dam, and Soulajule Dam. NMWD maintains and operates one dam at Stafford Lake on Novato Creek for its smaller service area. Storage characteristics for these dams were listed in the 1991 Environmental Hazards Element Technical Report #1 Flood Hazards in Marin County (Marin Co. Community Services Agency 1991).

An additional dam and reservoir, which will be owned and operated by Lucasfilm Ltd., is currently under construction at Big Rock Ranch. This dam and reservoir will serve a local water supply function for the film production facilities at Big Rock Ranch. Its storage capacity is estimated at roughly 120 acre-feet. While it is much smaller than any of the other water supply reservoirs operated by MMWD and NMWD, it still falls under the jurisdiction and control of the State Division of Dam Safety (DDS). All reservoirs with storage capacity exceeding 50 acre-feet or with dam heights over 25 feet are permitted and inspected by the DDS. Numerous small dams and stock ponds occur throughout the Inland Rural and Coastal Recreation Corridor lands in the Countywide Plan area and fall outside of the state's jurisdiction. These smaller impoundments are under the permitting authority of the County Department of Public Works in accordance with Marin County Code Title 11.04, Dam Construction and Repair.

Inundation mapping is conducted for most significant dam/reservoir complexes where downstream valleys are inhabited and the risk of loss of life and extensive property damage is significant. In the early-mid 1970s, MMWD and NMWD conducted hydraulic modeling of the downstream flood waves and associated inundation areas that would occur in response to dam failures at their water supply damsites in the Inland Rural and Coastal Recreation Corridor areas of Marin County. Of the eight dams under their jurisdictions, only the Soulajule Dam was excluded from the inundation mapping. Inundation maps for the modeled dams/reservoirs are on-file with the Community Development Agency (CDA) and were also included in the 1991 Environmental Hazards Element Technical Report on Floods. To date, the inundation mapping for Soulajule Dam remains undone. Since a failure of Soulajule Dam would inundate largely rural land and a Pacific Bell receiving site, and would endanger few populated areas (Technical Report: Floods 1991), it is unlikely that expensive hydraulic modeling and inundation mapping will be conducted under the current zoning. A preliminary hydraulic modeling of dam failure and downstream inundation was conducted for the new earthfill dam at Big Rock Ranch (Vandivere 1995). However, a more refined modeling using numerical methods would be required to verify and/or adjust the results of the preliminary analysis, prior to the publication of an

inundation map for planning purposes. Also, areas subject to inundation from failures at the many smaller dams and stock ponds under County jurisdiction have not been mapped (Technical Report: Floods ibid).

3. Sea Level Rise

The Bay Conservation and Development Commission's study of sea level rise and its impacts on San Francisco Bay (BCDC 1988) cited evidence that global sea level rise during the preceding century was about 0.0039 feet/year. According to BCDC staff, the 1988 study remains the local benchmark study for assessing the impacts of sea level rise in the Bay Area (Clearwater Hydrology conversation with Bob Batha, staff scientist, BCDC). Along the City-Centered Corridor, the nearest tide gaging stations studied were at Point Orient and Sausalito on San Pablo and San Francisco Bays. The local relative sea level change (i.e. the apparent rate minus the rate of local land uplift or subsidence) for these stations ranged from 0.0059 feet/year (Point Orient) to 0.0002 feet/year (Sausalito). The only Pacific coastline station that was included in the study was the Presidio gaging station (Golden Gate) which is the tidal reference station for San Francisco Bay. Since there was no vertical land motion indicated during releveling surveys of that benchmark tidal datum, the Presidio station was assumed to equal the global rate of sea level rise (0.0039 feet/year).

Further analysis of sea level rise during a more recent 19-year tidal epoch extending from 1964 to 1982, indicated that global sea level rise had quickened to roughly 0.0072 feet/year. Based on this more recent rate of rise, mean sea level at the Point Orient gaging station was estimated to increase from a present (1986) elevation of +0.40 feet to +0.86 feet NGVD in 2036. Similarly, mean sea level at the Sausalito gaging station was estimated to rise from +0.30 feet to +0.48 feet NGVD in 2036. For the Presidio gage, mean sea level was predicted to increase from +0.29 feet to +0.65 feet NGVD in 2036.

Given the unknowns at work in the generation of sea level rise, BCDC and its consultants (BCDC ibid.) propose a range of 0.005 to 0.05 feet per year for general planning purposes. Moreover, similar extrapolations applied to the computation of the highest estimated tide (HET) produced a predicted HET for the Year 2036 for the Point Orient, Sausalito and Presidio gaging stations of 6.9 feet, 6.3 feet and 6.4 feet NGVD, respectively. These HET elevations represent an increase of 0.2 to 0.5 feet over the station estimates cited by the Corps of Engineers (1984).

These predicted increases in both global sea level rise and San Francisco and San Pablo Bay tide elevations will increase the risk of flooding in the low-lying communities of Tamalpais Valley (Coyote Creek) and Santa Venetia during infrequent, extreme tides and/or high tides with coincident, severe watershed flooding. The risk of coastal flooding in Bolinas, Stinson Beach and other coastal communities due to extreme tides, storm swells and storm-generated runup could also increase due to the gradual increase in sea level. The extent of overtopping of seawalls, roadways and other coastal erosion works, as well as undermining of jetties and breakwater barriers could be exacerbated by sea level rise.

A re-mapping FEMA-designated flood hazard boundaries based on the projected 0.2-0.5 feet of sea level rise through the year 2036 (50 years from the date of the 1986 BCDC report) was considered for inclusion in this Environmental Hazards Element Technical Report update.

However, two problems became immediately apparent due to the minor elevation differential involved:

- The effect of a rise in the Corps' Highest Estimated Tide (HET), which is roughly equivalent to the 100-year high tide, on flood elevations along the Bay and Pacific Ocean shoreline is non-linear. In other words, a 0.5-feet rise in the HET may not translate to a 0.5-feet increase in the existing 100-year base flood elevation as mapped by FEMA. This is due to the fact that significant changes in flooding are likely to occur when low-lying, subsided levee sections are overtopped by the higher tides. Similarly, where streams are not segregated from their floodplains, small changes in elevation can intersect significant topographic features (e.g. slope break on a bank or flood terrace). In each case, the hydraulic behavior of floodflows or tidal flows can change. Thus, this phenomenon is site specific and cannot be evaluated based on the macro-scale assessment of sea level rise on the HET level at any position along the shorelines.

  Most communities within the active County Flood Zone network have raised, or are in the process of raising, levee elevations in response to the prudent changes in the Title 24 Development Standards and the general guidance given by the County DPW and other public works departments in the incorporated areas. Title 24 establishes the minimum elevations after subsidence for garages, finished floors and other structures adjacent to areas of tidal influence.

- *The topographic mapping for Marin County is not refined enough to support the mapping of a 0.2–0.5 feet change in flood elevations.* Thus, even if the impact on flood elevations were linear relative to the increase in the HET elevation, it wouldn't be possible to discriminate between the current and 2036 flood boundaries at this differential.

For these reasons, the mapping of 2036 flood boundaries dictated by the increased sea level was deemed infeasible at this level of investigation. An extensive program of flood modeling based on an updated survey of watershed channel conditions and levee elevations through the Countywide Plan area would be required to quantify the effects of sea level rise on the flood hazard. If more severe global warming and its potentially attendant impacts (e.g. melting of polar ice caps) were forecasted with a high likelihood of occurrence, the extent of sea level rise would increase on the order of feet rather than tenths of a foot. Under these conditions, such a high-profile re-assessment of flooding would be prudent.

4. FEMA Flood Mapping for the Countywide Plan Area

Exhibit 1 is a composite FIRM map for the Countywide Plan area which incorporates revisions through 1997. The base 100-year flood elevation in low-lying unincorporated areas in and adjacent to Santa Venetia was uniformly mapped at +6.0 ft NGVD, based on the demonstrated flooding that occurred in January 1982. Other flood zones were mapped using standard engineering methods involving hydrologic assessments of peak flow rates, flood water surface profile modeling and flood routing techniques. The Santa Venetia subdivision lies immediately adjacent to a leveed reach of lower Gallinas Creek, which is subject to both infrequent tidal flooding (due to levee overtopping by extreme tides) and watershed flooding (due to severe watershed runoff and debris inflows).

Portions of the FIRM map coverage for Western Marin were updated in 1986 and for Eastern Marin were updated in 1997. The most significant changes in the 1997 mapping were identified on the

revised FIRM maps for the Marin County Unincorporated Areas – Southern Part. The San Rafael Community Development Department (CDD) and the City's engineering consultant submitted a Letter of Map Revision (LOMR) application to FEMA for the lower reaches of Miller Creek, based on a revised flood analysis that was conducted in 1993. (Ensign and Buckley, Letter Report submitted to City of San Rafael, 1993) The flood analysis was initiated on the strength of new information on channel conditions (e.g. modifications) and more detailed topographic data. The resulting changes to the delineated flood hazard zone in this area were incorporated into the 1997-revised FIRM mapping.

Specific property owners can also petition FEMA for changes to flood hazard designations via the LOMR process. Information on this process is available from the County Department of Public Works or FEMA.

5. The Marin County Flood Control and Water Conservation District

The Marin County Flood Control and Water Conservation District (MCFCWCD) was established in 1953 by the State Legislature through the Marin County Flood Control and Water Conservation District Act (Chapter 68 of the Appendix of the California Water Code). Boundaries of the District coincide with county boundaries, with the exception that the Town of Corte Madera is not part of the District. The Marin County Board of Supervisors sits as the Board of Supervisors of the Flood Control District, and the District is operated in coordination with the County Department of Public Works. The District administers flood control projects and oversees revenue collection in each of the eight active Flood Control Zones in Marin. Flood Control District staff work for the County of Marin, but charge their time to the appropriate Flood Zones.

Marin County Flood Control Zones are located principally in populated area, although one of the Zones (Inverness Ridge – Zone 10) encompasses the largely rural area of Inverness. Each Zone has an Advisory Board which recommends flood control projects and funding to the Board of Supervisors. Flood Control Zones raise money through property taxes and assessment overrides. The Zones fund their own flood control projects, and contribute funds to the central administration of the Flood Control District. The Zones vary considerably in size, financial resources, and hazard severity. Funds raised within a Flood Control Zone can only be spent within that Zone. The Flood Control District has problems addressing all County flood control needs under a system characterized by revenue surpluses in some Zones, inadequate financing of flood control projects in others, and very little money for areas outside the system of Flood Control Zones altogether. The eight Flood Control Zones in the County are delineated in Exhibit 1.

The County has administered a number of flood protection measures in County Flood Control Zones. County Code Section 23.09 requires that projects include the purchase of land to re-establish the floodplain, flood proofing of property by raising flood prone buildings and making them watertight, construction of berms and retaining walls, and floodplain zoning. Other flood control activities undertaken in flood zones include the construction of physical facilities such as engineered stream channels, pump stations, levees and bank stabilization works.

The eight flood control zones in Marin are:

Flood Control Zone 1 (Novato) – This Zone encompasses the entire watershed tributary to Novato Creek, which includes all of the City of Novato plus a substantial amount of unincorporated area

around Novato. In November of 1984, the voters of this Zone approved a four-year, $9 million project to reduce flooding from Novato Creek and its tributaries. The Zone also periodically dredges watercourses and began an annual debris removal program in 1983 with the Marin Conservation Corps.

Flood Control Zone 3 (Richardson Bay) – Flood Control Zone 3 includes the area tributary to the upper end of Richardson Bay, all of Mill Valley, plus unincorporated areas such as Marin City, Tamalpais Valley, Homestead Valley, the Alto-Sutton Manor area, and portions of the Strawberry Peninsula. The Zone has built pump stations at Cardinal Road, Marin Avenue, Shoreline Highway at Coyote Creek and one station on Ryan Creek. The Zone has also adopted a plan for constructing major flood control works over several years.

Flood Control Zone 4 (Bel Air) – This small Zone is located off Tiburon Boulevard, recently annexed to the Town of Tiburon. The Zone maintains two ~~a~~ major storm water pump station, cleans existing drainage ditches, and plans to replace culverts under Highway 131 in conjunction with Caltrans, and construct an additional storm water pump station.

Flood Control Zone 5 (Stinson Beach) – Flood Zone 5 includes the entire area tributary to Eskoot Creek which runs through Stinson Beach. The Zone has a very limited budget and present policy includes maintenance operations only. Periodic inspection of the creek and required enforcement of County code provisions regarding debris and/or illegal structures occurs under the jurisdiction of the Flood Control District.

Flood Control Zone 6 (Rafael Meadows) – This Zone, located across the Highway 101 from the Marin County Civic Center, lies within the City of San Rafael. While the City of San Rafael performs all maintenance within the Zone, residents and the City keep the Zone active as a potential source of revenue for future projects.

Flood Control Zone 7 (Santa Venetia) – Flood Zone 7, located east of the Marin County Civic Center, faces a number of ongoing problems related to its location in a floodplain and atop bay mud which is slowly subsiding. The area was particularly hard hit during the winters of 1982 and 1983, affected both by stormwater runoff and extreme high tides. The Zone began reinforcing the existing levee system after the 1982-83 floods with a loan from Flood Control Zone 4. The Zone built a bypass system to take runoff from the adjacent southern hillslopes and convey it around local drainage systems into Las Gallinas Creek, and a series of stormwater pump stations to lift stormwater out of the area during prolonged, intense rainstorms. The Flood Control District presently maintains internal drainage systems, perimeter levees and five stormwater pump stations.

Flood Control Zone 9 (Ross Valley) – This Zone encompasses all of the Ross Valley with the exception of San Anselmo and Fairfax and is currently acting under court order to complete the Corte Madera Creek project. The project, though 70 percent completed, has been stalled for a number of years due to public opposition, litigation and funding shortfalls. An update of the Corte Madera Creek project discussion is presented in the following section.

Flood Control Zone 10 (Inverness Ridge – This Zone formed after the disastrous January 2-5, 1982 rainstorm. The Zone collects taxes and cleans and restores local creek channels. During the late 1980s, it received Coastal Conservancy grant funding for creek maintenance in Haggarty Gulch and

Fish Hatchery Creek. (Environmental Hazards Element Technical Report #1 Flood Hazards in Marin County 1991)

6. Current Status of County Flood Control Programs

a. Las Gallinas Creek Watershed – Santa Venetia

The community of Santa Venetia was constructed in the 1950s and occupies a north-facing hillslope and the former southern floodplain of Las Gallinas Creek, near its confluence with San Pablo Bay. Subsequent subsidence of the underlying Bay mud increased the local flood hazard, so a levee system was constructed to minimize the risk of tidal flooding from lower Las Gallinas Creek. The levee construction essentially segregated the floodplain from the Creek, such that the current community and its adjoining hillslopes comprise an independent watershed. Pump stations were also installed to evacuate local stormwater runoff. An extension to the perimeter levee, consisting of a double-bulkhead timber wall, was constructed in 1983. The low-lying areas of the subdivision remain prone to backwater flooding during periods of extreme high tides (such as January and December 1983), or coincident high tides and high magnitude floodflows on Las Gallinas Creek.

The perimeter levee that protects Santa Venetia from tidal flooding is the most critical element in the flood control plan. Up until recently, the rate of levee subsidence was causing concern among MCFCWCD staff. Another extension or reconstruction of the existing levee was viewed as a high priority for Zone 7. However, in the last few years, the documented rate of levee subsidence has decreased to an extent that staff feels there is more time to implement the reconstruction. MCFCWCD staff have recently made inquiries with the Corps of Engineers about instituting a new federally funded flood control project at Santa Venetia. (Clearwater Hydrology conversation with John Wooley, Land Development Engineer, MCFCWCD, Dec. 2001)

The MCFCD Zone 7 currently operates and maintains five stormwater pumping stations within the affected areas. Bypass pipes convey runoff from the adjoining southern hillslopes directly to outlets in Las Gallinas Creek. This reduces the volume of stormwater that must be evacuated by the pump stations, which are subject to occasional obstruction by debris and mechanical or electrical failures. In addition, the Zone installed two of three segments of an intertie pipeline connecting four of the five pump stations. The intertie allows surcharged stormwater accumulating at one or more station inlets to be redirected to other unobstructed or higher capacity stations. The referenced 1998 engineering studies determined that one installed segment of the intertie requires reconstruction, while the second installed segment is functioning satisfactorily. Utility line conflicts and the resulting field adjustments made to the grade of the Pump Station No. 1 to 5 intertie segment reduced its effectiveness. The absence of the third segment, in association with the severely inadequate capacity of Pump Station No. 1, further reduces the overall capacity of the dewatering system. At present, the pump station network and its partially completed intertie pipeline are sufficient to evacuate the incoming stormwater runoff generated by the design 10-year rainstorm, assuming no levee overtopping by tide waters.

Engineering recommendations for upgrading the capacity of the Santa Venetia stormwater evacuation system were cited in the Nute Engineering report (Ibid). Those which are still planned for implementation by MCFCWCD Zone No. 7 include:

- Rebuild Pump Station No. 2 with enough capacity to discharge the 100-year watershed inflow of roughly 50 cfs; incorporate backup generation and outlet piping as required.

- Construct a new pump station at the end of Estancia Way; this pump station will divert stormwater that currently enters the drainage ditch leading to Pump Station No. 5, which has an insufficient gradient to effectively convey incoming stormwater runoff, directly to Las Gallinas Creek.

In conjunction with the recommendations cited above, the Zone conducted a recent assessment of the pumping facilities at each of the five stations. Three of the five pump stations were determined to be in good condition and all five are equipped with back-up electrical generators. Easements adjacent to Pump Station No. 1 were purchased and the pump was rebuilt with a minimum total pumping capacity of 65 cfs, along with an upgraded 42-inch outlet pipe to Las Gallinas Creek. The rebuilding of Pump Station No. 1 eliminated any need for an intertie to Pump Station No. 5. As indicated above, Station No. 2 require some level of renovation and upgrading to achieve more reliable service and the target 100-year level of flood protection.(Clearwater Hydrology conversation with Tracy Clay, MCFCWCD, September 2005)

b. Coyote Creek Watershed – Tamalpais Valley

The community of Tamalpais Valley is bisected by Coyote Creek, a northeast trending tributary of Richardson Bay. The Coyote Creek Watershed encompasses highland areas within the Golden Gate National Recreation Area (GGNRA), as well as the low-lying and hillside subdivisions adjoining its lower reach. The US Army Corps of Engineers (COE) constructed a federal flood control project on Coyote Creek in the early 1960s. The lower tidally-influenced reach of the creek consists of an earthen, roughly trapezoidal channel section. Upstream of this reach, a rectangular concrete channel was constructed. It extends from roughly 500 feet upstream of Flamingo Road to just above Maple Street. Both the lower earthen reach and the concrete reach, totaling a distance of approximately 1.25 miles, are periodically dredged to maintain flood conveyance. Over the lifetime of the project, the dredging frequency has averaged once every 6-10 years. The MCFCWCD oversees the maintenance dredging which is contracted to private dredging firms. The COE conducts annual inspections of the project and makes recommendation to the County regarding maintenance needs.

Earthen levees were also constructed along the lower reach of the Corps project. Thus, at high bay tides, local stormwater runoff must be evacuated via pumping. The MCFCWCD operates and maintains three pump stations in the low-lying residential areas adjacent to the levees. The pumping stations are in good condition and the levee has been maintained at the original design elevation. All but one of the flood control improvements cited in the *Master Drainage Plan for the Tamalpais Valley Watershed* (Murray-McCormick Environmental Group 1973) have been implemented. These facilities afford flood protection ranging from the 25-50 year recurrence interval for Coyote Creek (depending on the extent of accumulated channel sedimentation), 25-year recurrence intervals for Crest Marin and Tennessee Creeks, and 50-year recurrence interval for the stormwater pumping stations. Higher levels of protection (e.g. 100-year) were not adopted by the Master Plan due to economic and engineering considerations. The close proximity of the levees to residential backyards and structures has restricted the County's options for any extension of the levee which could potentially increase protection levels (Clearwater Hydrology conversation with John Wooley, MCFCWCD, op cit).

c. Corte Madera Creek Flood Control Project

The Corte Madera Creek Flood Control Project (CMCFCP) is similar in form to the project on Coyote Creek. It consists of a earthen tidal reach which is maintained for navigation, a middle concrete channel reach and stilling basin (upstream end), and an unmodified upper reach, which extends upstream from the historic bridge crossing in the Town of Ross. As in other Corps flood control projects undertaken in the 1950s-70s, the rectangular concrete channel was designed to convey the 100-year flood without overtopping. However, failure to account for the increased hydraulic roughness that results from the transport of large quantities of sediment and debris in major flooding events caused a reduction in the actual flood conveyance in the modified channel reach. This became evident after the January 3-5, 1982 flood that overtopped the channel and caused major flood damage in the adjoining communities of Ross, Kentfield and Greenbrae. (San Anselmo, which lies further upstream of the concrete channel reach, was also subject to damaging flooding during the January 1982 event.) Subsequent hydraulic analysis of the flood utilizing tufts of vegetation that were deposited in fencing along the concrete reach confirmed the more viscous hydraulic behavior of the floodflows (Vandivere & Williams, 1982). The results of the investigation also indicated the need for more frequent dredging of the concrete channel, its stilling basin and the downstream outlet channel. Since January 1982, the MCFCWCD has dredged the concrete reach, stilling basin and outlet channel area twice: later in 1982 and again in 1996. Upon completion of the Corps project, the MCFCWCD intends to conduct maintenance dredging of the channel and stilling basin on a roughly 3-5-year cycle.

Until the early 1990s, public opposition to traditional flood control engineering rebutted any attempts to extend the original form of the Corps project upstream. However, in 2000 a community consensus for an extension of the project was finally reached. The consensus project is referred to in federal parlance as the Locally Preferred Project (LPP). The current elements of the LPP include raising of sections of the sidewalls of the existing concrete channel by 1.0 to 3.0 feet, deepening and stabilization of the upper earthen channel reach, and construction of a new state-of-the-art fish ladder. While the overall design concept has been approved, deliberations between the Corps and participating stakeholders continue over final design details. Flood bypass systems, an instream sediment trap under the Lagunitas Road Bridge, and various fish ladder designs are among the design details being discussed. The Town of Ross currently dredges this part of Corte Madera Creek, so its designation as a sediment trap would only be a formal recognition of this use.

Following its adoption, the LPP proceeded to the design and environmental review stage, which to date has not been completed. Once the project is constructed, the flood protection level should rise to that of roughly the 30-40 year recurrence interval event. This is equivalent to the hydraulic capacity of the Lagunitas Road Bridge undercrossing after the proposed channel deepening, which is estimated at 5,400 cfs. Additional flood carrying capacity could be achieved if the bridge were replaced. However, it was recently declared a State historic structure, so this existing channel constriction will likely keep the effective reach capacity at the 5,400 cfs level. (Clearwater Hydrology conversation with John Wooley, MCFCWCD, ibid)

d. Lucky Drive Neighborhoods – Town of Corte Madera

Lucky Drive encompasses portions of two neighborhoods and extends from a point roughly 1,500 feet west of Highway 101 to the east side of the highway. To the west of Highway 101, Lucky Drive serves a small commercial area. To the east of the highway, it transitions to the frontage road, known as Old

Redwood Highway. In this area east of Highway 101, a long-established trailer park occupies a low-lying area immediately south of the Greenbrae Board Walk and the Corte Madera Creek tidal channel. In January and December 1983, the local Creek levees were overtopped and these areas and a short section of Highway 101 at Lucky Drive were inundated by tide waters. The local community called for a flood control project, including heightened levees and pump stations. A benefit tax assessment was levied on all properties in the floodprone areas and environmental documents were prepared. However, citizens opposed to the project sued to block the project. While the stormwater pumping stations were eventually installed, none of the proposed levee improvements were implemented.

The El Nino flooding of 1997-'98 again resulted in inundation of the Lucky Drive neighborhoods and Highway 101. This spurred new interest in the flood control project and it was resurrected. A new EIR/EIS was prepared based on a revised set of levee requirements, including maximum heights of 6 to 8 feet adjacent to the east-side trailer park. These levee heights were requested by the trailer park residents in order to remove them from the FEMA-designated flood hazard zone. Removal from the flood hazard zone would have eliminated the federal requirement for flood insurance. However, other residents west of the freeway balked at the aesthetics of the lengthy and non-uniform levee configuration. At present, the project has again been shelved.

e. Novato Creek Flood Control Project

The Novato Creek Flood Control Project (NCFCP) currently consists of four phases (Phases 1-4) which were constructed successively during the period 1987-1991. The NCFCP was funded by a local bond measure and thus, is not a federal flood control project. Channel modifications included excavation, realignment, widening, bank stabilization and floodwall construction, and construction of regular (e.g. trapezoidal) cross-sections and levees on Warner Creek. Reaches of Novato Creek and Arroyo Avichi were also modified to some degree by the project.

The design capacity of the NCFCP is 3,300 cfs, which is equivalent to the 50-year recurrence interval flood. This level of protection is partially the result of the expansion of upstream reservoir storage at Stafford Dam, which was constructed in 1985. The channel design capacity is also dependent upon the maintenance of the design cross-sections in the modified reaches. Since the project includes a significant tidal reach (i.e., downstream of Diablo Avenue) and much of the upper watershed area is unstable, depositional rates for watershed and tidal sediments in the lower portion of the project are high. The MCFCWCD is responsible for maintenance dredging through the aggrading project reach. Maintenance dredging has been conducted every few years since completion of the project. In 1996, the MCFCWCD dredged 45,000 cubic yards of sediment from a one-mile reach of Novato Creek and a 0.3-mile segment of lower Warner Creek. (Collins 1998)

Upstream of the aggrading reach of Novato Creek, MCFCWCD maintenance efforts are more reflective of the more ecologically-sensitive practices associated with aquatic and riparian habitat protection and enhancement. These practices include targeted removal and/or trimming of obstructing willow and cattail growth and stabilization of streambanks using biotechnical methods, wherever practicable. (Clearwater Hydrology conversation with Elizabeth Lewis, Creek Naturalist, MCFCWCD, August 2001)

In 1997, the MCFCWCD retained a consulting fluvial geomorphologist to conduct a study of sediment sources and geomorphic processes in the Lower Novato Creek Watershed. The study was

commissioned in part to satisfy conditions specified by the RWQCB in its Section 401 Water Quality Certification for the NCFCP and other channel maintenance projects under its jurisdiction. The draft study report was published in 1998 (Collins, ibid). It documented the role of tidal siltation and watershed erosion on aggrading conditions in the lower NCFCP reach. It also identified erosion processes that are active in the mid- and upper reaches of the study area, which extended to Stafford Dam. Bank condition, channel roughness and channel habitat characteristics, including pool frequency/depth and large woody debris occurrence were described and/or quantified.

City of Novato: Stream Management Guidelines (Questa Engineering Corp., 2000) provides a comprehensive assessment of wetland and riparian habitat, water quality and flood control measures for application to the NCFCP and other streams in the City of Novato. The publication inventories habitat types, plant and animal species, and presents guidelines for channel maintenance, biotechnical bank stabilization, channel hydraulic and geomorphic design, riparian revegetation and eco-compatible landscape design. It is an example of the type of watershed management plan that can be developed to guide developers and municipalities in the direction of ecologically sensitive flood control policies and sustainable resource management, including habitat and water quality protection.

f. San Rafael Meadows

San Rafael Meadows is located immediately west of Highway 101 and the Marin County Civic Center. A small perennial creek runs through the neighborhood in a northerly direction and then crosses underneath Highway 101 where it joins the tidal slough paralleling McInnis Parkway. Currently, there is a proposal to develop the old Pacific Gas & Electric Co. (PG&E) property located in the upper watershed and to construct a pipeline which would capture upslope runoff and divert is to a downstream outlet under Merrydale Road. If implemented, this project will reduce both the frequency and severity of flooding in San Rafael Meadows.

E. MARIN COUNTYWIDE PLAN REVIEW

Countywide Plan policies and programs which directly or indirectly address flooding issues fall into two categories:

- Flood control and flood hazard protection
- Stream and Creekside Conservation Areas (SCAs)

Table 1 outlines each of the pertinent flood control and flood hazard protection policies and programs cited in the 1994 *Marin Countywide Plan* and identifies whether they are sufficient in their present form, should be eliminated due to redundancy or lack or relevance, or require some refinement. Policies and programs related to SCAs are evaluated in a similar manner in the Hydrology and Water Quality Technical Background Report. However, a general discussion of SCAs and their significance in flooding and flood control efforts is included below.

Stream Conservation Areas (SCAs) protect the following valuable hydrologic functions pertinent to flooding:

Infiltration and groundwater recharge – In many valley environs in the Countywide Plan area, the principal zone of rainfall infiltration and groundwater recharge is the alluvium (e.g. sands and gravels)

that occupy the valley floor. The restrictions on development within the SCAs, in particular the introduction of new impervious surfaces, maximize the extent of rainfall infiltration and groundwater recharge on the valley floor. This infiltrated and recharge process extends the time over which the rainfall discharges to local stream channels as seepage and groundwater discharge. The natural diversion of this water from the process of storm runoff generation reduces the peak flow rates associated with channel discharges for a given storm event. Maintenance of natural rates of runoff over portions of the watershed eases flooding pressures on hydraulic structures and natural channel reaches located further downstream.

Stream channel stability – SCAs provide protection of riparian vegetation along stream corridors. Riparian vegetation, particularly riparian trees, has a direct impact on the stability of streambanks. When riparian vegetation is removed, the shear strength provided to streambank soils by the root masses of trees and other riparian plants is lost. The streambanks then become more vulnerable to various forms of erosion and failure, e.g. slumping following high flow events, trampling by cattle access. This is not to infer that all corridors with riparian vegetation are stable. If upstream compaction of soils and gully formation occur due to livestock grazing, urbanization, or other detrimental watershed practices, the balance between stream discharge and sediment load can be lost and instabilities can ensue. However, even in such cases, the impact of bank erosion and stream instability is minimized by the aforementioned effects of riparian vegetation along the stream corridor. When streambanks become unstable, entire reaches of a stream channel, at and downstream of the initial instability, can undergo a process of progressive destabilization due to debris obstructions, heightened sediment deposition (e.g. in bar deposits and debris jams) and instream flow deflections. This can reduce the effective flood conveyance in a stream and increase local flood elevations.

F. KEY ISSUES, TRENDS AND OPPORTUNITIES

In general, the extent of the flood hazard in Marin County has been minimized to the extent possible given the political and economic realities of the County's constituent communities. In the majority of cases, recommended infrastructure improvements identified in community master drainage plans have been implemented. It is important to note that in some cases the master plan level of flood protection does not equal that of the 100-year flood. Moreover, with the exception of the community of Santa Venetia, the available options for flood control improvements are limited in their scale and potential efficacy by existing right-of-way and environmental constraints (e.g. Corte Madera Creek and Novato Creek), or by a lack of public consensus (e.g. Lucky Drive). Significant reductions in short to medium-term flood risk appear to be possible in Santa Venetia, if sufficient funding can be secured to complete the stormwater drainage improvements currently planned by MCFCWCD Zone 7. However, in Santa Venetia, levee reconstruction will eventually be required to protect the area from tidal flooding during extreme high tide events, such as occurred in January and December of 1983.

For new development and redevelopment along the urbanized eastern corridor, particularly in areas still drained by quasi-natural streams, the issue of peak flow and water quality mitigation needs to be addressed in a more comprehensive manner by the Department of Public Works, including the MCFCWCD, and the Community Development Agency. At present, the Development Standards outlined in Title 24 of the County Code are administered by the Department of Public Works. These standards consist of specific design specifications and directives that are evaluated at the Precise Plan level of a development project.

The Development Code (Title 22), which comprises both the County Zoning and Subdivision ordinances, guides the initial layout and design approach taken by developers at the Master Plan and Tentative Map stages of a project. The current County Development Code does not include strong enough guidance to the development community to influence a move toward integration of start-at-the-source design features. In combination with similarly strengthened specifications for new construction in the Title 24 Development Standards, the County would be able to influence development projects toward a more ecologically sensitive approach. Such changes could reduce the time and expense of environmental review, as many of the protests of the interested communities and regulatory agencies are associated with undergrounding of drainageways (i.e. replacement with storm drain systems), peak flow increases and water quality and sensitive habitat impacts – all of which could be minimized if the development community utilized more ecologically-sensitive design features at the earliest stages of the planning and environmental review process.

In August 2001, MCFCWCD staff prepared a memorandum that identified several sections of Title 22 which could be modified to conform more closely with project design guidelines outlined in *Start at the Source: Design Guidance Manual for Stormwater Quality Protection* (Bay Area Stormwater Managers Agencies Association (BASMAA) 1999) and *Start at the Source Tools Handbook* (BASMAA/EOA, Inc. 2000). Only one of the recommended sections pertained directly to flooding: Section 22.080 Parking Requirements. For this section, the recommended language comprised two bullet items:

- Reduce impervious area through shared parking
- Encourage the use of pervious surfaces (i.e. Turfblock, porous asphalt, gravel) wherever feasible, especially for overflow parking.

As discussed in the Hydrology and Water Quality Technical Background Report storm drain installations on formerly undeveloped lands outside of the established storm drains networks eliminate small surface drainageways and increase peak flow rates in more significant downstream channels due to decreases in concentration time for runoff. Researchers in urban hydrology have demonstrated that peak flow rates are directly proportional to the percentage of watershed draingeways that are sewered (e.g. Rantz 1971, Wanaanen and Crippen 1977). In particular, peak flows for the more frequent rainstorms (< 2-year event) that are associated with channel morphology increase and the runoff response for these flows becomes much flashier. The result is typically a gradual decline in channel stability, which typically becomes fully apparent when more severe floods (e.g. Jan. 1982, Feb. 1986, January 1997, and Feb. 1998) occur.

When channel instability increases, bank erosion and gully development release large quantities of sediment to the stream system. This sediment may accumulate in large sand/gravel bars, which can then alter local flow patterns and cause further channel destabilization. Then it will eventually deposit in the low gradient reaches of the streams that are confluent with the component bays of the San Francisco Bay Estuary. This downstream sedimentation both reduces the flood conveyance of flood control channels and increases the frequency of required dredging and its disruptive ecological impacts. Indirect costs to maintenance dredging include sediment disposal costs, which can increase dramatically for the more intensively developed urban areas where the sediments may be significantly contaminated with heavy metals and other pollutants. Collateral impacts can also occur in the form of silting of coarser stream gravels that anadramous fish use for spawning.

As noted above, modification of the Development Code is necessary to enact a "start at the source" approach to project design. Such measures are site-specific in the sense that not all measures fit any given site. However, on balance, these site design measures reduce the volume of runoff and peak flows, decrease the significance of the impacts on downstream hydraulic structures and flooding, increase the infiltration of rainfall and groundwater recharge, and reduce the migration of on-site contaminants into receiving waters. The County has three strong regulatory pillars to utilize in promoting modifications to the Development Code: Phase II NPDES stormwater permit requirements (2003); TMDLs for high priority contaminants, including mercury (2004), PCBs and Diazanon (due in 2006-2008); and Rule 4(d) for steelhead (2000). On-site stormwater design is a significant link in the chain of hydrologic influences on peak flow rates and flooding, water quality, and aquatic habitat.

Specifically, implementation of the following recommended actions will assist the County in minimizing the future flood hazard to lands in the Countywide Plan area:

- Explore opportunities to support the replacement of the two NPRR bridge trestles on Novato Creek – the current bridges obstruct the passage of floodwaters and trap debris during significant floods.

- Support the planning and implementation of stream restoration and watershed erosion control projects in the Novato Creek Watershed and other streams confluent with the San Francisco Bay Estuary – reductions in watershed sediment yield will reduce the frequency of channel dredging and other severe and costly forms of stream maintenance that are required to maintain the design flood capacity for flood control projects and local hydraulic structures. Such efforts will also help maintain self-scouring, stable channels. (See Hydrology and Water Quality Technical Background Report for a listing of specific restoration and management projects.)

- Continue MCFCWCD participation in the consensus-building activities that are instrumental in extending the Corte Madera Flood Control Project upstream in an ecologically responsible manner.

- Pursue federal funding for levee reconstruction in the Santa Venetia area – the MCFCWCD has made some initial inquiries with the Corps of Engineers regarding a future flood control project that would include levee reconstruction along lower Las Gallinas Creek. Such outside funding will likely be required due to lack of adequate local funding for such a major engineering project.

- Propose a revenue-sharing program or other creative financing options for the County Flood Control Zones – stress the advantages of such programs to the wealthier zones e.g. reduced County expenditures on disaster relief following levee and/or pump station failures, and less future pressure on the housing market should residents of Santa Venetia and other less well-to-do communities suffer permanent displacement.

- Continue the current, annual levee inspection program to aid in flood risk assessments and the prioritization of capital improvements to levees and stormwater pump stations.

- MCFCWCD should proceed as planned in its review of topographic mapping of channel and floodplain areas along the Novato Creek Flood Control Project. If adjustments are required, this will likely affect flood control and channel stabilization activities along the project reaches.

- Continue to promote habitat-sensitive stream management and maintenance practices; press for mandatory monitoring of bank stabilization and stream restoration projects to enable staff to evaluate the efficacy of different techniques in achieving channel stability and enhancing habitat quality.

- Modify Code Section 23.18 Urban Runoff Pollution Prevention and Title 24: Development Standards of the County Code in the following areas:

  - Strengthen code language in Section 23.18.093 items (b) and (c) regarding BMPs for new developments and redevelopments. Enforce the implementation of site design measures that minimize increases in runoff volume and peak flows. Refer project applicants to the BASMAA publications: Start at the Source: Design Guidance Manual for Stormwater Quality Protection (BASMAA 1999) and Start at the Source Tools Handbook (BASMAA/EOA, Inc. 2000); and enforce the implementation of this approach via the Community Development Agency and MCFCWCD's environmental (e.g. EIR) and precise plan review process. Prohibit the elimination of surface drainageways and their substitution by storm drain systems, wherever surface drainageways can be retained without exacerbating local flooding conditions. For headwaters swales or gullies that drain small watershed areas, minor drainageway re-alignment and/or restoration should be preferred over storm drain installations.

II. MARIN COUNTYWIDE PLAN REVIEW

Existing County policies of the 1994 *Marin Countywide Plan* related to flooding are reviewed in Table 1 and suggestions are provided for those policies that need refinement.

Table 1 – Evaluation of Existing Countywide Plan Flooding Policies and Programs

Environmental Quality Element

RESOURCE CONSERVATION AREAS **1. Flood Control Policies**	
Policy EQ-2.36 Floodplain Management Ordinance. The ordinance for floodplain management in compliance with regulations for the Federal Flood Control Insurance Program should continue to be implemented.	Still applicable. Standards for construction, utilities, and subdivisions are still consistent with existing National Flood Insurance Program (NFIP). Special provisions for coastal areas also in conformance with Local Coastal Plan requirements. One recommended change is to use the proper name of the federal program as noted above.
Policy EQ-2.38 Flood Control Measures. Flood control measures should retain natural features and conditions as much as possible. Compatible uses (agriculture, wildlife habitat, recreation, etc.) of flood ponding areas and seasonal floodways should be promoted.	Needs Refinement. Better definition is needed for "natural features and conditions". For example, natural features should include natural earthen drainageways (rather than large – scale storm drain installation). Also, where natural features are degraded due to erosion, preference should be given to restoration using integrated principles of fluvial geomorphology and hydraulic engineering, and implementation with biotechnical stabilization techniques, rather than culverting, riprapping or other forms of unvegetated structural stabilization.
Policy EQ-2.39 Flood Ponding Areas. Publicly controlled flood ponding areas should be retained. Ponding covenants or easements held by the Flood Control District on property should not be transferred to other properties to allow development within floodways.	Still Applicable. Since this policy appears to bear more directly on minimizing the flood hazard, it should be transferred to the Env. Hazards section

Policy EQ-2.40 Alteration to Floodways, Floodplains and Ponding Areas. Filling or other physical alteration in floodways, floodplains, or ponding areas should be limited to the minimum necessary as determined in development permits issued by the County.	Eliminate. This policy contradicts language in Section 23.09 Floodplain Management which states that no encroachment (including fill) is allowed in a Primary Floodway and is allowed in a Secondary Floodway only to the extent it doesn't increase the risk of local or downstream flooding or interfere with local evacuation of runoff to the stream system. A single policy discussing flooding capacity maintenance in channels and their floodplains should be written, perhaps as a revision to Policy EH-8.6 Flood Runoff. The language in the policy should better conform to the actual language in Title 23.09. Various types of instream and floodway/floodplain fills and encroachments can be discussed this single policy.

2. Bayfront Conservation Areas

Policy EQ-2.64 Land Uses in Floodplains. Areas defined as floodplain should serve the dual purpose of habitat and flood protection. Areas should be evaluated periodically to determine whether increases in the volume and rate of runoff from urbanization or natural forces warrant further flood mitigation measures.	Still Applicable. Provisions to be added to Policy EQ-2.65 should be sufficient to cover associated regulatory constraints on fills and encroachments.
Policy EQ-2.65 100-year Floodplain. The County's regulatory procedures should reflect 100-year floodplain areas as determined by the Federal Emergency Management Agency (FEMA).	Needs Refinement Add detail regarding satisfaction of Title 23.09 Floodplain Management and its restrictions on fills and encroachments of various types in Primary and Secondary Floodways.

THE BUILT ENVIRONMENT

1. General Policies

Policy EQ-3.7 Avoidance of Hazards from Earthquake, Erosion, Landslide, Floods, and Fires. Construction and operations shall be located and designed to avoid or minimize the hazards from earthquake, erosion, landslides, floods, fire, and accidents consistent with policies and programs in the Environmental Hazards Element.	Still Applicable

Land Uses

Policy EQ-3.21 Creekside Development. Along creeks, development must retain the natural vegetation, prevent water pollution, and minimize flood hazards from runoff (see Figure EQ-13).	Needs Refinement. Policy should refer to specific SCA policies in Env. Quality Element as well as Title 23.09 Floodplain Management. In particular, note that SCAs prohibit removal of riparian vegetation and a buffer of 50 ft. outside of the landward edge of the corridor, or 100 ft. from the top of the nearest bank, whichever is greater.

Environmental Hazards Element

Policy EH-3.1 Location of Future Development. New development shall be sited in a manner which avoids or minimizes the potential of hazards from earthquake, erosion, landslide, floods and fire. Development should not be endangered by nor contribute to hazardous conditions on the site or on adjoining properties.	Still Applicable
Program EH-3.1a Protect Review. The Community Development Agency shall continue to review the impact of a project on the site and surrounding properties potentially affected by the development.	Needs Refinement. Add language that discusses the monitoring periods affecting general engineering improvements, which are overseen by County DPW, and monitoring of stormwater quality and the mitigation or restoration components of a project. The water quality and mitigation monitoring will likely also be under the supervision of DPW/MCFCWCD.
Policy EH-8.2 Construction. Improvements should be designed to withstand impact from a tsunami and the debris it will carry. Structural features which could become dislodged or detached (docks, decking, floats, vessels) should be situated where they do not have the potential of becoming potential implements of destruction.	Still Applicable
Program EH-8.2a Implementing Regulations. The County shall continue to implement the regulations of Marin County Code Title 23.09 (Floodplain Management), which establishes Coastal High Hazard Zones with special locational and construction standards for all land uses subject to inundation by a tsunami.	Still Applicable

Policy EH-8.3 Multiple Use. The County should continue to promote the multiple use of areas set aside for flood retention ponding purposes (i.e. agriculture, open space, education, ecology), provided these uses can tolerate occasional flooding.	Still Applicable
Program EH-8.3a Application Review. The County should encourage the multiple use of ponding and encroachment areas designated under Title 23 (Floodplain Management). Through the application review process, the County should also encourage the use of lands reserved for floodplains under the Floodway Zoning provisions of Title 22 (Zoning) .	Still Applicable
Policy EH-8.4 Regulatory Methods of Flood Control. The County should encourage regulatory methods of flood control, rather than construction-related methods of flood control. Regulatory methods reduce the need for flood control projects, minimize losses in areas where flooding is inevitable, and ensure that those who occupy flood hazard areas are aware of the risks and assume responsibility for their actions.	Still Applicable
Program EH-8.4a Flood Hazard Zone Polices and County Code Provisions. The County shall continue to support and enforce policies in the Marin County Code pertaining to special flood hazard zones, including the Coastal High Hazard Zone (Title 23, Floodplain Management), the Bayfront, Floodplain, Tidelands, and Coastal Zones, Title 11 (Watercourse Obstruction), Title 22 (Floodplain Districts), and the provisions of Title 20 (Subdivisions).	Still Applicable

Program EH-8.4b Clarify Zoning Ordinance. The County Community Development Agency should strengthen and clarify references to flood hazard areas occurring along the San Francisco Bay, Tomales Bay, and the Pacific Ocean in the zoning ordinance sections pertaining to the Bayfront Conservation Zone, the Coastal Zone, the Planned District Zones, and the Tidelands Zone.	??
Program EH-8.4c Refer Applications. The County Community Development Agency shall continue to refer all permit applications for proposed construction, substantial improvements and other development to the Department of Public Works to determine whether development is proposed within flood prone areas and therefore subject to the provisions of Title 23.09 (Floodplain Management).	Still Applicable
Program EH-8.4d Restrict Dangerous Uses. The County shall enforce the special location, storage, water supply, sewer, subdivision, and mobile home standards for flood hazard areas identified in Title 23 (Floodplain Management). Title 23 restricts uses that are dangerous to health, safety, and property due to erosion hazards, increases in flood heights or velocities.	Still Applicable
Program EH-8.4e Apply Construction Standards. The County Community Development Agency shall require that uses vulnerable to floods, including facilities that serve these uses, are protected against flood damage at the time of construction. The construction standards of the Marin County Code, including Title 23 (Floodplain Management) shall be applied to protect these uses from flood damage.	Still Applicable

Program EH-8.4f Restrictions in Floodways. The County should support special restrictions in floodways and watercourses. Developments in floodways risk damage from erosion, high velocity flood waters, and potential projectiles from debris carried in the flood waters. Restrictions should prohibit encroachments in watercourses, prohibiting structures within a primary floodway, and restricting development in a secondary floodway or flood fringe that would increase risks to public health and safety in the event of a flood.	Still Applicable
Policy EH-8.5 Zoning Overlays. To minimize flooding hazards, the County should expand the use of floodplain zoning overlays in flood areas.	??
Policy EH-8.6 Flood Runoff. The County should ensure that capacity is maintained in stream channels. The preferred measures for maintaining capacity are: regulating development; and whenever feasible, storing, ponding, or maintenance dredging. The County should control filling, grading, dredging, and other development that may increase flood damage by increasing sedimentation in streams and watercourses and increasing the amount of impervious surface in an area.	Needs Refinement
Program EH-8.6a Enforcing County Codes. The County shall continue to enforce the provisions of Titles 11, 19, 20, 22 and 23, regarding grading, excavation, filling, and dredging.	Still Applicable
Program EH-8.6b Hydrologic and Geologic Studies. The County should require detailed hydrologic and geologic studies in development projects which have the potential for increasing sedimentation of watercourses, increasing impervious surface, or altering natural drainage patterns in order to insure adequate capacity for the safe handling of flood runoff.	Needs Refinement. Add to end: "...for the safe handling of runoff and the hydraulic and geomorphic integrity of the stream system and its aquatic habitat."

Program EH-8.6c Reevaluate Flood Prone Areas. The County should reevaluate flood prone areas, periodically regarding changes to elevations as a result of off-site development or natural forces.	Needs Refinement. Counties and municipalities rarely undertake such re-evaluations due to excessive cost. However, the language of this policy could be altered to support County review of CLOMRs and LOMRs (Letters of Map Revision) that are prepared by property owners in accordance with FEMA guidelines.
Policy EH-8.7 Flood Barriers. The County should prevent the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.	Still Applicable
Policy EH-9.2 Notify property Owners. Property owners who are located in areas of possible inundation from failure at one of eight major dams should be notified regarding susceptibility to flood hazard.	Still Applicable. However, if a detailed dambreak and downstream inundation analysis is eventually performed for the Big Rock Dam, the number of dams identified in the policy would be increased to nine.
Program EH-9.2a Public Information Regarding Dam Inundation Areas. Information on the location of dam inundation areas, for the eight major dams, should be made publicly available in the County Community Development Agency.	Still Applicable
Policy EH-I0.1 Rise in Ocean Level. The County will consider the potential for a sea level rise when processing development applications that might be affected by such a rise.	Needs Refinement. Since current rate of sea level rise does not significantly increase flood elevations, add some mention of the periodic County review of the rate of sea level rise in Program EH-10.1a (below).
Program EH-10.1a Modify Construction Standards. The County Community Development Agency should work with the County Flood Control and Water Conservation District and Department of Public Works to prepare a plan for responding to a potential rise in the sea level. The County should consider developing flood control projects and modifying the Marin County Code Chapters 11, 22, and 23 to include construction standards for areas subject to increased flooding from a rise in the sea level.	Needs Refinement. Some form of periodic evaluation of the current status of sea level rise should be conducted by MCFCWCD/DPW/CDA (e.g. every 5 years) in order to determine whether a full scale re-evaluation of County Code and Development Standards is required to accommodate an acceleration in the rate of sea level rise.

Program EH-10.1b Monitoring Stations. The County should cooperate with the United States Geological Survey, the San Francisco Bay Conservation and Development Commission, and other agencies that establish monitoring stations to track the rise in Bay and ocean water levels .	Still Applicable

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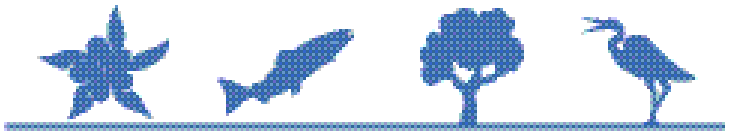
APPENDIX 1-K

GEOLOGY, MINERAL RESOURCES AND HAZARDOUS MATERIALS TECHNICAL BACKGROUND REPORT, MARCH 2002, UPDATED NOVEMBER 2005

MARIN COUNTYWIDE PLAN



Geology, Mineral Resources and Hazardous Materials Technical Background Report

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I. PURPOSE AND EXECUTIVE SUMMARY

This technical background report evaluates the existing geologic (seismic and non-seismic) hazards, mineral resource issues and hazardous material issues affecting the County of Marin. This report is provided to assist County staff in updating the previous Countywide Plan (adopted on January 18, 1994) by incorporating more recent and updated information and to provide recently available information that can be incorporated into the County GIS mapping system.

II. GEOLOGIC LEGISLATION

A. Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was signed into law December 22, 1972, and went into effect March 7, 1973. The Act, codified in the Public Resources Code as Division 2, Chapter 7.5, has been amended eleven times. The Act was enacted to regulate development near active faults in order to mitigate the hazard of surface fault rupture. In general, the Act has two requirements:

- Prohibiting the location of "developments and structures for human occupancy" across the trace of active faults; and,
- Establishing Earthquake Fault Zones as defined by the State Geologist, within which affected cities and counties must establish special procedures for reviewing and approving applications for new building permits within the Zones.

This law initially was designated as the Alquist-Priolo Geologic Hazard Zones Act. The Act was renamed the Alquist-Priolo Special Studies Zone Act effective May 4, 1975 and the Alquist-Priolo Earthquake Fault Zoning Act effective January 1, 1994. The original designation "Special Studies Zones" was changed to "Earthquake Fault Zones" when the Act was last renamed (Hart and Bryant, 1999).

Under the Act, the State Geologist (Chief of the California Geological Survey (CGS)) is required to delineate "Earthquake Fault Zones" along known active faults in California. Cities and counties affected by the zones must regulate certain development "projects" within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. The State Mining and Geology Board provides additional regulations (Policies and Criteria) to guide cities and counties in their implementation of the law (California Code of Regulations, Title 14, Div. 2) (Hart and Bryant, 1999). The principal responsibilities and functions for Cities and Counties required by the Alquist-Priolo Act, include:

- Must adopt zoning laws, ordinances, rules, and regulations; primary responsibility for implementing Act (Sec. 2621.5).
- Must post notices of new Earthquake Fault Zone Maps (Sec. 2621.9 and 2622).
- Regulates specified "projects" within Earthquake Fault Zones (Sec. 2623).
  1. Determines need for geologic reports prior to project development.

2. Approves geologic reports prior to issuing development permits.
3. May initiate waiver procedures.

As defined in the Act, an "active fault" is a fault that has had surface displacement within Holocene time (about the last 11,000 years). The San Andreas Fault Zone (SAFZ) is the only known on-land "active fault" and only zoned fault within the boundaries of Marin County. Eight Earthquake Fault Zone maps cover the SAFZ and show the "active" traces of the fault in Marin County. The Earthquake Fault Zones are shown on the following U.S. Geological Survey 1:24,000 scale 7½-minute quadrangles: Bodega Head, Bolinas, Double Point, Drakes Bay, Inverness, Point Reyes, Tomales, and Valley Ford. There have been no changes to the Earthquake Fault Zone Maps within Marin County since all eight quadrangle maps were issued on July 1, 1974 and no new maps have been issued within the County since July 1, 1974 (CDMG, 2000).

B. Seismic Hazards Mapping Act

1. Purpose and Programs

The State Legislature passed the Seismic Hazards mapping Act in 1990, which was codified in the Public Resources Code as Division 2, Chapter 7.8, which became operative on April 1, 1991. The purpose of the Act is to identify areas where earthquakes are likely to cause shaking, liquefaction, landslides, or other ground failure, and to regulate development so as to reduce future earthquake losses (CDMG, 2001a). The Act requires that various governmental agencies and private parties undertake specific responsibilities of the Act (CDMG, 2001b). The following is a list, mostly derived from CDMG (2001a), of the agencies and their responsibilities and functions under the Act.

a. State Mining and Geology Board

- The Seismic Hazards Mapping Act establishes the authority of the State Mining and Geology Board to provide policy and guidance through regulations for a statewide seismic hazard mapping and technical advisory program to assist cities, counties and state agencies in fulfilling their responsibilities for protecting the public health and safety from the effects of strong ground shaking, liquefaction or other ground failure, landslides and other seismic hazards caused by earthquakes, including tsunami and seiche threats.
- The authority includes providing programs to identify and map seismic hazard zones in the State in order for cities and counties to adequately prepare the safety element of their general plans and to encourage land use management policies and regulations to reduce and mitigate those hazards so as to protect public health and safety (State Mining and Geology Board, 2000).

b. State Geologist

- Compile maps identifying Seismic Hazard Zones, for protecting the public health and safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure and other seismic hazards caused by earthquakes.
- Submit the compiled Seismic Hazard Maps to all affected cities, counties, state agencies, and the State Mining and Geology Board for review and comment. Following this review, the State Geologist may revise the maps, as appropriate, and must provide Official Maps to affected cities, counties, and state agencies, and the appropriate county recorder.

c. Cities and Counties

- Post notices at the offices of the county recorder, county assessor, and county planning commission, and other appropriate sites, identifying the location of any Seismic Hazard Zone Maps issued by the State Geologist that cover their County.
- Record information received: Upon receiving copies of the Official Maps of Seismic Hazard Zones, the county recorder shall record all information transmitted as part of the public record.
- Regulate specified "projects" within Seismic Hazard Zones:
  1. Determine the need for geotechnical reports prior to development projects. The purpose, scope, and requirements for project approval are outlined in CCR Section 3724(c).
  2. Review and determine acceptability of geotechnical reports prior to issuing development permits.
  3. Submit a copy of each acceptable geotechnical report, including the mitigation measures, if any that are to be taken, to the State Geologist within 30 days of report acceptance.
- Take Seismic Hazard Zone Map information into account in the safety element of the general plan and in land-use planning and permitting ordinances.
- Collect building fee and remit to the Department of Conservation. The city or county may retain up to 5 percent for data utilization, certain types of earthquake education, and, under certain circumstances, for improving preparedness for post-earthquake damage assessment.

d. Seismic Safety Commission

- Advise the State Geologist and the State Mining and Geology Board.

e. Sellers of Real Property or Their Agents.

- Disclosure: Sellers of any real property located within a Seismic Hazard Zone must notify prospective buyers of that fact.

The Seismic Hazards Mapping Act requires the State Geologist to establish the regulatory zones titled "Zones of Required Investigation," and to issue appropriate maps titled: "Seismic Hazard Zone maps." The regulatory zones encompass areas prone to liquefaction (failure of water-saturated soil) and earthquake-induced landslides. These maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling construction and development. Single-family frame dwellings up to two stories not part of a development of four or more units are exempt from the state requirements. However, local agencies can be more restrictive than state law requires. If a property is located in a zone, the state has determined that there may be weak soil and/or rock underlying the property. If present, these weak materials can fail during an earthquake and, unless proper mitigative measures are taken during grading and construction, can cause damage to structures. Before a development permit can be issued or a subdivision approved, cities and counties must require a site-specific investigation to determine whether a significant hazard exists at the site and, if so, recommending mitigating measures to reduce the risk to an acceptable level. The investigation must be performed by state-licensed engineering geologists and/or civil engineers. If the property lies within a mapped Seismic Hazard Zone, that fact must be disclosed by the seller to prospective buyers (CDMG, 2001c).

The CGS has released Official Seismic Hazard Zone Maps, affecting counties and cities in Northern and Southern California (CGS, 2005). At the present time, no maps have been issued in Marin County.

Maps that are created by the CGS use digital data that can be implemented into a GIS system. The raw digital data that is put into the system is made available for public agencies. When maps are completed for portions of Marin County the raw data should be available to be used in the Marin County GIS system.

2. Guidelines for Mitigation

The CDMG released Special Publication 117: "Guidelines for evaluating and mitigating seismic hazards in California," in 1997 to provide specific guidelines for engineering geologists and civil engineers for evaluating and providing mitigation measures for seismic hazards. The objectives of the guidelines include:

- Assisting in the evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigations; and,
- Promoting uniform and effective statewide implementation of the evaluation and mitigation of the Seismic Hazards Mapping Act.

These guidelines represent the current standard of care for assessing and mitigating seismic hazards in California and are established as the minimum public safety standard for mitigation of earthquake hazards. The minimum level of mitigation for a project should "reduce the risk of ground failure during an earthquake to a level that does not cause the collapse of buildings for human occupancy, but in most cases, not to a level of no ground failure at all."

C. GEOLOGIC HAZARD ABATEMENT DISTRICTS (GHAD)

Geologic Hazard Abatement Districts (GHADs) were enacted by the Beverly Act of 1979 (SB1195) and allow local residents to collectively mitigate geological hazards that pose a threat to their properties. GHADs are designed to handle long-term abatement and maintenance of real property potentially threatened by geologic hazards (Rogers, 2001). They are enabled by Division 17 of the Public Resources Code, Sections 26500 – 26654.

GHADs may be formed for the following purposes:

- Prevention, mitigation, abatement, or control of a geologic hazard; and,
- Mitigation or abatement of structural hazards that are partly or wholly caused by geologic hazards.

A geologic hazard is defined by the Code as "an actual or threatened landslide, land subsidence, soil erosion, earthquake, fault movement, or any other natural or unnatural movement of land or earth. Historically, GHADs have generally been used as a method for mitigating a landslide hazard that crosses several property boundaries. In Marin County, a recently proposed GHAD involves mitigation of large landslides at Easton Point in the Town of Tiburon (Town of Tiburon, 2001). Establishment of a GHAD can provide a useful mechanism to ensure proper inspection and monitoring of the effectiveness of mitigation measures for a geologic hazard and for undertaking routine maintenance of facilities required to minimize the hazard's impacts. Other abatement districts that have worked well in the past have occurred in Blackhawk, Clayton, Moraga, Orinda, Palos Verdes, San Rafael, and San Ramon.

The formation of a GHAD district may be initiated either by a petition signed by owners of not less than 10 percent of the real property to be included within the proposed district; or, by resolution of the legislative body of a local agency; such as, a city or county. Formation must also include a "plan of control." This "plan of control" must include a report prepared by a certified engineering geologist that describes the geologic hazard in detail, including its location and affected area, and a plan for the prevention, mitigation abatement, or control thereof. Olshansky (1986) states:

> "It is a mechanism that responds to the physical realities of landslides, and allows property owners to cooperate in solving a common problem. It removes much of the stigma l of legal liabilities among adjacent landowners and allows them to cooperate rather than litigate. It also provides a cost-effective solution, requiring only one geotechnical engineering firm and one plan to solve the problems of several landowners."

Because of the many geologic hazards within the boundaries of Marin County, especially landslides, GHADs can provide a useful tool for effectively mitigating these hazards.

D. SUMMARY AND ISSUES TO CONSIDER

- The existing County policies regarding the Alquist-Priolo Earthquake Fault Zoning Act should continue to be enforced (Existing policies EH-4.1, EH-4.2, EH-4.3 and EH-4.4 and their supporting programs).
- A similar set of policies should be created to address the future Seismic Hazard Zone maps in Marin County that will eventually be issued under the Seismic Hazards Mapping Act.
- Geologic hazard abatement districts can be an effective tool for managing geologic hazard areas and reducing the risks posed by some hazards, especially landsliding, and therefore should be encouraged.

III. GENERAL GEOLOGIC SETTING

A. REGIONAL TECTONIC FRAMEWORK AND GENERAL GEOLOGIC HISTORY

Marin County is located in the central portion of the Coast Range geomorphic province (Exhibit 1). This province extends about 600 miles along the western edge of California and is bounded to the south by the Transverse Ranges, to the north by the Klamath Mountains and to the east by the Great Valley. The Coast Range geomorphic province is dominated by northwest-southeast trending ridges and valleys. The development of the coast range geomorphic province has been controlled by the dynamics of plate tectonics.

Plate tectonics provides a broad mechanical framework for presenting and understanding the geology and geologic hazards present in Marin County. The upper crust of the earth consists of rigid plates that move relative to each other and interact dynamically with each other at their boundaries. The geology of California has been dominated by the interaction of the Pacific and North American plates. The currently active boundary between these two plates is surficially manifested by the northwest-southeast

Exhibit 1.
Regional Geologic Setting of the Coast Ranges

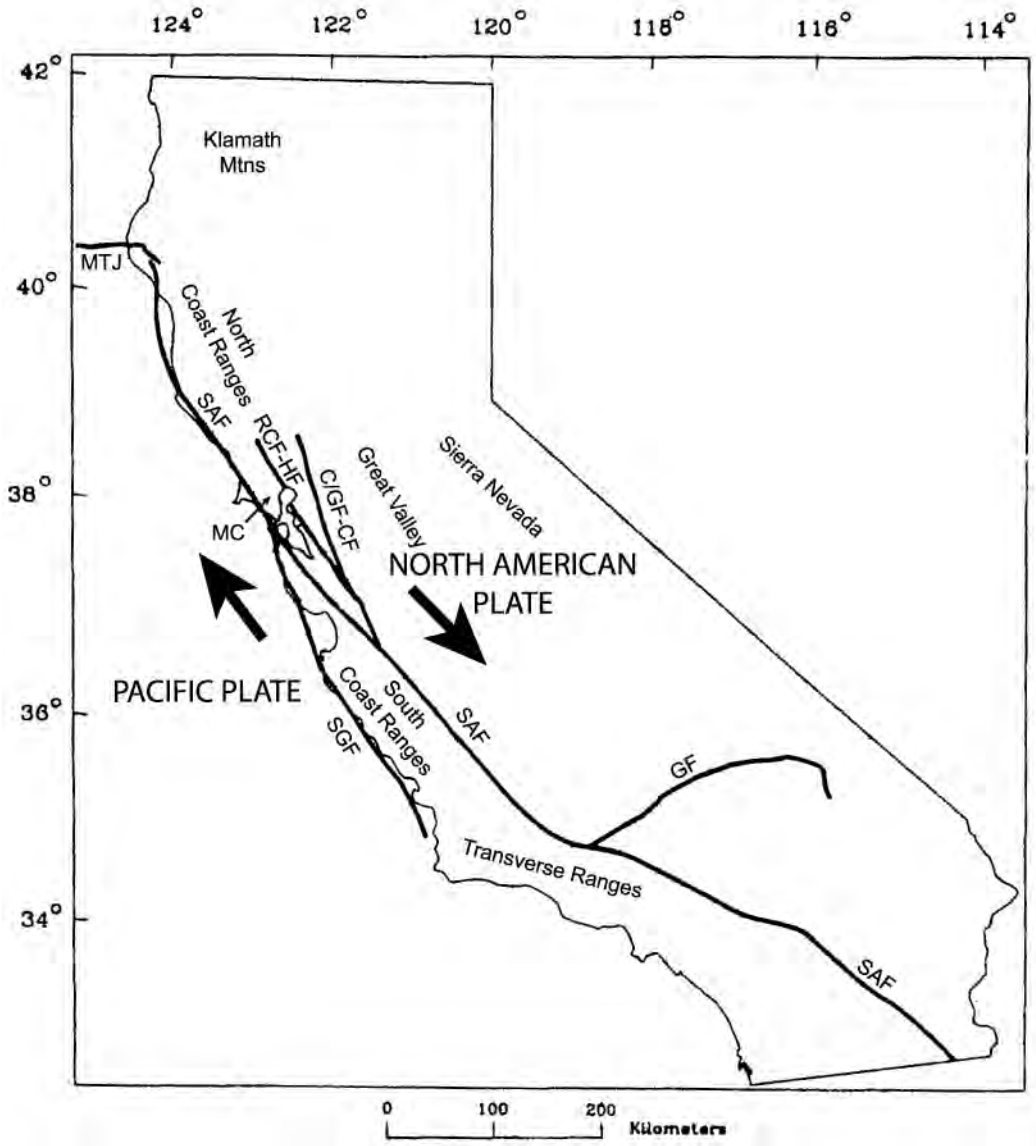


Exhibit 1. Regional Geologic Setting of the Coast Ranges and general overview of fault systems (C/GF-CF, Concord/Green Valley and Calaveras Faults; GF, Garlock Fault; MC, Marin County; MTJ, Mendocino Triple Junction; RCF-HF, Rodgers Creek and Hayward Faults; SAF, San Andreas Fault; SGF, San Gregorio Fault); modified from Jones et al. (1994). Large arrows indicate relative motion of the North American and Pacific plates.

trending San Andreas Fault Zone (SAFZ) that separates the Point Reyes Peninsula from the remaining eastern portion of Marin County. Point Reyes Peninsula is located on the Pacific tectonic plate and that portion of the County east of the SAFZ is located on the North American plate. This dividing zone occurs within the northwest-southeast trending Olema Valley, Tomales Bay and Bolinas Lagoon.

GEOLOGY, MINERAL RESOURCES AND HAZARDOUS MATERIALS

The following general description of the regional geologic history is largely derived from Blake et al. (2000). The bedrock east of the SAFZ consists of Mesozoic (Table 1) rocks unconformably overlain by Tertiary (Miocene and younger) deposits. These rocks represent a complex history that includes late Mesozoic to early Cenozoic subduction and accretion, subsequent uplift and detachment faulting, and Neogene oblique reverse faulting that continues to the present time (Blake et al., 2000). The Mesozoic rocks consist of the Great Valley complex and the Franciscan complex. The Great Valley complex represents the accreted and deformed remnants of Jurassic oceanic crust and a thick sequence of turbidites (disturbed deep ocean sediments). The Franciscan complex rocks were probably Jurassic oceanic crust and Jurassic to Cretaceous pelagic deposits (marine sediments) overlain by Upper Jurassic to Upper Cretaceous turbidites. During Late Cretaceous time, the Franciscan complex was subducted beneath the Coast Range, which resulted in the deformed and sheared rocks that are present. During late Miocene, the regional tectonic regime changed and became dominated by the transform boundary of the San Andreas fault system and deposition of sediments on the older complexes.

The bedrock west of the SAFZ is part of what is known as the Salinian complex. The oldest rocks in this complex consist of Upper Cretaceous granitic rock with pendants of older metamorphic rocks. These rocks are immediately west of the SAFZ. These older rocks are nonconformably overlain by Tertiary rocks comprised of three sedimentary sequences separated by unconformities (break or gap in the geologic record). The portion of the Salinian complex of Point Reyes peninsula appears to have been displaced northward approximately 94 miles on the San Gregorio fault over the last 11 to 12 million years. The granitic rocks, early Eocene conglomerates, and other younger sedimentary rocks are very similar to rocks on the east side of the San Gregorio fault in the Monterey Peninsula region. This northward displacement continues intermittently to this day and the last great movement occurred during the 1906 earthquake where horizontal ground displacements between 13 to 20 feet were recorded in the SAFZ from Bolinas Lagoon to Tomales Bay (Brown and Wolfe, 1972).

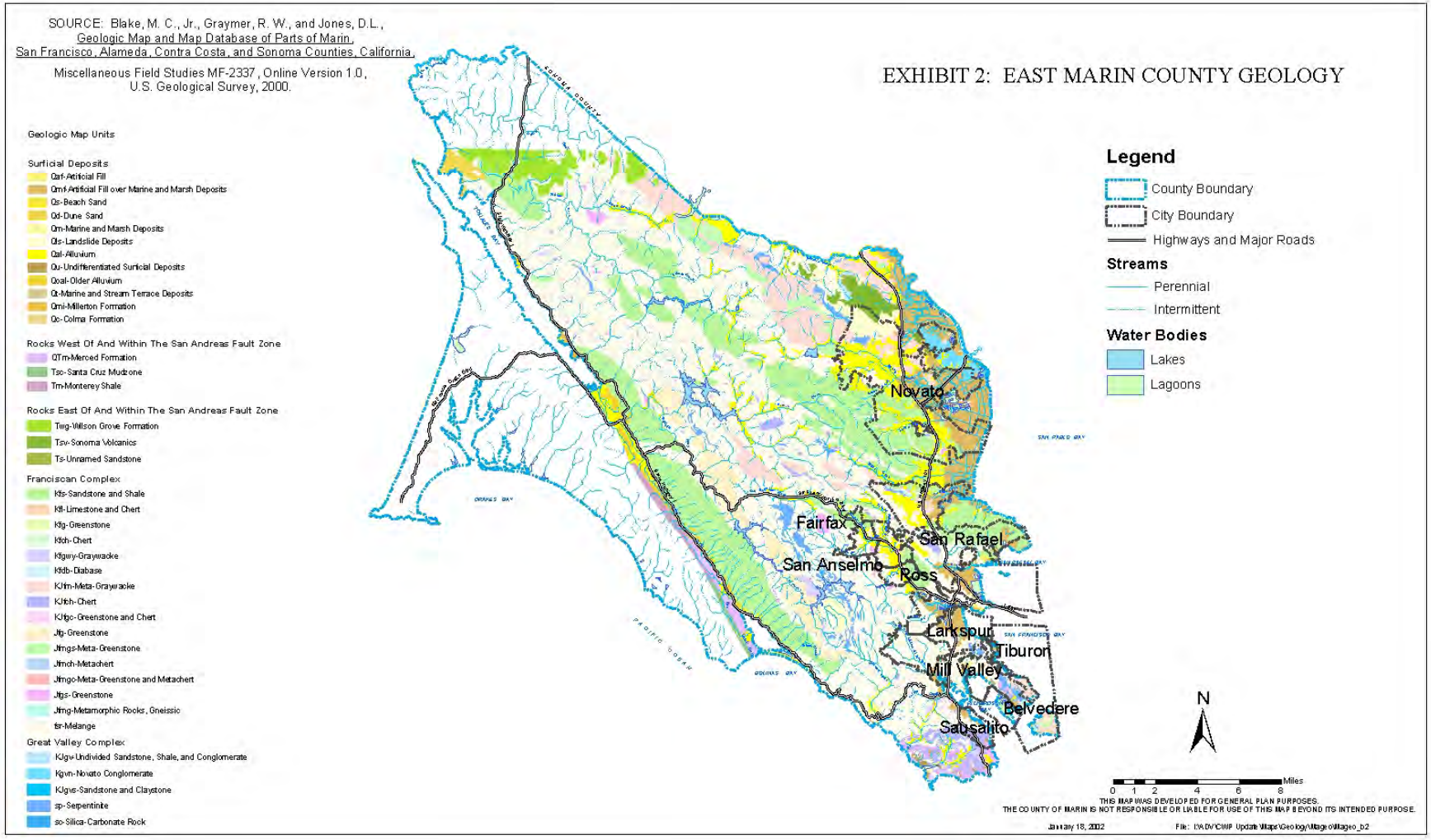
The Pleistocene to recent geologic history of Marin County has played a large role in creating the steep topography and recent sedimentation along the boundaries of the upland areas. During the last Pleistocene major high stand of sea level (known as the Sangamon interglacial stage), about 115,000 years ago, The sea level encroached into the San Francisco Bay and deposited Yerba Buena (Old Bay) Mud. Following this last high stand the sea level began to recede during the Wisconsin glacial stage, 90,000 to 11,000 years ago. During the Wisconsin glacial stage the sea level dropped as much as 350 feet below the present elevation. This drained the bay and led to significant erosion due to rejuvenation and increased incisement of stream channels; thereby, cutting steeper topography into the Marin uplands (Helley et al., 1979; Rogers and Figuers, 1991).

As the Wisconsin glacial stage ended about 11,000 years ago, the rising sea entered through the Golden Gate between 11,000 and 10,000 years ago at a rate of about 1-inch per year and spread across the low-lying flatlands as rapidly as 10 feet/year until 8,000 years ago (Atwater et al., 1977). From 8,000 years ago to the present the shoreline changes have been more gradual. The declining rate of sea-level rise was finally surpassed by the rate of sediment accumulation in the estuaries resulting in growth (progradation) of mudflats and salt marshes by deposition of estuarine Bay Muds. Most of this growth has been within the last several thousand years (Atwater et al., 1977).

Table I –
The Geologic Time Scale

Era	Period	Epoch	Time Interval (in years ago)
Cenozoic	Quaternary	Holocene	10,000 to present
		Pleistocene	1.8 million to 10,000
	Tertiary	Pliocene	5.3 to 1.8 million
		Miocene	23.8 to 5.3 million
		Oligocene	33.7 to 23.8 million
		Eocene	55.5 to 33.7 million
		Paleocene	65 to 55.5 million
Mesozoic	Cretaceous		145 to 65 million
	Jurassic		213 to 145 million
	Triassic		248 to 213 million
Paleozoic			544 to 248 million

Modified from USGS (1999).


SOURCE: Blake, M. C., Jr., Graymer, R. W., and Jones, D.L.,
Geologic Map and Map Database of Parts of Marin,
San Francisco, Alameda, Contra Costa, and Sonoma Counties, California.
Miscellaneous Field Studies MF-2337, Online Version 1.0,
U.S. Geological Survey, 2000.
EXHIBIT 2: EAST MARIN COUNTY GEOLOGY
Geologic Map Units
Surficial Deposits
Qaf-Artificial Fill
Qmf-Artificial Fill over Marine and Marsh Deposits
Qs-Beach Sand
Qd-Dune Sand
Qm-Marine and Marsh Deposits
Qls-Landslide Deposits
Qal-Alluvium
Qu-Undifferentiated Surficial Deposits
Qoal-Older Alluvium
Qt-Marine and Stream Terrace Deposits
Qmi-Millerton Formation
Qc-Colma Formation
Rocks West Of And Within The San Andreas Fault Zone
QTm-Merced Formation
Tsc-Santa Cruz Mudstone
Tm-Monterey Shale
Rocks East Of And Within The San Andreas Fault Zone
Twg-Wilson Grove Formation
Tsv-Sonoma Volcanics
Ts-Unnamed Sandstone
Franciscan Complex
Kfs-Sandstone and Shale
Kfl-Limestone and Chert
Kfg-Greenstone
Kfch-Chert
Kfgwy-Graywacke
Kfdb-Diabase
KJfm-Meta-Graywacke
KJfch-Chert
KJfgc-Greenstone and Chert
Jfg-Greenstone
Jfmgs-Meta-Greenstone
Jfmch-Metachert
Jfmgc-Meta-Greenstone and Metachert
Jfgs-Greenstone
Jfmg-Metamorphic Rocks, Gneissic
fsr-Melange
Great Valley Complex
KJgv-Undivided Sandstone, Shale, and Conglomerate
Kgvn-Novato Conglomerate
KJgvs-Sandstone and Claystone
sp-Serpentinite
so-Silica-Carbonate Rock
Legend
County Boundary
City Boundary
Highways and Major Roads
Streams
Perennial
Intermittent
Water Bodies
Lakes
Lagoons
Novato
Fairfax
San Rafael
San Anselmo
Ross
Larkspur
Tiburon
Mill Valley
Belvedere
Sausalito
N
0 1 2 4 6 8
Miles
THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
THE COUNTY OF MARIN IS NOT RESPONSIBLE OR LIABLE FOR USE OF THIS MAP BEYOND ITS INTENDED PURPOSE.
January 18, 2002
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B. GEOLOGY EAST OF THE SAN ANDREAS FAULT ZONE

Exhibit 2 presents the general geologic units east of the SAFZ. This map is a compilation of previously published and unpublished maps and new geologic mapping and field checking by Blake et al. (2000) and issued as U.S. Geological Survey Miscellaneous Field Studies Map MF-2337, Version 1.0. The map data was released in digital form so that it could be used in a GIS database. The data for the entire map, including geologic units along the SAFZ (west side of the map) are shown. Some units along the SAFZ overlap or are redundant with units shown in the same area on Exhibit 3 (Geology West of the San Andreas Fault Zone). This is because these maps were prepared separately and by different authors. The list of map units in Exhibit 2 shows all mapped units, their unit name and age (in parentheses). These map units can be separated into two main categories: bedrock and surficial deposits. A general description of the rock types within these main categories is described below and is mostly derived from Blake et al. (2000).

1. Bedrock

Bedrock is the classification for all the rock material that underlies the younger surficial deposits and soil. The bedrock in Marin County east of the SAFZ can be separated into two categories based on time of deposition. The bedrock younger units consist of those rocks that are part of the Tertiary overlap sequence, which rest with an angular unconformity on the older bedrock Mesozoic complexes.

The oldest rocks in Marin County, east of the SAFZ, are those that belong in the Franciscan and Great Valley complexes. The rocks in both of these complexes are Cretaceous and Jurassic in age. The Great Valley complex represents the accreted and deformed remnants of Jurassic oceanic crust, known as the Coast Range ophiolite, and a thick sequence of marine sediments. The Franciscan complex rocks were probably Jurassic oceanic crust and Jurassic and Cretaceous marine sediments that were at least partially subducted and accreted beneath the Coast Range ophiolite (Blake, et al., 2000).

In Marin County, the Great Valley complex underlies portions of northwest Marin County in the vicinity of Burdell Mountain and southeast of Novato. The majority of the rocks consist of conglomerates, sandstones and shales. Southeast of Novato a significant outcrop of conglomerate is present, which is mapped as the Novato conglomerate. The Novato conglomerate is considered to be relatively strong and stable rock (Rice, 1973).

The Franciscan complex underlies the majority of Marin County, east of SAFZ, and many of the rock characteristics of this complex are responsible for many of the hazards discussed. The Franciscan complex is dominated by the mélange, which was first defined by Hsu (1968) as:

> "mappable bodies of deformed rocks characterized by the inclusion of native and exotic blocks, which may range up to several miles long, in a pervasively sheared, commonly pelitic [rock composed of clay] matrix."

Exhibit 2 shows several large zones of northwest-southeast trending blocks of rock bounded by faults and numerous smaller inclusions of rock within the mélange. This geologic terrain is characteristic of the Franciscan complex in the Coast Range and dominates the geology of Marin County. In general, the rocks other than mélange are composed of weakly to strongly metamorphosed sandstone, shale, limestone, chert, greenstone, serpentinite, greywacke, diabase, greenstone and various metamorphic rocks.

The characteristics and behavior of these various rocks are dependent on many variables; such as, the degree of weathering, presence of bedding, extent of fracturing and degree of induration. For example, greenstone in one portion of the County may be highly fractured and weathered relative to greenstone in other portions of the County. This variability of rock characteristics is site-specific and not all-inclusive. Mélange, on the other hand, is relatively consistent throughout the County. It is characteristically inherently weak and pervasively sheared. It is the source of highly expansive soils and the reason for pervasive landsliding east of the SAFZ.

The Pliocene aged Wilson Grove Formation consists of sandstone that underlies much of the north portion of the County and was deposited during the Pliocene. Previous maps in the area questionably labeled this unit as the "Merced" Formation (Blake et al., 1971; Blake et al., 1974). The Pliocene and Miocene aged Sonoma volcanics are generally located at Burdell Mountain and vicinity and are about 12 million years old. The Sonoma volcanic rocks are generally stable; however, large landslides in the Sonoma volcanics are present south and southwest of Burdell Mountain. These landslides failed in the older underlying weaker materials. Miocene aged sandstone is also present in the same vicinity.

2. Surficial Deposits

The surficial deposits on the map are deposits that have been deposited within the Quaternary, which is within the last 1.8 million years. The youngest deposits in this category are loose and soft sediments and debris deposited within the last 10,000 years (Holocene). These deposits are typically those that are the most susceptible to seismic shaking, liquefaction and differential settlement. In many locations, deposition of these units is ongoing. These deposits include artificial fill, artificial fill over marine and marsh deposits (young bay mud), beach sand, dune sand, marine and marsh deposits (young bay mud), landslide deposits, alluvium, and slope debris and ravine fill (also labeled as colluvium in portions of the text). The geologic map includes a unit of undifferentiated surficial deposits (Qu) that may include any of the units listed above and older Quaternary deposits.

The older Quaternary deposits are those mapped units that were deposited in the Quaternary, but are no longer actively being deposited. They have been deposited within the Pleistocene Epoch between 10,000 to 1.8 million years ago. These units include: volcanic gravel, older beach deposits, older alluvium, marine and stream terrace deposits, Millerton Formation and the Colma Formation. These older units may also have an increased susceptibility to seismic shaking, liquefaction, differential settlement and landsliding because they have generally not been buried deep or long enough to become well compacted and indurated. However, in general they are less susceptible to geologic hazards than the younger surficial deposits.

C. GEOLOGY WEST OF THE SAN ANDREAS FAULT ZONE

Exhibit 3 presents the general geologic units west of the SAFZ. This map is a compilation of previously published and unpublished maps and new geologic mapping and field checking by Clark and Brabb (1997) and issued as U.S. Geological Survey Open-File Report 97-456. The map data was released in digital form so that it could be used in a GIS database. The data for the entire map, including geologic units along the SAFZ (west side of the map) are shown. Some units along the SAFZ overlap or are redundant with units shown in the same area on Exhibit 2 (Geology East of the San Andreas Fault Zone). This is because these maps were prepared separately and by different authors. The list of map units in Exhibit 3 shows all mapped units, their unit name, age (in parentheses), and a brief description. These map units can also be separated into two main categories: bedrock and surficial deposits. A general description of the rock types within these main categories is described below and mostly taken from Clark and Brabb (1997).

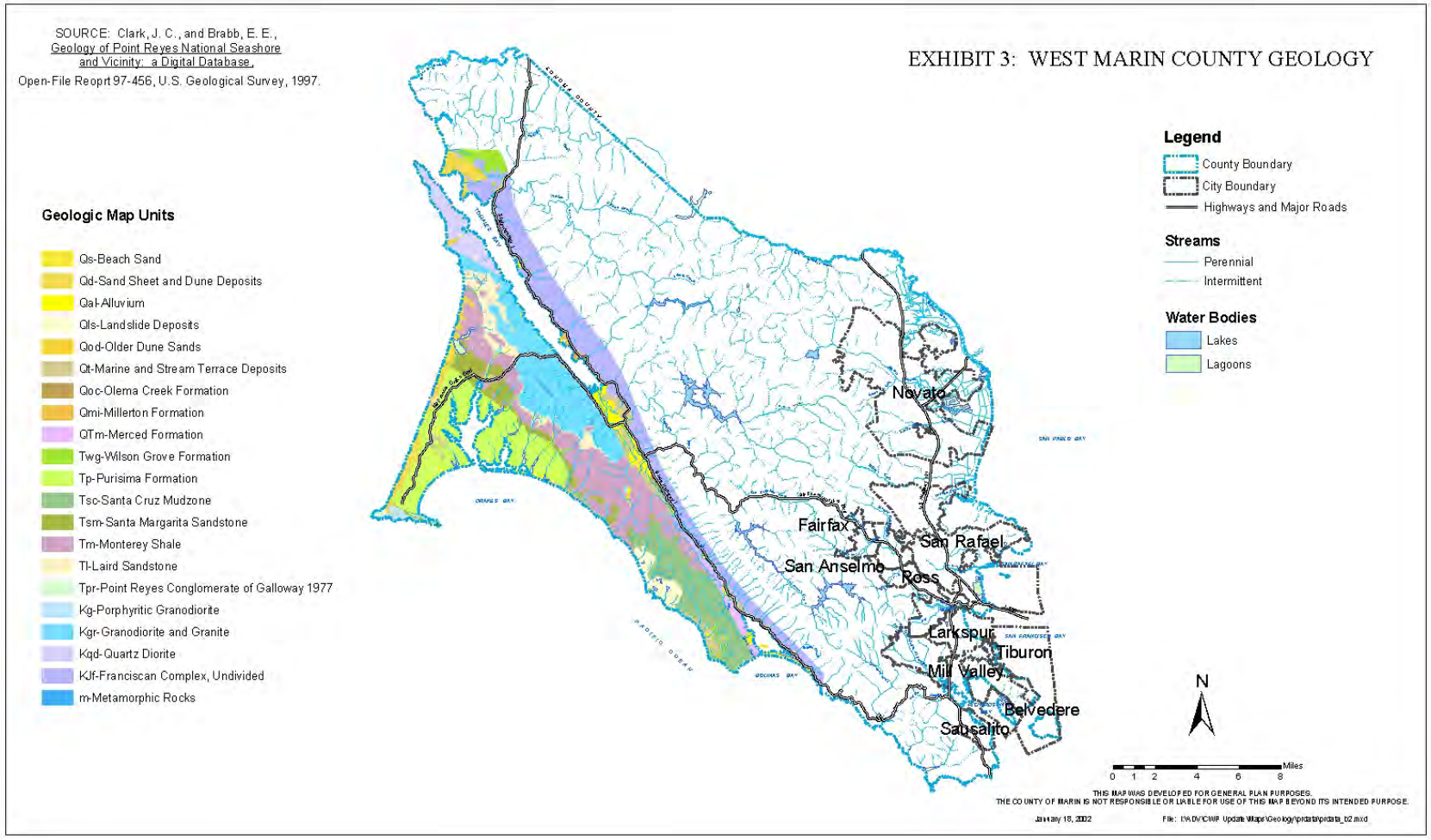
1. Bedrock

The oldest rocks in Marin County, west of the SAFZ, consist of intrusive igneous rocks of Upper Cretaceous age with inclusions, also known as pendants, of older metamorphic rocks. These rocks are the underlying basement rocks west of the SAFZ, which is known as the Salinian complex. The Porphyritic granodiorite of Point Reyes crops out at the resistant cliffs of Point Reyes. Tonalite of Tomales Point underlies only this portion of the Peninsula. The granitic rocks continue south from Tomales Point and the uplands of Inverness ridge consist of granodiorite and granite.

These Upper Cretaceous rocks are nonconformably overlain by a package of Tertiary sedimentary rocks. The oldest Tertiary rock is the late Eocene Point Reyes Conglomerate, which is present at the west end of the Peninsula, overlying the granodiorite of Point Reyes. Along the eastern side of the Point Reyes Peninsula, the granitic rocks are overlain by the middle Miocene Laird Sandstone. The Laird Sandstone typically consists of light brown, medium to coarse-grained poorly cemented sandstone that rests on the granitic rocks in the northern half of the peninsula. The Monterey Formation, consisting of porcelanite and chert, is predominately in the central portion and southern half of the Peninsula. The retreating cliffs near Bolinas are undercut Monterey Formation rocks that fail along bedding planes. These older sedimentary rocks are up to 5,300 feet thick.

SOURCE: Clark, J. C., and Brabb, E. E., Geology of Point Reyes National Seashore and Vicinity: a Digital Database, Open-File Reoprt 97-456, U.S. Geological Survey, 1997.

EXHIBIT 3: WEST MARIN COUNTY GEOLOGY



All of the older rocks described above are unconformably overlain by a sequence of upper Miocene to lower Pliocene sedimentary rocks approximately 8,500 feet thick. The basal unit consists of the Santa Margarita Sandstone, which consists of glauconitic and bituminous arkosic sandstone. This is overlain by a siliceous mudstone unit named the Santa Cruz Mudstone and a siltstone, sandstone and mudstone unit named the Purisima Formation. These three units correlate with rocks in the Santa Cruz Mountains and are given the same formational names because of similar stratigraphic, lithologic, and fossil relationships. As described briefly in the general geology section, they have been horizontally offset from the Santa Cruz Mountain correlative units due to movement on the San Gregorio and SAF.

2. Surficial Deposits

As discussed in the section east of the SAFZ, the surficial deposits on the map are deposits that have been deposited within the Quaternary, which is within the last 1.8 million years. The youngest deposits in this category are loose and soft sediments and debris deposited within the last 10,000 years (Holocene). These deposits are typically those that are the most susceptible to seismic shaking, liquefaction and differential settlement. In many locations, deposition of these units is ongoing. West of the SAFZ, the Holocene deposits include beach sands and dune sands that are located along portions of the coast, alluvium and some landslide deposits. Older Quaternary deposits mapped include some landslide deposits, older dune sands and terrace deposits. The terrace deposits are located in the vicinity of Bolinas Point, along the SAFZ and adjacent to portions of the coastline.

D. GEOLOGIC UNITS WITHIN THE SAN ANDREAS FAULT ZONE

Three distinct units are present within the SAFZ that were deposited from upper Pliocene to Pleistocene (Exhibit 3). The upper Pliocene to Pleistocene Merced Formation is located at the southeast end of the Point Reyes Peninsula within the fault zone along Bolinas lagoon. The weakly consolidated siltstones, sandstones and pebbly conglomerate record coastal and shallow marine sedimentation through much of the Pleistocene (Clifton and Hunter, 1999). The Millerton Formation consists of poorly consolidated and deeply weathered alluvial and estuarine clay, silt, sand and gravel. It is found at Tom's Point, Tomasini and Millerton Points on the east side of Tomales Bay. The Olema Creek Formation consists of granitic sand and gravel interbedded with estuarine mud and peat. It is located within the SAFZ southeast of Olema. The Millerton and Olema Creek Formation are important units in that they record post-130,000 year deposition and deformation within the SAFZ (Grove and Niemi, 1999).

E. SUMMARY AND ISSUES TO CONSIDER

- The geology in Marin County is quite varied and complex and is continually evolving rather quickly (in terms of geologic time) because of its location at an active plate margin. The boundary of this plate margin is the San Andreas Fault.
- Because of long-term strike-slip movement on the San Andreas Fault, the geology on either side of the fault is quite different. East of the fault, the geology is dominated by bedrock of the Franciscan Formation and associated mélange. West of the fault, the bedrock geology is dominated by granitic rocks and overlying sedimentary rocks. The differences in the many types of bedrock materials have an affect on the geologic hazards that are present.

- The surficial deposits located on both sides of and within the San Andreas fault zone, typically have a greater amount of geologic hazards associated with them; Including, liquefaction potential, shaking amplification potential, subsidence and differential settlement and shallow slope failures.
- New data and information on the geology and geologic hazards of Marin County will continue to be generated. It is recommended that the GIS database be maintained and added to as necessary to include new, additional, or updated information as it becomes available. Moreover, where appropriate this information should be made easily accessible to increase public awareness of the geologic hazards in the County. Policy EH-1.1 and EH-1.2 and their associated programs provide a system for collection and dissemination of hazard information. These Policies and programs should be evaluated and refinements should be considered (see Section XIII).

IV. FAULTING AND SEISMIC HAZARDS

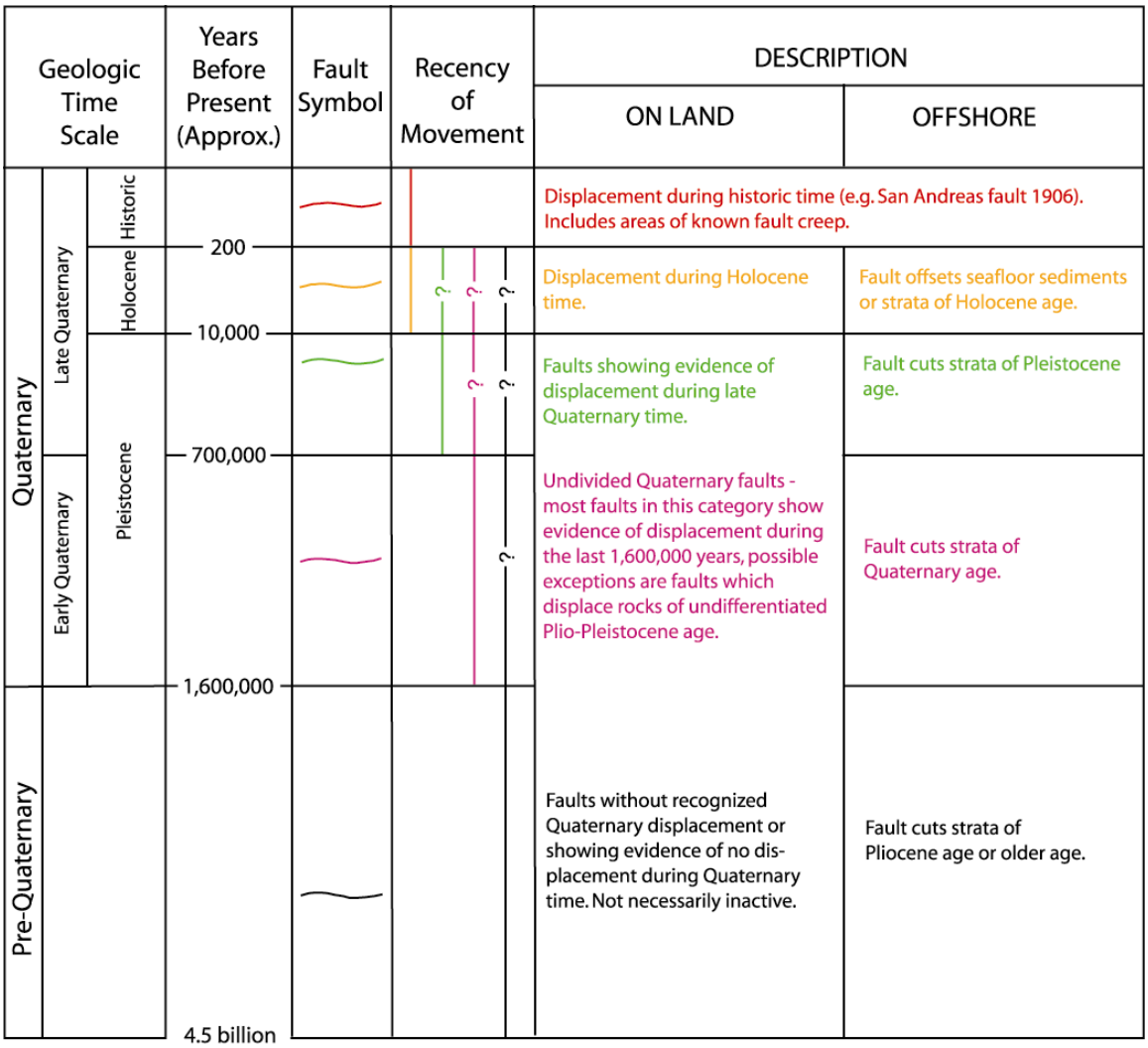
A. ACTIVE FAULTING AND FAULT RUPTURE

A fault is defined as a fracture or zone of closely associated fractures along which rocks on one side have been displaced with respect to those on the other side. Most faults are the result of repeated displacement that may have taken place suddenly and/or by slow creep. A fault zone is a zone of related faults that commonly are braided and subparallel, but may be branching and divergent. A fault zone has significant width, ranging from a few feet to several miles (Hart and Bryant, 1999). When a fault comes in contact with the earth's surface it is known as a fault trace. An active fault is defined as one, which has "had surface displacement within Holocene time (about the last 11,000 years as defined by the Alquist-Priolo Earthquake Fault Zoning Act)."

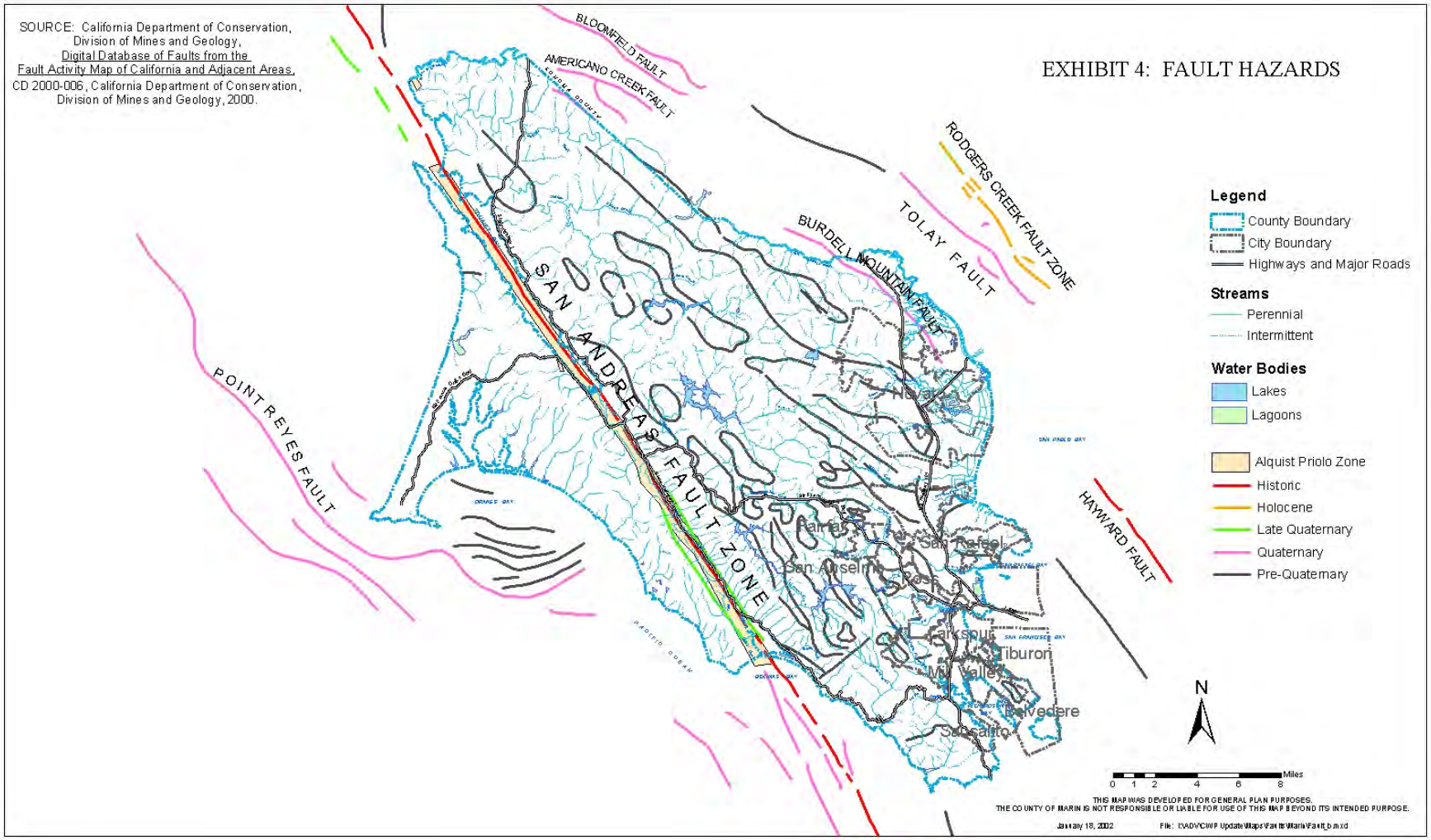
The California Division of Mines and Geology has delineated earthquake fault zones per the policies of the Alquist-Priolo Earthquake Fault Zoning Act. Several faults are present in Marin County; however, only the San Andreas fault zone is considered to be sufficiently active (having ruptured in the Holocene) and well defined within the Marin County boundaries and is zoned under the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 1999; Jennings, 1994). In Marin County, the maps delineating the San Andreas fault zone were issued in 1974. These maps include the Bodega Head, Bolinas, Double Point, Drakes Bay, Inverness, Point Reyes, Tomales, and Valley Ford Quadrangles (Exhibit 4).

Exhibit 4 is a compilation of the all the faults in or near the boundaries of Marin County that were compiled by Jennings (1994) in "Fault Activity Map of California and Adjacent Areas." Five types of faults are shown on the map and described in the map explanation and in Table 2. The faults that are considered to be active are the Historic (red) and Holocene (orange) faults.

Table 2.
Explanation of Fault Types Shown in Exhibit 4



Source: Jennings (1994).
Note: The question mark shown under "Recency of Movement" indicate that although evidence shows specific faults to have been active within some period of geologic time, they should not be considered inactive. It is not possible to tell if a fault will be reactivated.


SOURCE: California Department of Conservation, Division of Mines and Geology, Digital Database of Faults from the Fault Activity Map of California and Adjacent Areas, CD 2000-006, California Department of Conservation, Division of Mines and Geology, 2000.
EXHIBIT 4: FAULT HAZARDS
BLOOMFIELD FAULT
AMERICANO CREEK FAULT
RODGERS CREEK FAULT ZONE
TOLAY FAULT
BURDELL MOUNTAIN FAULT
SAN ANDREAS FAULT ZONE
POINT REYES FAULT
HAYWARD FAULT
Novato
Ross
San Anselmo
San Rafael
Larkspur
Tiburon
Mill Valley
Belvedere
Sausalito
Legend
County Boundary
City Boundary
Highways and Major Roads
Streams
Perennial
Intermittent
Water Bodies
Lakes
Lagoons
Alquist Priolo Zone
Historic
Holocene
Late Quaternary
Quaternary
Pre-Quaternary
N
Miles
0 1 2 4 6 8
THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
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January 18, 2002
File: I:\ADVC\WP Update\Maps\Final\MarinFault_b.mxd

Jennings (1994) shows various mapped faults within the boundaries of Marin County (Exhibit 4). The SAFZ cutting through Point Reyes Peninsula is shown as having surface displacement during historic time (within the last 200 years). This correlates with the M8.3 1906 earthquake, which resulted in a number of recorded surface ruptures in Marin County (Hall and Hughes, 1980). Some segments of the SAFZ only show evidence of displacement some time between 200 to 700,000 years ago. The SAF is a strike-slip fault, meaning that most of its displacement involves horizontal movement in which rocks on opposite sides of the fault plane slide sideways past each other.

The northern end of the active Hayward fault is located within the boundaries of Marin County, but it is in San Pablo Bay where it steps to the right in a complex fault zone transferring strain to the Rodgers Creek fault (McCarthy and Hart, 1993). It is therefore not zoned as an Earthquake Fault Zone within Marin County, but is seismically active.

Three other named faults located near or within the boundaries of Marin County show evidence of displacement during the last 1.6 million years (Jennings, 1994). These include the Burdell Mountain Fault and Americano Creek Fault in the vicinity of the east and northeast boundary of Marin County and the Point Reyes Fault, which is located offshore of the Point Reyes Peninsula. Rice (1973) stated that youthful appearing topographic features are the strongest evidence for geologically recent displacement of the Burdell Mountain Fault zone; however, an age has not been determined. McCulloch and Greene (1989) shows the Point Reyes Fault to be well defined and active or potentially active; however, the age of most recent faulting has not been determined. Late Pleistocene wave-cut terraces on the Point-Reyes Peninsula show formation of an emergent coastline during sea level high stands, suggesting tectonic uplift of the Point Reyes Peninsula (Davis, 2001). Evidence suggests that active folding and uplift is occurring and accommodated, in part, by late Pleistocene and potentially ongoing movement on the Point Reyes thrust (Grove, 2005).

It is also conceivable that earthquakes may occur on faults not previously recognized or on faults that do not have a trace in the ground surface. Recent research indicates the potential for blind thrust fault(s) to be present beneath Marin County (Furlong, 2004). These faults are not exposed at the surface and are typically broadly defined based on the analysis of seismic wave recordings of several hundreds of small earthquakes. In the Bay region, the Mt. Diablo blind thrust fault, which is associated with the Diablo Range, is reported to possibly be capable of a magnitude 6.75 earthquake (Unruh, 2001). Due to the buried nature to these faults, their existence is usually not known until they produce an earthquake. The risk for surface rupture potential for the buried thrust faults is inferred to be low.

B. SEISMICITY

The San Francisco Bay Region is a tectonically active region that has several active faults. Some of these faults have produced significantly large and destructive earthquakes. The most recent being in 1838, 1868, 1906 and 1989 (Table 3). Six strike-slip faults and one thrust fault in the San Francisco Bay area are known to be slipping between 2 to 24 mm/yr. These faults in general release most of the seismic energy in the Bay area and include: the San Andreas, Hayward-Rodgers Creek, Calaveras, San Gregorio, Concord-Green Valley, Greenville, and Mount Diablo Faults (Working Group on California Earthquake Probabilities, 2003).

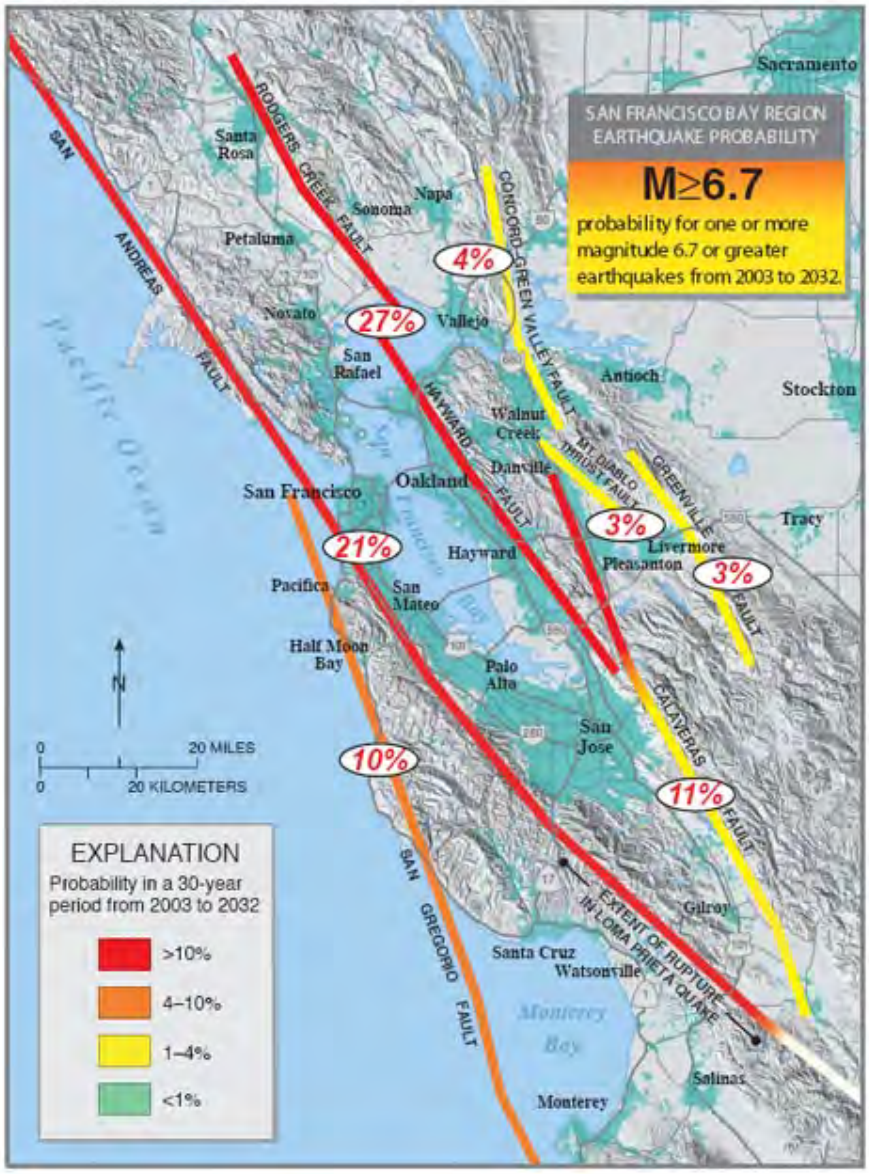
Table 3.
Historical Bay Area Earthquakes Causing Significant Damage

Year	Fault	Epicenter	Richter Magnitude (M)	Modified Mercalli Intensity (MM)*
1836	San Andreas, Calaveras, or Sargent	San Juan Bautista, Hayward	6.3[a]	VII
1838	San Andreas	San Francisco	7.5[a]	X
1852	San Andreas	San Francisco Peninsula	?	VIII
1858	Hayward	San Jose	?	VIII
1861	Calaveras	Livermore	7 +	VIII
1865	San Andreas	Santa Cruz Mountains	7 +	VIII – IX
1868	Hayward	Hayward	6.7	IX – X
1906	San Andreas	San Francisco	8.3	XI
1911	Hayward	San Jose	6.6	VII – VIII
1954	San Andreas	Watsonville	5.2	VIII
1969	Healdsburg	Santa Rosa	5.7	VII-VIII
1989	San Andreas	Santa Cruz Mountains	7.1	IX – X

Source: Montgomery (1990), (a = Toppozada and Borchardt, 1998).
* See Table 4 for definitions of intensities.

The Working Group on California Earthquake Probabilities (WG02) found that there is a 62% probability of at least one magnitude 6.7 or greater earthquake before 2032 within the San Francisco Bay Region (Exhibit 5). This earthquake is likely to occur on one of the seven major fault systems in the bay area. It was determined that the Hayward-Rodgers Creek, San Andreas and Calavares fault systems have the highest probabilities of generating a M≥6.7 earthquake before 2032. The San Andreas and the Hayward-Rodgers Creek fault systems could have the greatest impacts on Marin County because of their proximity to population centers within Marin County and the fact that they have the highest probability of rupture in the San Francisco Bay Region. The WG02 found a 21% probability for the San Andreas fault system and a 27% probability on the Hayward-Rodgers Creek fault system for a M≥6.7 earthquake before 2032. It was also found that an estimated probability of 80% exists for a M6.0 to M6.7 earthquake event in the San Francisco Bay Region.

Exhibit 4a.
Probability of a M≥6.7 earthquake in the San Francisco Bay Region



C. GROUND SHAKING AND SHAKING SUSCEPTIBILITY

1. Hazard Description

The shaking and resulting destruction from earthquakes is caused by seismic waves traveling through the ground. Earthquakes are generated at a rupture point along a fault, which is known as the focus of an earthquake. The seismic waves travel from the focus in all directions. Earthquakes generate two specific types of seismic waves that are responsible for damage to structures. Body waves are waves that travel through the ground and surface waves travel only along the ground surface. The body waves tend to produce the sharp jolting and shaking, while surface waves produce a rolling or swaying motion.

The strength of an earthquake can be measured in two ways. Intensity is a qualitative measurement of the sensations and damages produced by an earthquake. A commonly used intensity scale is the Modified Mercalli Intensity Scale (Table 4). This intensity scale is subjective and if affected by more than just the energy released by an earthquake. Factors affecting the intensity include: distance from the epicenter, focal depth of the earthquake, population density and local geology of the area, type of building construction employed, and duration of shaking.

A quantitative evaluation of the size of an earthquake, known as magnitude, was first developed by Charles F. Richter in 1935 and is known as the Richter Magnitude. This method of measurement determines the energy of an earthquake by measurement of the amplitude of a wave recorded on a seismograph. Table 5 compares Richter Magnitude with the Modified Mercalli Intensity Scale. Other magnitude scales are used for measuring magnitude. A typical scale for large magnitude earthquakes is the Seismic-Moment Magnitude Scale, which is similar but more accurately measures the size of a large earthquake than the Richter Magnitude.

As expected, increasing magnitude results in an increased severity of ground shaking because the energy released by an earthquake is relative to its magnitude. The magnitude scale is logarithmic so each increase in magnitude results in an increase of energy released of approximately 32 times the proceeding magnitude. Ground shaking is the primary cause of damage during an earthquake. The intensity of ground shaking felt by a structure during an earthquake is largely dependent on the type of underlying earth materials. Waves will travel through bedrock differently

Table 4.
Modified Mercalli Intensity Scale

Earthquake Intensity (MM)	Description
I	Not felt by a very few under especially favorable circumstances.
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing of truck. Duration estimated.
IV	During the day, felt indoors by many and outdoors by few. At night, some awakened. Dishes, windows, doors disturbed, and walls make cracking sound. Sensation like a heavy truck striking a building. Standing motorcars rocked noticeably.
V	Felt by nearly everyone, many awakened. Some dishes, windows, etc. broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by people driving motorcars.
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. People driving motorcars disturbed.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
XI	Few, if any, masonry structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.

than they will travel through bay mud or unconsolidated alluvium. Structures built on poorly consolidated sediments will experience longer

shaking duration and greater surface wave amplitude than those built on bedrock or other stiffer geologic deposits. Severity of ground shaking damage is also largely dependent on the type and quality of construction of the structures being affected.

A way of determining the seismic intensities that a region will experience is by evaluating the earth materials that will be affected by the seismic waves. Seekins et al. (2000) produced maps of the San Francisco Bay Area that show a general overview of the various earth materials underlying the region and their potential ground shaking amplification effect based on their shear wave velocity (Exhibit 6).

Exhibit 6 shows five soil types that are defined by their shear-wave velocity as determined by the National Earthquake Hazards Reduction Program (NEHRP). The shaking amplification at a particular site is affected by the velocity at which the rock or soil (combined under the term soil type) transmits shear waves. Soil types with a high shear wave velocity do not contribute greatly to amplification, while soil types with low shear wave velocities can greatly amplify the shaking at a particular site. Exhibit 5 is not a representation of how strong the shaking is going to be, but a representation of areas in the County where the shaking can be greatly amplified because of the underlying earth materials. Soil Types A and B with shear wave velocity measurements greater than 750 meters per second are considered to not contribute greatly to shaking amplification. Soil Type C has a shear wave velocity between 350-750 meters per second. Soil Types D and E are those with shear wave velocities of 350 meter per second or less and these materials will significantly contribute to shaking amplification. The areas underlain by soil Type E will have the greatest amplification of shaking.

As an example of what this data shows, if a house on a Type A site was located at the same distance from an earthquake as a house on a Type E site, the house on the Type E site will experience a significantly greater amount of shaking because of the greater amount of amplification. Therefore, it is most likely that a house on the Type E site would likely sustain a greater amount of damage in an earthquake (assuming both houses are of similar design and construction).

In general, the map shows the younger alluvial deposits, especially bay muds, to be the most susceptible to shaking amplification. Areas of particular concern are the Type E soils, which include recent deposits at the southeast end of Tomales Bay, deposits in Bolinas Bay, and those flat lying areas adjacent to San Pablo Bay that are generally underlain by bay muds and fill overlying bay muds. These areas are of greatest risk to experiencing the strongest ground shaking in the County.

Table 5.
Richter Magnitude vs. Modified Mercalli Intensity

Richter Magnitude (M)	Expected Modified Mercalli Maximum Intensity at Epicenter (MM)
2	I – II Usually detected only by instruments.
3	III Felt indoors.
4	IV – V Felt by most people; slight damage.
5	VI – VII Felt by all; many frightened and run outdoors; damage minor to moderate.
6	VII – VIII Everybody runs outdoors; damage moderate to major
7	IX – X Major damage.
8	X – XII Total and major damage.

Source: California Department of Conservation, Division of Mines and Geology (1984).

Hypothetical earthquake scenarios (ShakeMaps) for the San Francisco Bay Area have been created by the California Integrated Seismic Network and are available online at www.cisn.org. These scenario events are based on the Working Group (WG02) probability analysis and the current knowledge of potential shaking effects. These maps are not predictions of earthquakes, but are ground shaking models of a hypothetical earthquake. These maps are a useful tool for planning and coordinating emergency response. For Marin County, the two most potentially damaging earthquake scenarios would be a repeat of the 1906 rupture on the San Andreas Fault and rupture of the North Hayward-Rodgers Creek Faults. Exhibits 7 and 8 show the potential shaking effects these scenario events would have on the region (California Integrated Seismic Network, 2003ab). These scenarios are presented here because they are potential events on the fault segments shown by the Working Group (WG02) to have the greatest probability of rupture before 2032.

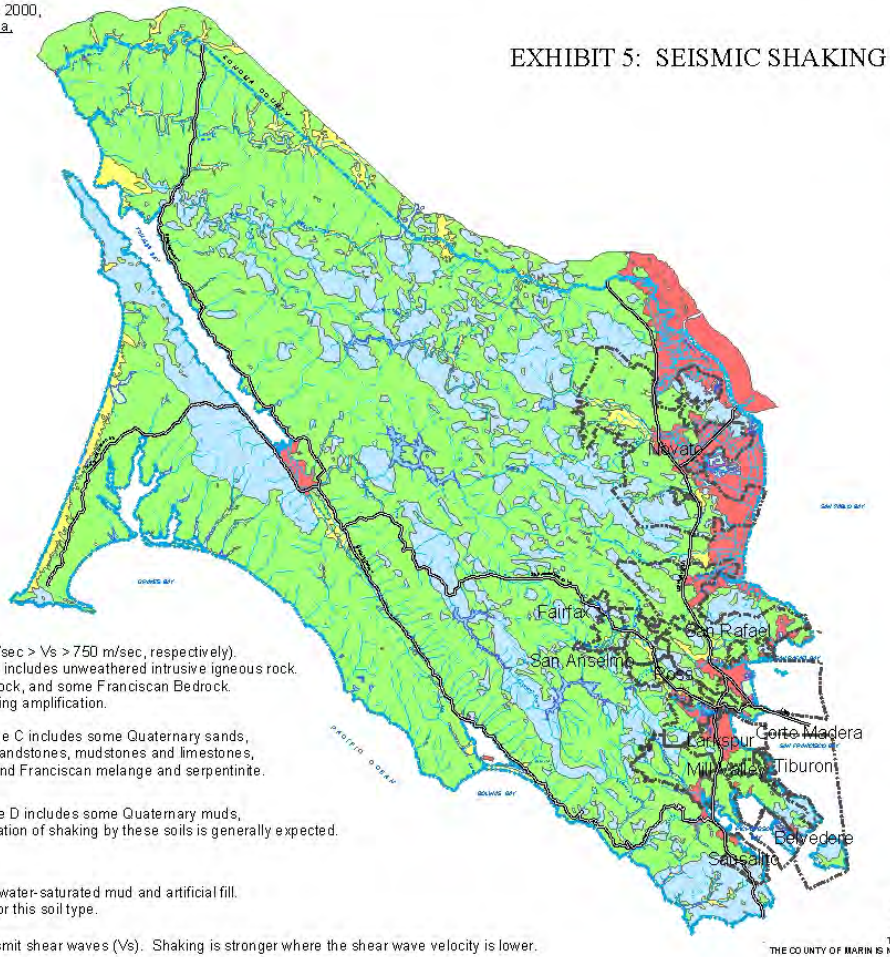
2. Hazard Mitigation

Because Marin County is located within such a seismically active region and because some areas of development are near the SAFZ, there is a high probability that structures will experience strong ground shaking during the lifetimes of any proposed development. This ground shaking could produce seismically induced liquefaction, landsliding and differential settlement and cause significant damage to structures not designed for intense ground shaking. Exhibit 5 provides a general overview of those deposits in the County that are most susceptible to ground shaking amplification and it can be used to pinpoint areas in the County that have the greatest susceptibility to ground shaking.

The structural damage caused by ground shaking can be lessened by a combination of proper standard of care geotechnical evaluations on a site-specific basis and by compliance with all applicable seismic design provisions of the building code. Geotechnical evaluations of a site can determine the susceptibility of a site to shaking. Design of a structure should consider this geotechnical information and incorporate it into the design to minimize the impact of this hazard.

SOURCE: Seekins, Linda C.,Boatwright, Jack, and Fumal, Tom, 2000, Soil Type and Shaking Hazard in the San Francisco Bay Area, http://quake.wr.usgs.gov/prepare/soil_type/index.html, Earthquake Hazards Program-Northern California, U.S. Geological Survey, 2000.

EXHIBIT 5: SEISMIC SHAKING AMPLIFICATION HAZARDS



Legend

- County Boundary
- City Boundary
- Highways and Major Roads

Streams

- Perennial
- Intermittent

Water Bodies

- Lakes
- Lagoons

Soil Type

Soil Types A and B (Vs* > 1500 m/sec and 1500 m/sec > Vs > 750 m/sec, respectively). Soil type A occurs infrequently in the bay areas and includes unweathered intrusive igneous rock. Soil type B includes volcanics, most Mesozoic bedrock, and some Franciscan Bedrock. Soil types A and B do not contribute greatly to shaking amplification.

Soil Type C (750 m/sec > Vs > 350 m/sec). Soil type C includes some Quaternary sands, sandstones and mudstones, some Upper Tertiary sandstones, mudstones and limestones, some Lower Tertiary mudstones and sandstones, and Franciscan melange and serpentinite.

Soil Type D (350 m/sec > Vs> 200 m/sec). Soil type D includes some Quaternary muds, sands, gravels, silts and muds. Significant amplification of shaking by these soils is generally expected.

Soil Type E (200 m/sec > Vs). Soil type E includes water-saturated mud and artificial fill. The strongest amplification of shaking is expected for this soil type.

* Site amplification is the velocity at which the rock or soil transmit shear waves (Vs). Shaking is stronger where the shear wave velocity is lower.
Source: (Seekins et al., 2000)

N

0 1 2 4 6 8 Miles

THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
THE COUNTY OF MARIN IS NOT RESPONSIBLE OR LIABLE FOR USE OF THIS MAP BEYOND ITS INTENDED PURPOSE.

January 18, 2002 File: EVADVCWP UpdateMaps\Slake\Slake_b.mxd

D. LIQUEFACTION SUSCEPTIBILITY

1. Hazard Description

Liquefaction is defined as the transformation of a granular material from a solid state into a liquefied state because of increased pore-water pressures (Youd, 1973). Liquefaction and earthquake-induced ground failures, due to liquefaction of underlying materials, has led to significant damage to structures and loss of life throughout the world. Liquefaction features have been located in Marin County following large magnitude earthquakes in the region, including the 1906 San Francisco earthquake and the 1989 Loma Prieta earthquake (Tinsley et al., 1998; Youd and Hoose, 1978). Observed common types of ground failures resulting from liquefaction can include (taken from CDMG, 2001a):

- Lateral Spread – Lateral spread is the lateral (horizontal) displacement of surficial blocks of sediments as a result of liquefaction in a subsurface layer. Once liquefaction transforms the subsurface layer into a fluidized mass, gravity plus inertial forces that result from the earthquake may cause the mass to move downslope towards a cut slope or free face (such as a river channel or a canal). Lateral spreads most commonly occur on gentle slopes that range between 0.3 and 3 degrees, and commonly displace the surface by several to tens of feet. Such movement typically damages pipelines, utilities, bridges, and other structures having shallow foundations. During the 1906 San Francisco earthquake, lateral spreads, causing displacement of only a few feet damaged every major pipeline that broke. Thus, liquefaction compromised the ability to fight the fires that caused about 85 percent of the damage to San Francisco. A lateral spread triggered by the 1989 Loma Prieta earthquake damaged the Moss Landing Marin Laboratory beyond repair and the site was abandoned as unsuitable for a new structure.
- Flow Failure – Flow failure usually occurs on slopes greater than 3 degrees and is the most catastrophic mode of ground failure caused by liquefaction. The flows are principally liquefied soil or blocks of intact material riding on a liquefied subsurface zone. Displacements are commonly tens of miles per hour.
- Ground Oscillation – When liquefaction occurs at depth but the slope is too gentle to permit lateral displacement, the soil blocks that are not liquefied may decouple from one another and oscillate on the liquefied zone. The resulting ground oscillation may be accompanied by the opening and closing of fissures and sand boils, potentially damaging structures and underground utilities.
- Loss of Bearing Strength – When a soil loses strength and liquefies, loss of bearing strength may occur beneath a structure, possibly causing the building to settle and tip. If the structure is buoyant, it may float upward. Earthquake shaking from the 1989 Loma Prieta earthquake caused soil supporting a State Highway 1 bridge to lose bearing strength resulting in collapse of the bridge. Liquefaction also caused pipelines joining structures to break, some of which resulted in fires.

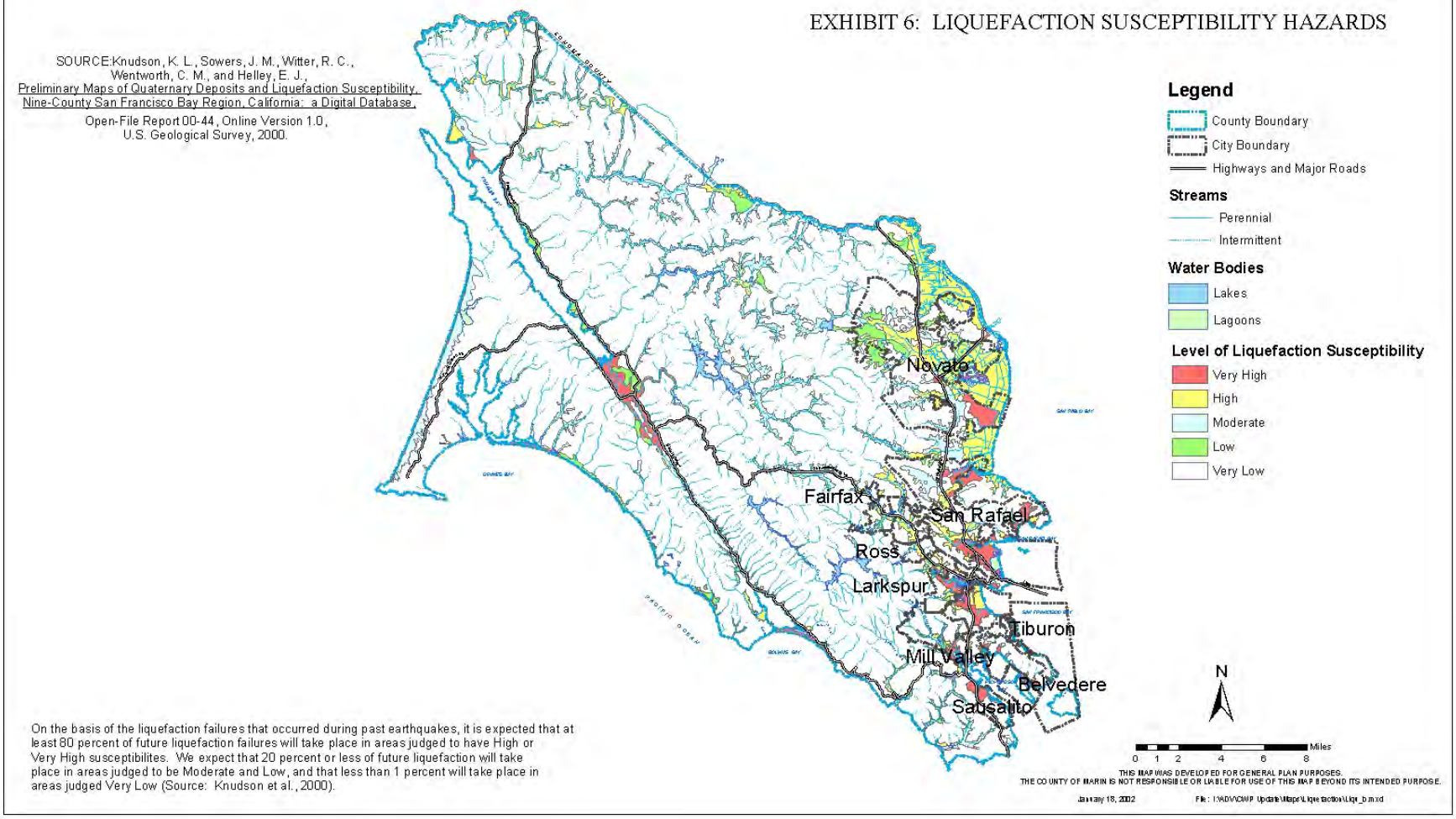
Studies of seismic-induced liquefaction throughout the world have shown that liquefaction occurs in areas underlain by loose, saturated, cohesionless, sand, silt and gravel. Areas that are likely to favor liquefaction include the following:

- Areas known to have experienced liquefaction during historic earthquakes.
- Areas of uncompacted fills containing liquefaction susceptible material that are saturated, nearly saturated, or may be expected to become saturated.
- Areas where sufficient existing geotechnical data and analyses indicated that the soils are potentially liquefiable.

- Areas containing young (less than 15,000 years old) soils where there is limited or no geotechnical data.

Relatively recent detailed mapping of Quaternary deposits of the San Francisco Bay region has allowed for a more in-depth analysis of liquefaction susceptibility in Marin County (Knudson et al., 2000). Exhibit 6 shows the results of this in-depth liquefaction susceptibility analysis and shows the liquefaction potential rating for a particular location. This study determined that the geologic materials most susceptible to liquefaction include Holocene stream channel deposits, Holocene beach deposits, and artificial fill overlying Bay Muds (High to Very High Susceptibility). Liquefaction susceptibility units were designated on the basis of a criteria matrix that assigns susceptibility values to all combinations of geologic unit (type and age of the deposit) and ground-water level. The resulting units reflect the likelihood that loose, saturated, granular sediment is present within 50 feet of the ground surface. The matrix was calibrated using information on past occurrences of liquefaction, previous geologic and geotechnical studies, and limited boring log data that includes standard penetration test information (Knudson et al., 2000).

EXHIBIT 6: LIQUEFACTION SUSCEPTIBILITY HAZARDS



Based on liquefaction failures that occurred during past earthquakes, Knudson et al. (2000) expects that at least 80 percent of future liquefaction failures will take place in areas judged to have High or Very High susceptibilities. They expect that 20 percent or less of future liquefaction will take place in areas judged to be Moderate and Low, and less than 1 percent will take place in areas judged Very Low (Exhibit 9).

2. Hazard Mitigation

Liquefaction hazards should be evaluated on a site-specific basis as part of any new development's overall geotechnical investigation. The CDMG Special Publication 117 "Guidelines for Evaluating and Mitigating Seismic Hazards in California," represents the standard of care for assessing and mitigating liquefaction hazards. Exhibit 6 provides a general overview of areas of potential liquefaction and can be used to delineate liquefaction susceptible areas that may require detailed site-specific analysis.

E. TSUNAMIS AND SEICHES

1. Hazard Description

Tsunamis are long-period waves generated by shifting of a large volume of water. They can be triggered by a submarine earthquake, submarine volcanic eruptions, submarine landslides or slumps of large volumes of earth, meteor impacts and onshore slope failures that fail into oceans or bays. Seiches are related to tsunamis and are triggered by the same sources, but occur in enclosed and semi-enclosed bodies of water, such as, bays, inlets, lakes and reservoirs.

Tsunamis and seiches travel outward from the source event and they may be directed in a specific direction depending on the source mechanism. More than one wave is generated in an event. The traveling speed of a tsunami depends on depth of water and it adjusts its speed according to the depth of the water. Wave speeds can reach 500 miles an hour and tsunami crests can be separated by as much as 100 miles. In the open ocean, a tsunami generally produces an unnoticeable rise and fall of the ocean surface, but as it enters coastal areas, the wave increases in height. As the tsunami reaches the coast and the water depth lessens, the speed diminishes and the wave height increases. The first wave may not always be the largest and successive larger waves usually follow.

Tsunamis are generally associated with seismic activity and are a common hazard in tectonically active portions of the world. The west coast of North America is susceptible to this hazard because it is located in the Pacific "Ring of Fire", which includes many zones of tectonic plate interactions resulting in the many earthquakes, volcanic eruptions and landslides that are common in this portion of the world. The sources of tsunamis are prevalent and coastal communities located within the "Ring of Fire" are susceptible to tsunamis.

Seiches could occur in any reservoir located in the County and in San Pablo and San Francisco bays. The extent of potential seiche runup in these bodies of water is unknown. Runup in the bays is thought to be less in magnitude then the runup of potential tsunamis along the Pacific Coast. Since a tsunami is considered a greater potential hazard, it is the focus of the following discussion.

2. Hazard Effects and Potential

Once a tsunami reaches land, the damage and areal extent are determined by the wave runup and the extent of inundation. The runup is the rush of water up a beach or structure. As the runup continues

inland, it reaches a maximum runup, which is the maximum vertical height above stillwater (tide level) that the water reaches. The horizontal distance that a runup penetrates inland is known as inundation and inundation height is the maximum runup along a particular transect (Eisner et al., 2001).

As a tsunami approaches, the damages may begin to accumulate. The first sign of an approaching tsunami may be the drawdown of the of the approaching wave trough. A rapid drawdown can create strong currents in harbors and channels resulting in damage to structures and boats. However, the surge of water inland may be the first sign, leading to damage to structures in the path of the runup. The power of the runup can float cars, structures and other debris and transport them inland, sometimes leaving them stranded away from their original location. The surge back toward the body of water can be just as destructive as the surge inland.

Local seismogenic sources may create tsunamis between Cape Mendocino to San Francisco and include the offshore zone of the San Andreas fault and the Point Reyes fault (if active) located offshore of the southwest tip of Marin County. A number of other sources are located offshore the California coast. A tsunami wave up to ¼ to ½-foot high was recorded in 1906 in the vicinity of the Golden Gate as a result of the 1906 earthquake event on the SAFZ. Far source events also can create a tsunami hazard. The 1964 earthquake generated off the south coast of Alaska generated a tsunami that created waves up to 20-feet high, caused more than $11 million dollars in property damage to Crescent City in northern California and produced a measured wave height of 7½ feet in the vicinity of the Golden Gate (Bishop et al., 1973). Reportedly, this event did cause some damage to the Clipperton Yacht Harbor at Sausalito from currents generated by the tsunami (Ritter and Dupre, 1972). More than 20 tsunamis of differing heights have impacted the State of California, in the past two centuries (Eisner, 2001).

The exposure of the Marin coastline to a tsunami hazard will vary locally, depending on the many factors involved. The creation of tsunami runup calculations and inundation maps require complex numerical analysis of source location, source type, local onshore and offshore topography, and other factors. Houston and Garcia (1978) produced an analysis of runup heights for the western coast of the United States. They estimated the runup heights above mean sea level (MSL) for 100 and 500-year return period tsunamis from far-field sources. As an example, their study predicts a 100-year tsunami wave runup varying from 10 feet MSL at the mouth of Bolinas Bay to 10.6 feet MSL at the Stinson Beach State Park boundary. A 500-year tsunami wave runup varies from 17.6 feet MSL at the mouth of Bolinas Bay to 18.8 feet MSL at the Stinson Beach State Park boundary (Johnson, 1983).

The National Tsunami Hazard Mitigation Program (NTHMP) (2001) lists several factors affecting communities to tsunami exposure. This list has been modified to focus on Marin County:

- All or parts of the mainland states are located near active subduction zones (Cascadia and Alaska-Aleutian) or other well-defined tsunami-producing zones. Local tsunamis generated by these zones will reach the coasts extremely quickly (within 5-30 minutes, depending on the distance to the zones.
- Strong earthquakes, whether accompanied by tsunamis or not, are rare events in most low-lying coastal communities (Large earthquake events are common in geological time, but are few and far between in a human lifespan.). With little strong ground shaking experience, these communities have little awareness of earthquake hazards. Yet, even with minimal earthquake activity, the risk of damage from a major tsunami is considered high for these communities.

- Except in Hawaii and a few mainland coastal communities, tsunami awareness is not currently embedded in coastal community "culture."
- Many coastal communities in Marin County are relatively small.
- Marin County has a largely recreational use of its coastline, having short-term and seasonal visitors. This presents a special problem, as losses could be very high if a destructive tsunami occurred at a seasonal peak population time.

3. Tsunami Hazard Mitigation

In 1996, the National Oceanic and Atmospheric Administration (NOAA) formed the Tsunami Hazard Mitigation Federal/State Working Group, which created a Tsunami Hazard Mitigation Implementation Plan for mitigating tsunami hazards threatening coastal communities of the United States (Bernard, 2001). The Plan produced by the working group implemented five specific programs, including: production of inundation maps, improvement of seismic networks, deployment of tsunami detection buoys, development of hazard mitigation programs, and development of state/NOAA coordination and technical support. These programs have been and are being carried out by the Federal/State NTHMP Steering Group.

Currently tsunami inundation maps do not include the Marin County coast; however, a map has been completed for the San Francisco-San Mateo County area (Gonzalez et al., 2001). Tsunami modeling continues to be developed and has reportedly been initiated for areas north of the Golden Gate (Gonzalez et al., 2004). Seismic networks have been installed, which has reduced the time required to locate and determine magnitude of an earthquake event from 8 minutes to 2 minutes. Tsunami detection buoys have been deployed thereby providing faster and more accurate tsunami data. Publications and workshops have been created to educate and inform the public on tsunamis hazards. This includes a "TsunamiReady" program that recognizes communities that have met minimum criteria to properly respond to NOAA tsunami warnings. These programs are ongoing and will continue to improve the ability of the west coast to be prepared for tsunami events (Bernard, 2001).A new plan has been announced for an improved Tsunami Detection and Warning System and it is reported that this will provide the United States with nearly 100% detection capability for a U.S. coastal tsunami (Office of Science and Technology, 2005).

Tsunami wave runup and inundation should be considered for proposed development along coastal areas of Marin County. Runup calculations, such as those from Houston and Garcia (1978), and any future inundation maps should be utilized for Marin County coastal planning and protection. On a federal/state level, tsunami hazard mitigation is actively being implemented and the County should incorporate new and future tsunami mitigation programs into coastal planning policies.

F. EARTHQUAKE INDUCED LANDSLIDES

Landslides will not be discussed in detail here, but will be discussed thoroughly in the following section "Slope Stability and Landsliding." However, landslides triggered by earthquake ground motion are a significant seismic hazard. Numerous landslides can be triggered by an earthquake and cause substantial damage to a region. It is reported that the 1906 earthquake generated more than 10,000 landslides throughout the Bay area (Keefer, 1984). The more recent 1989 Loma Prieta earthquake triggered thousands of slides throughout approximately 15,000 km^2 of Central California, including some in southern Marin County at Bolinas, Stinson Beach and Muir Beach (Keefer and Mansion, 1998).

Many of the different types of landslides, as described by Varnes (1978), can occur during an earthquake. Some landslides, especially lateral spreads and flows, are associated with soil liquefaction and are therefore more likely triggered by earthquakes than other mechanisms. Ground shaking is one of many triggering mechanisms that can generated a new slide or reactivate an old one. It appears that most earthquake-induced landslides occur in materials that are highly susceptible to earthquake-induced failure, including weakly cemented rocks, artificial fills, uncemented alluvial materials, and both ancient and recent preexisting landslide deposits (Keefer, 1998).

G. SUMMARY AND ISSUES TO CONSIDER

- Several faults are present in Marin County, but the San Andreas Fault is the only land fault considered sufficiently active to be zoned under the Alquist-Priolo Earthquake Fault Zoning Act. The last surface ground rupture was in 1906. The Hayward Fault is also zoned, but in Marin County, it lies offshore.
- The fact that the San Andreas fault is the only land based zoned fault in the County does not rule out the possibility of fault rupture on some of the other known faults or potential unknown faults. Some mapped faults show signs of displacement within the last 1.6 million years (Quaternary); therefore, the potential for rupture on some of these faults cannot be ruled out. Additionally, older potentially active and even inactive faults can move sympathetically during shaking on a nearby active fault.
- Marin County is located in the seismically active San Francisco Bay Region. Fault rupture and strong seismic shaking are inevitable and there is a reported 62% probability of at least one magnitude 6.7 or greater earthquake before 2032 in the region.
- Marin County has within its boundaries the two faults in the region with the reportedly highest probability of rupture: The San Andreas fault and the Hayward fault.
- Enforcement of the existing policies and procedures required for development located within Alquist-Priolo Earthquake Fault Zones must be continued. Existing policies EH-4.1, EH-4.2, EH-4.3 and EH-4.4 and their supporting programs address this issue. Some refinements of these policies and programs are recommended and listed in Section XIII. Existing Policy EH-2.3 is an effective policy at reducing the hazard of potential fault rupture to critical facilities and is still applicable.
- Ground shaking is a geologic hazard that can result in significant damage within the County. Some areas are more susceptible to stronger shaking because of proximity to potential rupture zones and because of the shaking amplification of some underlying soils and rock. These areas have been identified.
- Mitigation of the ground shaking hazard must be addressed to reduce risk associated with this hazard. Those areas underlain by soils and rock prone to significant shaking amplification are considered potentially high-risk zones and should be evaluated properly. Some existing policies and programs address this issue and they need to be continually applied to existing and new structures (Policy EH-5.1, EH-5.2, EH-5.3, and EH-5.4). Further discussion of this hazard in relation to vulnerable structures is in the Structural Hazards section.
- Liquefaction is a potential hazard, especially in areas that are underlain with deposits reported to have a high to very high susceptibility rating. Liquefaction has occurred during past earthquakes within Marin County.
- There are no existing policies that specifically address areas that are susceptible to liquefaction. However, the California Geological Survey (CGS) has prepared guidelines for geotechnical investigations of liquefaction potential. Within Marin County, proposed developments located in

areas of moderate to very high liquefaction susceptibility should be preceded by a thorough, site-specific geotechnical investigation to evaluate liquefaction susceptibility in accordance with CGS guidelines. This will allow for proper mitigation or avoidance of this potential hazard.

- Tsunamis pose a threat to coastal communities and the County coastline is located in an active tsunami producing region of the world.
- When available, tsunami wave runup and inundation maps should be considered in coastal planning and development. Existing County policy (Policy EH-8.1) only addresses the location of critical facilities in tsunami hazard zones. Policy should be considered for all development and existing communities along the coast that could be impacted.
- The County should consider implementation of a tsunami mitigation program that would provide education for those involved in planning, developing or living in coastal communities.

V. SLOPE STABILITY AND LANDSLIDING

A. HAZARD DESCRIPTION

A large portion of Marin county is mapped as having landslides or being near landslide prone areas. A landslide refers to the downslope movement of materials such as rock, soil, or fill under the direct influence of gravity. This downward movement can occur along a surface (glide plane, landslide plane, or discrete slip surface) or without a distinct failure surface. The presence of landslides is due to several influences and factors related to slope stability, including: slope angle, weathering, climate, water content, vegetation, overloading, erosion, earthquakes, and human-induced factors. The interrelationship of these influences create a dynamic equilibrium, in which slopes are subjected to constant changes over time.

Where landslides are present on undeveloped land, movement can occur naturally during prolonged rainstorms when soils are saturated. Ground shaking during an earthquake can also trigger landslides, especially under saturated conditions. When development occurs on or near landslides, both people and property are exposed to these hazards. Without proper repair construction activities and routine use and maintenance, grading and drainage changes caused by development can reactivate long-dormant or more recent landslides, which otherwise would remain stable under static conditions. This can occur because earthmoving changes the ground surface and subsurface and can alter the shape and stability of a slide mass and change drainage and groundwater conditions. Unmitigated dormant landslides also can be reactivated, at least in part, through the effects of residential landscape irrigation, primarily over-watering attributable to lawn care and planting of non-drought tolerant ornamental species. Over the long-term, irrigation generally increases moisture levels sufficiently to precipitate land slippage during years with greater than normal rainfall. A residential subdivision can introduce the equivalent of more than 100 inches of rainfall per year, although use of drip and low-flow irrigation systems and planting of native and drought resistant species substantially mitigates this moisture increase (Rogers, 1992).

Landslides are caused by the dynamics of the previously listed factors, but they are usually triggered by the following forces that disrupt slope equilibrium:

- Adding weight (adding driving force) to the top of a potential slide area,
- Removing mass (removing toe support or resisting force) from the base of a potential slide area,

- Increasing the volume of water to create heightening of pore water pressures within a potential slide area; and,
- Vibrations from earthquakes, which also can serve to heighten pore water pressures.

This overview of landslide hazards in Marin County is intended as a general guide for land use planning purposes. It should not be construed as a site-specific study, which requires detailed engineering geologic and geotechnical investigations for proper evaluation of an individual development project. The information provided discusses the general known slope stability hazards in the County and the recognition that these slope stability issues need to be addressed in regard to land use policy. In general, Marin County is very hilly and combined with the adverse geologic conditions, the numerous slopes in the County are susceptible to landsliding.

The many types of landslides are listed below. The names and description are from a classification system based on the type of movement and the type of material that is failing. All of these landslide types can occur in Marin County; however, slides and flows are relatively common. These definitions are based mainly on the work by Varnes (1978) and taken from Wold and Jochim (1989).

1. Falls

- Falls are abrupt movements of masses of geologic materials that become detached from steep slopes or cliffs. Movement occurs by free-fall, bouncing, and rolling. Depending on the type of earth materials involved, the result is a rockfall, soil fall, debris fall, earth fall or boulder fall. All types of falls are promoted by undercutting, differential weathering, excavation, or stream erosion.

2. Topple

- A topple is a block of rock that tilts or rotates forward on a pivot or hinge point and then separates from the main mass, falling to the slope below, and subsequently bouncing or rolling down the slope.

3. Slides

Slides refer to movements of soil or rock along a distinct surface of rupture, which separates the unstable slide material from more stable underlying material. The two major types of slides are rotational slides and translational slides.

- Rotational Slides – A rotational slide is one in which the surface of the rupture is curved concavely upward (spoon shaped) and the slide movement is more or less rotational about an axis that is parallel to the contour of the slope. A "slump" is a common term used for small rotational slides.
- Translational Slides – In a translational slide the mass moves out, or down and outward along a relatively planar surface and has little rotational movement or backward tilting. The mass commonly slides out on top of the original ground surface. Such a slide may progress over great distances if conditions are right. The slide material may range from loose unconsolidated soils to extensive slabs of rock.
- Block Slide – A block slide is a translational slide in which the moving mass consists of a single unit, or few closely related units that move downslope as a single unit.

4. Lateral Spreads

Lateral spreads are a result of the nearly horizontal movement of geologic materials and are distinctive because they usually occur on very gentle slopes. The failure is caused by liquefaction, the process whereby saturated, loose, cohesionless sediments (usually sands and silts) are transformed from a solid into a liquefied state; or plastic flow of subjacent material. Failure is usually triggered by rapid ground motion such as that experienced during an earthquake, or by slow chemical changes in the pore water and mineral constituents.

5. Flows

- Creep – Creep is the imperceptibly slow, steady downward movement of slope-forming soil or rock. Creep is indicated by curved tree trunks, bent fences or retaining walls, tilted poles or fences, and small soil ripples or terracettes.
- Debris Flow – A debris flow is a form of rapid mass movement in which loose soils, rocks and organic matter combine with entrained air and water to form a slurry that then flows downslope. Debris flow areas are usually associated with steep gullies. Individual debris flow areas can usually be identified by the presence of debris fans at the termini of the drainage basins.
- Debris Avalanche – A debris avalanche is a variety of very rapid to extremely rapid debris flow.
- Earthflow – Earthflows have a characteristic "hourglass" shape. A bowl or depression forms at the head where the unstable material collects and flows out. The central area is narrow and usually becomes wider as it reaches the valley floor. Flows generally occur in fine-grained materials or clay-bearing rocks on moderate slopes and with saturated conditions. However, dry flows of granular material are also possible.
- Mudflow – A mudflow is an earthflow that consists of material that is wet enough to flow rapidly and that contains at least 50 percent sand-, silt-, and clay-sized particles.
- Subaqueous Landslide – Landslides that take place principally or totally underwater in lakes, reservoirs, along river banks, or in coastal and offshore marine areas are called subaqueous landslides. The failure of subaqueous slopes may result from a variety of factors acting singly or together, including rapid lacustrine or marine sedimentation, biogenic methane gas in sediments, surface water storm waves, current scours, water level drawdown, depositional oversteeping, or earthquake stresses. Many different types of subaqueous landslides have been identified in different locations, including rotational and translational slides, debris flows and mudflows, sand and silt liquefaction flows. Subaqueous slides may trigger a tsunami, which could result in coastal damages.

B. HAZARD POTENTIAL

1. Novato Area

Rice (1975) mapped the geology and landslide susceptibility in the region around Novato. In general, the semi-schist and related metamorphic rocks of the Franciscan Formation are associated with expansive soils, resulting in soil creep and soil debris flows. When soils accumulate to a depth of more than 2 to 3 feet on moderately steep slopes the soils tend to exhibit evidence of downslope mobility. The Franciscan mélange is more widespread in other parts of Marin County than in the Novato area. However, some of this terrain is present. The mélange terrain is characterized by scattered prominent sharp outcrops or monument-like masses of hard rock projecting out of smooth natural slopes. The mélange matrix consists of easily eroded materials with a weak shear strength, and show creep and sporadic earth and debris flows. The unsheared coherent rock masses within the matrix commonly act

as buttresses at bottoms of slopes, which should be considered before removing during any slope repairs.

The Novato Conglomerate is a relatively strong and stable rock unit and weathering typically yields stable gravelly soils. The bedding is typically defined by sparse lenses of sandstone and they are not significant planes of weakness. In general, the massive sandstone and thinly bedded sandstone and shale bedrock exhibit high stability on natural slopes. However, they produce sandy and/or silty soils prone to erosion. The soils developed on this bedrock are also susceptible to liquefaction when saturated and when they accumulate in thick masses, they are potential sources of rapid, liquid-flow type landslides (debris avalanches).

The volcanic rocks in the Burdell Mountain area are abundant and large landslides are present in the vicinity of Burdell Mountain. These landslides resulted not from failure of the volcanic rocks, but from the underlying metamorphic rocks in the area and are likely unstable masses.

Colluvium is present throughout the upland areas. A blanket-like accumulation many feet thick occurs on steep heavily wooded north facing slopes. The south slopes are commonly grass covered, more gently inclined and have a thinner alluvial cover. This should be considered before removing any forest vegetation, which could greatly impact the slope stability and increase the amount of failures. Most debris flows and debris avalanches develop in the thick colluvium, which is highly susceptible to slope instability if subjected to grading or clearing.

2. Southeastern and Central Marin County

Relatively detailed mapping of the geology and landslide susceptibility has been performed in and around several communities in southeastern and central Marin County (Rice et al., 1976). The slope stability issues in this portion of Marin County are similar to those in other areas previously mapped. Most landslide damages are reported to have taken place within pre-existing landslide deposits from continued or renewed movement. The majority of slope failures that occur are soil and rock debris flows.

The Franciscan mélange and semi-schist and related metamorphics typically develop soil profiles that have a high clay content, usually montmorillonite, which has a high shrink-swell potential. These soils have little shear strength when they become wet and are susceptible to significant downslope creep. An accumulation of more than 2 to 3 feet of this type of soil increases the probability of soil debris and earth flows.

Other rock types in the area are usually relatively stable if they are in a massive and unweathered state. Metamorphic volcanic rock (also known as Greenstone) has a high strength and is erosion resistant when it is not sheared. However, if it is sheared and greatly fractured it weathers to clay that is relatively weak and susceptible to rapid erosion and landsliding. Sandstone and shale bedrock, which is the most common rock type in central Marin, is generally stable except where it has been sheared or closely fractured and deeply weathered.

Soil debris avalanches are common usually during periods of heavy rainfall. These failures are typically only in sandy and silty soil with little clay content and when the soil is completely saturated. Many of the debris avalanches in southeast Marin County occur in colluvium. A blanket like accumulation many

feet thick are common on steep heavily-wooded north facing slopes. The dense tree cover inhibits erosion of the colluvium and stabilizes it.

3. Western Marin County

Wagner (1977) and Wagner and Smith (1977) mapped the geology and landslide susceptibility in portions of western Marin; specifically, in and around Bolinas and the area around the southeast end of Tomales Bay; including, areas around Inverness, Inverness Park, Point Reyes Station, and Olema. As discussed previously in the General Geologic Setting portion of this report the general geology west of the SAFZ consists of Late Cenozoic marine and continental rocks resting upon Cretaceous granitic basement (Salinian Block). East of the fault, the Franciscan complex is overlain by the Pleistocene Millerton Formation and other Quaternary deposits. Therefore, the slope stability problems are different on each side of the SAFZ, because the geology is different.

The general slope stability issues are reported by Wagner (1977). Landslides are prevalent along the coast and resulting in rapidly retreating sea cliffs in the coastline around Bolinas. Slope failures are present in moderate to steep slopes underlain by the Merced Formation. Debris flows are common in areas underlain by mélange matrix.

In the Bolinas Peninsula slope stability problems are associated with the different geologic units. Slope failures are common in the Monterey Formation, which has bedding that generally strikes about N 40° W and usually dips 40 to 60 degrees to the west. This bedding orientation has resulted in unstable conditions and large landslides on the coastline. The younger Merced Formation underlies the east part of Bolinas peninsula. This formation consists of poorly consolidated sediments that erode easily and are very susceptible to debris flow landslides and falls. The terrace deposits are generally in level terrain; however, they are easily erodible, have a low shear strength resulting in small slumps and gullying. The older alluvium in the area also contains unconsolidated material and is prone to slumping on the steep sides of deeply incised streams.

In the Tomales Bay area slope stability problems are common, but vary depending on which side of the SAFZ the failure occurs. East of the SAFZ, the Franciscan complex is the major unit and most slope failures occur in it. As discussed previously, slope creep and earth flows are common types of failures typical of the mélange matrix of the Franciscan. The Late Pleistocene Millerton Formation exposed in the cliffs on the east side of Tomales Bay typically slumps. West of the SAF zone, the ground is covered by thick vegetation that likely has a stabilizing effect on the steep slopes. This area is generally underlain by granitic rocks. These granitic rocks are deeply weathered and the weathered profile and overlying soil are likely prone to failure. Removing the vegetation by clearing and grading could likely result in activating new landslides or reactivating old landslides.

4. Countywide Landslide Potential

Wentworth and Frizzell (1975) performed photo-reconnaissance mapping of landslide deposits for a major portion of Marin County. These maps were based solely on photo interpretation methods and are at a smaller scale than the more detailed mapping discussed above (Rice, 1975; Rice et al., 1976; Wagner, 1977). However, they provide a general overview of the landsliding present in Marin County. These 7.5-minute quadrangle maps show that the Marin County uplands are significantly affected by some form of landsliding. The distribution of landslides varies and is controlled by the many causal factors discussed previously.

Landslides, especially debris flows and debris avalanches have been widespread and common in Marin County during times of heavy intense rainfall. Following the January 3-5, 1982 storm 4,600 debris flows were mapped just within Marin County (Ellen et al., 1988). Direct cost damage from landslides within Marin County were estimated to be $18,464,000 (Creasey, 1988). The mapping found several associations of debris flows and the natural landscape:

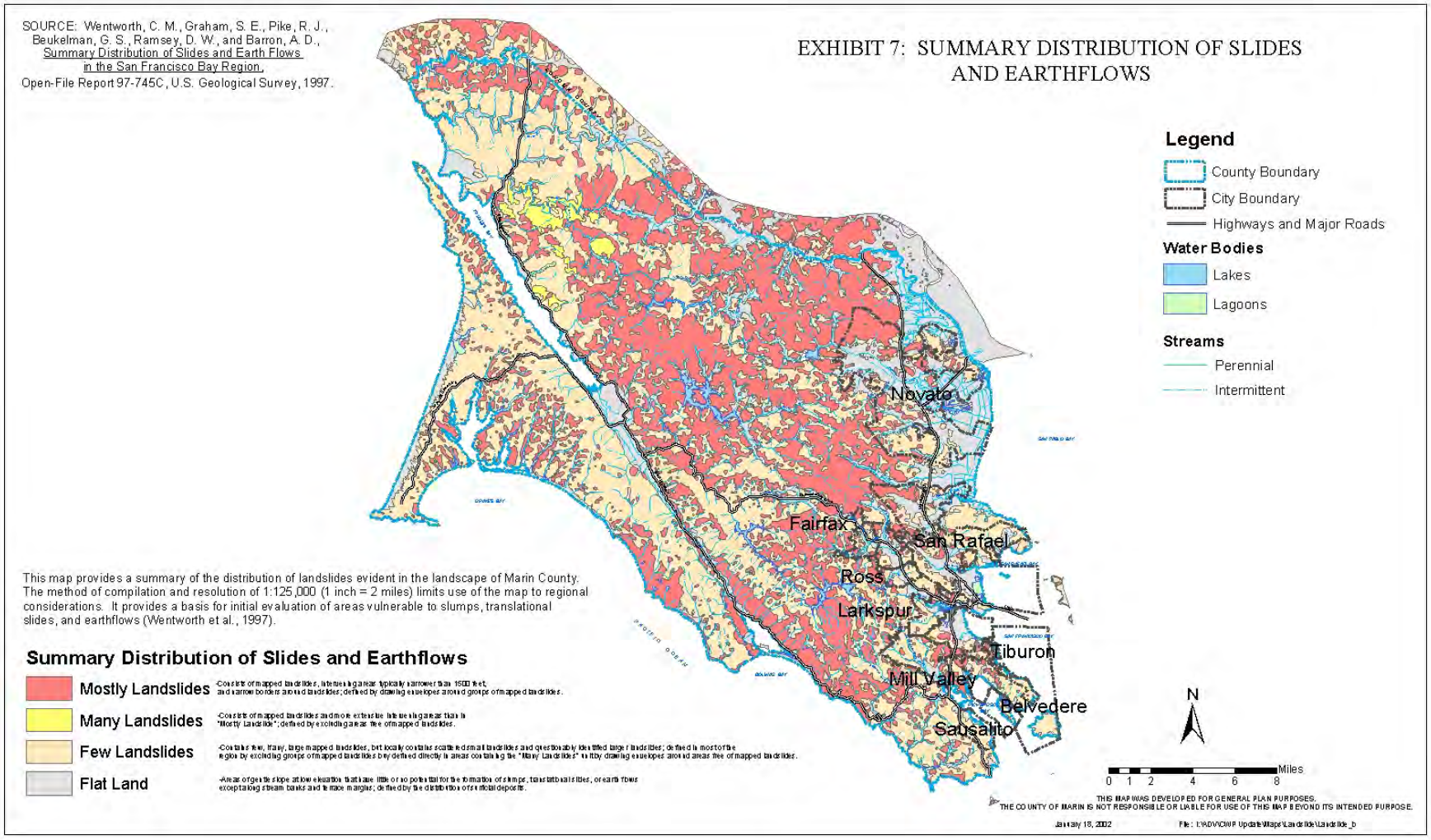
- Steep slopes (80 percent occurred on slopes steeper than 27.5 degrees.
- Granular soil mantle.
- Granular soil mantle with both bedrock contacts and materials that have contrasts in permeability.
- They are closely associated with drainages.
- They are associated with intense rainstorms.

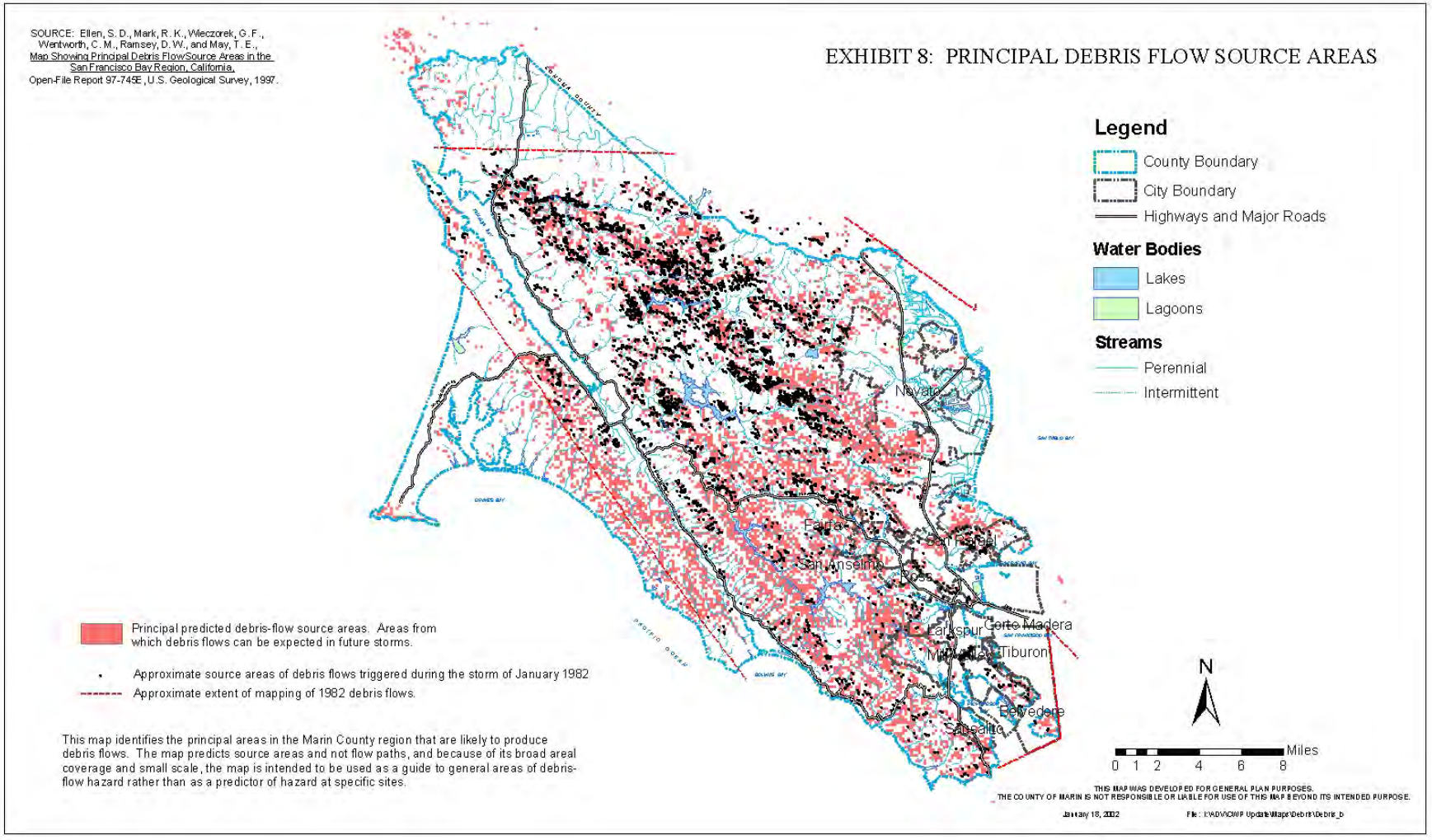
Reconnaissance landslide mapping has been performed in Marin County several times following periods of intense rainfall. The first published map by the U.S. Geological Survey was performed following the 1968-69 winter season (Taylor and Brabb, 1972). Above average rainfall occurred that season and 66 landslides were recorded with total public and private costs estimated at $1,054,950. Another published map was for the 1972-73 winter season (Taylor and Nilsen, 1975) shows that 153 landslides were reported in Marin County with a high concentration in Mill Valley and the Fairfax-San Anselmo area. The total public and private costs were estimated to total $3,064, 490.

Following the 1997-98 El Nino winter season Godt (1999) shows that near-record rainfall levels in the region caused landslides throughout the 10 County San Francisco Bay region during the first week of February 1998. Some counties received as much as 240 percent of normal rainfall. Several known landslides were located in Marin County and the majority were located near the cities of Tomales, Mill Valley and Novato (Morrissey et al., 1999). The total cost was estimated to be at least $2,540,000 in damage to public and private properties. Fifty eight percent of the total costs were related to damage caused by earth and debris slides. In Marin County over 65 percent of the recorded slides were debris flows.

Exhibit 10 shows the summary distribution of landslides evident in the landscape of Marin County. This map is a compilation of previous detailed mapping. The method of compilation and resolution of 1:125,000 (1 inch = 2 miles) limits the use of the map for regional considerations and is not to be used for site-specific evaluations. The red and yellow areas are locations that consist of mostly or many landslides, respectively. The orange areas contain few if any large mapped landslides, but locally contains scattered small landslides and questionably identified larger landslides. The gray areas are flat lands where landslide potential is low, except along stream banks and terrace margins. As can be seen from the map, a majority of the upland areas in Marin County may be potentially susceptible to landslide hazards.

Exhibit 11 shows the principal debris flow source areas in Marin County at a resolution of 1:125,000 (1 inch = 2 miles). Debris flows can be expected to originate largely in the areas shown on this map. Debris flows in a given storm originate from a number of source areas scattered throughout steep parts of the landscape, such as, old colluvial (soil) filled ravines. During subsequent storms, new debris flows


SOURCE: Wentworth, C. M., Graham, S. E., Pike, R. J., Beukelman, G. S., Ramsey, D. W., and Barron, A. D., Summary Distribution of Slides and Earth Flows in the San Francisco Bay Region, Open-File Report 97-745C, U.S. Geological Survey, 1997.
EXHIBIT 7: SUMMARY DISTRIBUTION OF SLIDES AND EARTHFLOWS
Legend
County Boundary
City Boundary
Highways and Major Roads
Water Bodies
Lakes
Lagoons
Streams
Perennial
Intermittent
Novato
Fairfax
San Rafael
Ross
Larkspur
Tiburon
Mill Valley
Belvedere
Sausalito
This map provides a summary of the distribution of landslides evident in the landscape of Marin County. The method of compilation and resolution of 1:125,000 (1 inch = 2 miles) limits use of the map to regional considerations. It provides a basis for initial evaluation of areas vulnerable to slumps, translational slides, and earthflows (Wentworth et al., 1997).
Summary Distribution of Slides and Earthflows
Mostly Landslides
Consists of mapped landslides, intervening areas typically narrower than 1500 feet, and narrow borders around landslides; defined by drawing envelopes around groups of mapped landslides.
Many Landslides
Consists of mapped landslides and more extensive intervening areas than in "Mostly Landslide", defined by excluding areas free of mapped landslides.
Few Landslides
Contains few, many, large mapped landslides, but locally contains scattered small landslides and questionably identified larger landslides; defined in most of the region by excluding groups of mapped landslides but defined directly in areas containing the "Many Landslides" unit by drawing envelopes around areas free of mapped landslides.
Flat Land
Areas of gentle slope at low elevation that have little or no potential for the formation of slumps, translational slides, or earthflows except along stream banks and terrace margins; defined by the distribution of alluvial deposits.
N
0 1 2 4 6 8 Miles
THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
THE COUNTY OF MARIN IS NOT RESPONSIBLE OR LIABLE FOR USE OF THIS MAP BEYOND ITS INTENDED PURPOSE.
January 18, 2002
File: I:\ADVCWP Update\Maps\Landslide\Landslide_b


SOURCE: Ellen, S. D., Mark, R. K., Wieczorek, G. F., Wentworth, C. M., Ramsey, D. W., and May, T. E., Map Showing Principal Debris FlowSource Areas in the San Francisco Bay Region, California, Open-File Report 97-745E, U.S. Geological Survey, 1997.
EXHIBIT 8: PRINCIPAL DEBRIS FLOW SOURCE AREAS
Legend
County Boundary
City Boundary
Highways and Major Roads
Water Bodies
Lakes
Lagoons
Streams
Perennial
Intermittent
Novato
Fairfax
San Rafael
San Anselmo
Larkspur
Corte Madera
Mill Valley
Tiburon
Belvedere
Sausalito
Principal predicted debris-flow source areas. Areas from which debris flows can be expected in future storms.
Approximate source areas of debris flows triggered during the storm of January 1982
Approximate extent of mapping of 1982 debris flows.
This map identifies the principal areas in the Marin County region that are likely to produce debris flows. The map predicts source areas and not flow paths, and because of its broad areal coverage and small scale, the map is intended to be used as a guide to general areas of debris-flow hazard rather than as a predictor of hazard at specific sites.
N
Miles
0 1 2 4 6 8
THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
THE COUNTY OF MARIN IS NOT RESPONSIBLE OR LIABLE FOR USE OF THIS MAP BEYOND ITS INTENDED PURPOSE.
January 18, 2002

originate from various sources when the soils become saturated. These various sources, however, are similar in topographic form because debris flow initiation requires steep slopes and prefers concave parts of hillsides, such as, soil filled ravines. These topographic characteristics were used to compile the map in order to predict the likely future source areas shown (Ellen et al., 1997).

The red zones in Exhibit 11 are the principal areas from which debris flows can be expected during future storms. The black dots represent the debris-flow sources mapped after the heavy rain events in January 1982 and during the 1997-98 El Nino winter season. The dots provide an example of the abundance of debris flows that might be expected during a major rainstorm, and they illustrate that approximate nature of this predictive map (Ellen et al., 1997).

Because debris flows start in upland areas, they travel downslope and downstream from the source areas. This results in hazardous conditions that extend beyond the red zones on the map. These hazard areas can be near the base of steep hillsides, near the mouths of steep hillside drainages, and in and near the mouths of canyons that drain steep terrain. The hazards at the edges of the red zones should be considered. Debris flows are of the greatest concern during times of heavy rainfall, as shown in the historical record and because they typically move rapidly downslope and without warning. Because the map depicts potential source areas and not flow paths, and because of its broad areal coverage and small scale, the map is intended to be used as a guide to general areas of debris-flow hazard rather than as a predictor of a hazard at specific sites. Appropriate uses include storm-preparedness planning for emergency access and response (Ellen et al., 1997).

C. HAZARD MITIGATION

1. Reasons for Mitigation

The direct and indirect economic losses from landsliding throughout the State of California have been enormous. And, as shown by previous landslide mapping and economic loss estimates, the costs have been significant in Marin County. Schuster and Fleming (1986) define direct costs as those related to replacement, repair, or maintenance due to damage of property or facilities within the boundaries of a landslide. The indirect costs include:

- Reduced real estate values,
- Loss of productivity of agricultural or forest lands,
- Loss of tax revenues from properties devalued as a result of landslides,
- Costs of measures to prevent or mitigate future landslide damage,
- Adverse effects on the water quality and biology in streams,
- Loss of human productivity due to injury or death,
- Costs of litigation.

It has been determined that landslides in developing areas are largely caused by human activity, usually construction activity. Nilsen and Turner (1975) estimated that approximately 80 percent of landslides in Contra Costa County were due to human activity. This indicates the importance of effective enforcement of grading and construction codes in reducing landslide hazards. In addition, in Marin County the historical record has shown that a majority of landslides are due to two triggering mechanisms that have always been present and will continue to trigger landslides in the County:

- Earthquakes; and,

- Intense Rainfall

Combined with the adverse geologic conditions these triggering mechanisms pose a great threat to the slope stability in the County.

2. Methods of Mitigation

In order to reduce the direct and indirect costs and mitigate the causal factors of landsliding an effective mitigative plan is necessary. The USGS found that communities that achieved landslide loss reductions implemented four conditions that led to successful mitigative programs (USGS, 1982):

- An adequate base of technical information about the local landslide problem,
- An "able and concerned" local government,
- A technical community able to apply and add to the technical planning base; and,
- An informed population that supports a mitigation program objective.

Wold and Jochim (1989) state: "The key to achieving loss reduction is the identification and implementation of specific mitigation initiatives, as agreed upon and set forth in a local or state landslide hazard mitigation plan." They also propose that achievement can be obtained by applying the following techniques:

- Preventing or minimizing the exposure of populations and facilities to landsliding,
- Preventing, reducing, or managing the actual occurrence of landslides,
- Physically controlling landslide-prone slopes; and,
- Protecting existing structures.

Wold and Jochim (1989) recommend the following planning process steps that are involved in developing a landslide hazard mitigation plan (adopted for Countywide mitigation):

- Analysis of the types of landslide hazards in the County and a general assessment of the vulnerability of people and property to the County's landslides hazards,
- Identification of specific areas of the County where landslides have the most serious or immediate potential impacts and a detailed analysis of their vulnerabilities,
- Translation and transfer of technical information on hazards and vulnerabilities to users such as decision makers, community planners, and emergency management officials,
- Assessment of resources and mitigation programs available in the public and private sectors to deal with the identified potential impacts,
- Determination of local capability shortfalls and unmet needs in order to apply technical and financial assistance where it can best contribute to the reduction of future losses,
- Formulation of goals and objectives for County landslide hazard mitigation plans, and the development of cost-effective mitigation projects that address identified vulnerabilities,
- Establishment of a permanent County hazard mitigation system to prioritize and promote mitigation goals and objectives and to secure and direct funding for implementation; and,
- Periodic evaluation and modification of the plan and planning process.

D. SUMMARY AND ISSUES TO CONSIDER

- Landslide and slope stability hazards are prevalent throughout Marin County due to the existing adverse geologic conditions. The potential threat of a significant number of failures occurring at the same time is great during strong seismic shaking or during intense rainfall events. Landsliding during causative events such as these could cause significant levels of damage and significantly impact structures, utilities, services, roads, etc.
- Studies of landslides, especially debris flows, triggered by significant rain events over the last three decades have shown that millions of dollars in damage occur in Marin County during these events. Reducing this cost should be a key goal of landslide hazard mitigation.
- Evaluation of landsliding and slope stability should be done through additional detailed and large scale mapping studies. This would help in reducing the potential hazards. This type of evaluation study could be conducted with other public agencies, such as the Division of Mines and Geology and the U.S. Geological Survey, as was done with the previous studies in the 1970's. The information from these studies is still currently used. Adding to and improving upon past studies should provide additional and more refined knowledge to be used in mitigating this hazard. A future source of information will be the upcoming Seismic Hazard Zone Maps and their accompanying reports. These maps will provide valuable information with respect to areas that may be susceptible to earthquake-induced landslides.
- The definition of what constitutes a landslide hazard area should be reevaluated. A landslide hazard area is currently defined by stability zones 3 and 4 on County slope stability maps. These maps do not cover some areas of the County and more detailed studies could redefine stability zones based on new updated information.
- Regular review and reevaluation of existing County policies and building code regulations should be done. Continued improvement of hillside safety and hazard prevention measures can contribute to reducing the cost of damage.
- Increased education and awareness of the landslide and slope stability issues by public officials, consultants, developers, homeowners, and contractors will encourage proper geotechnical and engineering geologic investigations and effective mitigative efforts. Information concerning landslide and slope stability issues should be accessible to homeowners and incentives and disincentives should be created to promote mitigation efforts.
- Development of a hillside safety and hazard mitigation program would lead to creating an effective vehicle in dealing with this ongoing long-term issue. This issue will only grow as continued development encroaches on the hilly "marginal" areas within the County.
- Effective grading policies, regulations and enforcement play a vital role in mitigating this hazard and they are at the core of any hillside safety and hazard mitigation program.
- Both a geotechnical engineer and a certified engineering geologist should perform any slope stability investigation and analysis. Existing County landslide and slopes stability policies (Policies EH-6.1, EH-6.2, and EH-6.3) should be refined and include the combined efforts of a geotechnical engineer and engineering geologist. Development of all hillside properties should be preceded by a detailed engineering geologic and geotechnical engineering investigation. Those properties found to have landslide and/or debris flow deposits should be analyzed thoroughly and properly mitigated prior to development.

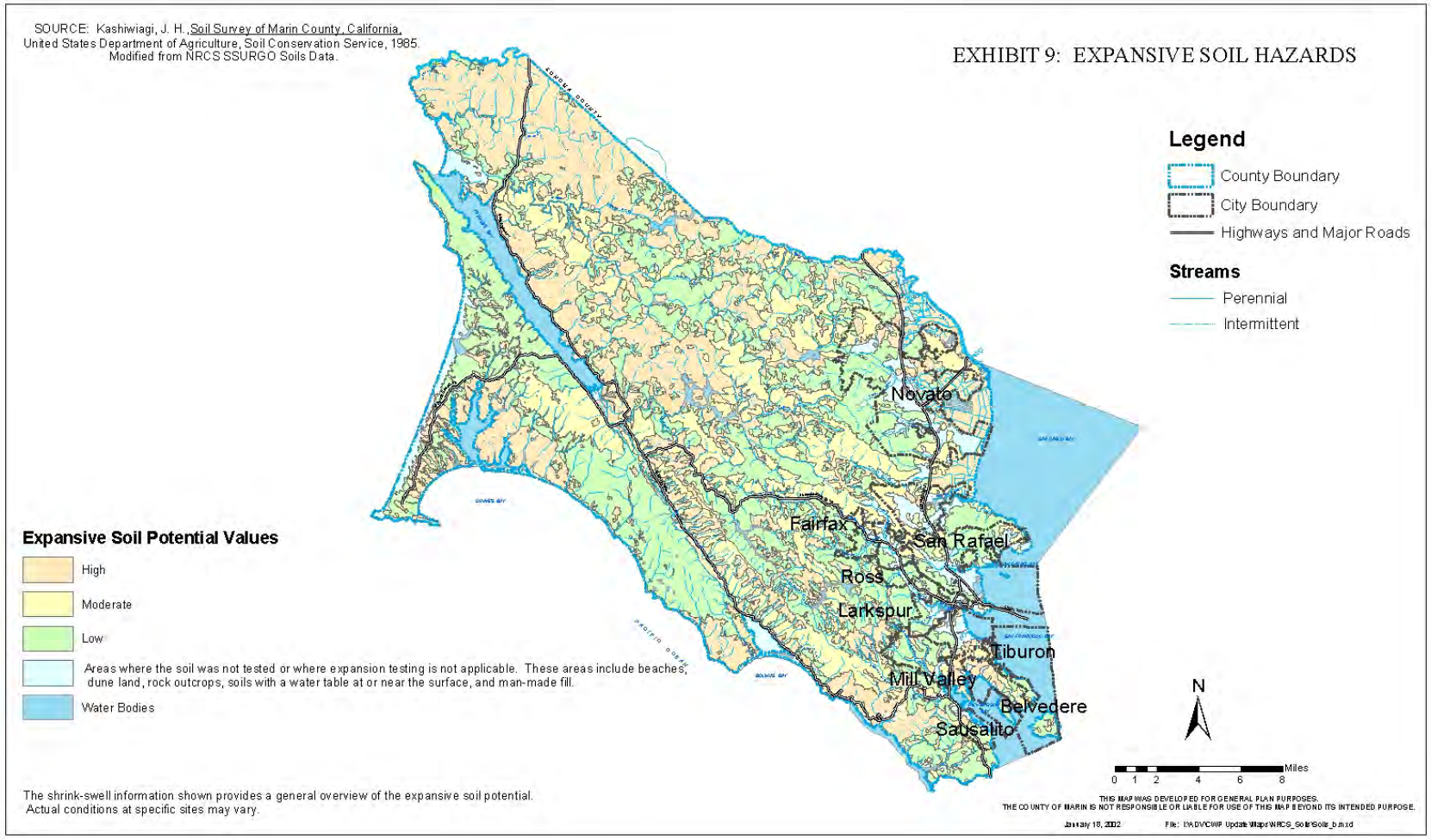
VI. EXPANSIVE AND CREEPING SOILS

A. HAZARD DESCRIPTION

Many of the soils present in Marin County have moderate to high expansion potential. Such soils generally are cohesive, have a high clay content, and shrink when dried. Montmorillonite or other smectite group clay minerals are usually present in expansive soils. Expansive soils are naturally prone to large volume changes through the absorption of pore water. The physical manifestation of such moisture change most often is expansion or swelling during the winter and subsequent shrinkage due to drying or desiccation in the summer. This cyclic volume change can exert large forces on nearby structures, causing damage to concrete slabs and foundation elements and cosmetic damage to interior and exterior wall surfaces, tilted posts, fences, retaining walls, and ruptured utility lines. Thick soil accumulations of expansive soils are responsible for the numerous earth flows that are present throughout the hillsides of the County, particularly in areas underlain by Franciscan mélange. The thickness and depth to an expansive soil layer will influence the degree of shrinking and swelling that may take place. On a hillside, expansive soils are adversely affected by gravity and cyclically creep downhill. This type of creep movement typically occurs during the drying cycle.

Exhibit 12 shows the soil units that are listed in the 1985 Soil Survey of Marin County prepared by the United States Department of Agriculture, Soil Conservation Service as having low, moderate and high expansion potential components in their soil profile (Kashiwagi, 1985). Due to the scale of the mapping, the map units are typically composed of more than one soil type within their boundaries. Individual profiles for a specific soil type may have different expansion potentials. For example, a single soil type may have low, medium and high expansion potential layers in its profile. Therefore, the highest expansion potential designation determined for a specific map unit is shown on Exhibit 12. This provides a conservative overview of the soil expansion potential in the County.

The soil survey indicates that laboratory measurements of swelling undisturbed clods were made for many soils; and, for others swelling was estimated on the basis of the kind and amount of clay minerals in the soils and on measurements of similar soils. If the shrink-swell potential is rated from moderate to very high, shrinking and swelling can cause damage to


SOURCE: Kashiwiagi, J. H., Soil Survey of Marin County, California, United States Department of Agriculture, Soil Conservation Service, 1985. Modified from NRCS SSURGO Soils Data.
EXHIBIT 9: EXPANSIVE SOIL HAZARDS
Legend
County Boundary
City Boundary
Highways and Major Roads
Streams
Perennial
Intermittent
Novato
Fairfax
San Rafael
Ross
Larkspur
Tiburon
Mill Valley
Belvedere
Sausalito
Expansive Soil Potential Values
High
Moderate
Low
Areas where the soil was not tested or where expansion testing is not applicable. These areas include beaches, dune land, rock outcrops, soils with a water table at or near the surface, and man-made fill.
Water Bodies
N
0 1 2 4 6 8 Miles
The shrink-swell information shown provides a general overview of the expansive soil potential. Actual conditions at specific sites may vary.
THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
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January 18, 2002

buildings, roads and other structures. The shrink-swell potential classes in the table and used in the exhibit are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are: low, a change of less than 3 percent; moderate, 3 to 6 percent; high, more than 6 percent, and; very high, greater than 9 percent (Kashiwagi, 1985). There are no soils in the survey listed as very high. Those areas not given a designation of high, moderate or low are areas where the soil was not tested or where expansion testing is not applicable. These areas include beaches, dune land, rock outcrops, soils with a water table at or near the surface, and man-made fill.

The shrink-swell data from the soil survey shown in Exhibit 12 provides a general overview of the expansive soil conditions in the County. Actual conditions for a specific development may vary; therefore, site-specific geotechnical investigations and testing of expansive soil potential should be performed in areas where there is a potential concern.

B. HAZARD MITIGATION

Several mitigative measures are available for expansive soils. For site-specific conditions, a soils engineer must recommend specific design criteria; notably, the minimum embedment depth of footings, pressure on retaining walls, reinforcement in footings, etc. Use of minimum standards of the Building Code or more conservative design parameters should be implemented on a case-by-case basis.

Typical mitigative measures for treatment of expansive soils include:

- Pre-saturating fill soils and wet placement of fill soils above optimum moisture content.
- Placing a non-expansive imported soil in the upper part of the building pad.
- Burying expansive soils deep in the fill.
- Treating soil with lime.
- Mixing expansive soils with less expansive soils.
- Designing foundation systems to incorporate measured variation of soil swell with effective confinement (dead weight).

Mitigative Measures typically incorporated in building design include:

- Strengthening of foundations and use of suspended wood floors.
- Drilling pier and grade beam foundations with sufficient embedment.
- Building floating slabs and pre-stressed (post-tensioned) slabs-on-grade.
- Chemical treatment.
- Proper drainage control.
- A combination of these techniques.

C. SUMMARY AND ISSUES TO CONSIDER

- Expansive soils are present throughout Marin County and are responsible for a large amount of surficial creep and slope failure in upland areas. Expansive soils are also responsible for damage to structures in upland and flatland areas.
- Increased education and awareness of the hazards resulting from expansive soils by public officials, consultants, developers, homeowners, and contractors will encourage proper geotechnical and engineering geologic investigations, effective foundation design, grading and drainage policies.

- Methods provided in the Uniform Building Code and future codes used by Marin County for addressing this hazard are minimum standards that should be effectively enforced to mitigate this issue.
- The existing County policies and methodologies for mitigating expansive soil hazards should be regularly reevaluated for improvements as new information is obtained and new design methods are created.
- Existing County policies do not specifically address the issue of expansive soils; however, some existing policies should be refined to include expansive soils in their text (see Section XIII). Specific policies tailored toward expansive soils should be considered. New developments located in known or mapped high to moderate expansion potential zones should be preceded by a thorough, site-specific geotechnical investigation to evaluate expansion hazard. Laboratory testing for expansion potential should be performed at finished grade on a lot by lot basis as deemed appropriate by the project geotechnical engineer. This will allow for proper mitigation or avoidance of this potential hazard.

VII. GRADING

A. INTRODUCTION

Grading operations are used consistently throughout California to mitigate adverse soil conditions and repair landslides. Grading with site-specific under-construction input from engineering geologists historically has lowered the incidence of influence by adverse geologic conditions, such as, compressible soils and landslides. Without mitigative grading in affected terrain, the potential for developments being impacted is increased substantially.

Specific conditions of individual sites dictate how much grading is necessary to successfully mitigate adverse geological conditions and typically include minimal grading and mass grading, although it is the depth and volume of earthmoving activities which define these types of grading, not necessarily the areal extent of surface disturbance.

The type and location of grading operations required to mitigate adverse geological conditions successfully for the long-term cannot be determined before completion of subsurface investigations, which are necessary to provide sufficient detailed information to characterize the extent of adverse conditions and to design measures suitable to remediate site-specific conditions. Once site-specific conditions are determined, the appropriateness of the following techniques can be considered on a case-by-case basis for inclusion in the design and implementation of projects:

- Mechanically stabilize embankments, construct toe buttresses, and infill incising creek channels (creek channel incisions are geologic "triggers" that spawn landsliding) to reduce the amount of grading. Such techniques can permit minimal grading with the degree of long-term safety normally associated with conventional buttress repairs.
- Use passive mitigation to reduce the potential for landslide induced hazards in the area of large landslides. This technique would involve setting development back or relocating structures away from large identified potential landslide features to avoid damage or destruction from sliding. Physical avoidance to mitigate potential slide impacts on proposed improvements would eliminate the zone of disturbance caused by grading.

- Both mechanical stabilization and passive mitigation would be effective in reducing the magnitude of grading. However, if not planned properly to reduce the corridor of disturbance, grading could impact a large area adversely in a number of ways. Secondary impacts caused by grading include dust control, traffic, noise, erosion and water needs during construction.

B. TYPES OF GRADING

1. Minimal Grading

Minimal site grading may involve a large area in plan view but generally is shallow and involves the least amount of earthmoving necessary to reach the desired finished building grades. Because minimal grading may not stabilize all major geologic hazards (such as bedrock landslides), it is usually most appropriate on sites with generally favorable geologic conditions or where landslides are relatively shallow. Minimal grading can also involve the use of retaining structures, mechanically stabilized embankments and surface and subsurface drainage, to further stabilize sites with a limited grading concept.

2. Mass Grading

Mass mitigative grading (such as that used in buttress fill slope reconstruction) involves the removal and recompaction of thousands of cubic yards of earth material in order to stabilize an unstable or unsupported slope or to repair large landslide deposits. While mass grading may ultimately produce a safer site, it usually creates a much greater corridor of disturbance than minimal grading techniques. Mass grading also can produce many secondary effects, such as biotic, dust, noise and traffic concerns. This type of grading is best performed only in areas, which are not environmentally sensitive.

C. HISTORY OF GRADING CODES

The numerous problems, procedures, trials, and errors suffered by governmental agencies and hillside-development in California during the period from 1956 through 1961 inadvertently became the basis of Chapter 70 of the Uniform Building Code (UBC) published by the International Conference of Building Officials (ICBO). A regrettable lack of uniformity had persisted in the existing grading codes. The codes lacked integrity because they had been pieced together as particular problems arose rather than developed comprehensibly. The only valuable geotechnical field supervision of grading during that period was by soil-testing companies and governmental grading inspectors. The lack of uniform code requirements and the limited grading code enforcement personnel understandably failed to require a quality of performance that insured safe construction (Scullin, 1983). Chapter 70 of the UBC was written in 1962 and developed out of the grading codes for the County of Los Angeles. It was adopted and added to the UBC as an appendix in 1964. The section was later revised several times and the final version was incorporated into the 1969 UBC. Research has shown that modern grading codes have reduced rain-induced damages to structures in graded tracts by as much as 90 percent (Scullin, 1983).

D. GRADING CODE ADMINISTRATION AND ENFORCEMENT

Effective grading code enforcement has clearly been shown as an effective way to reduce losses due to natural geologic hazards. Potential natural hazards do not become community risks until urban development and population encroachment hinder the natural geologic processes. Interruptions of natural processes without knowledgeable technical management have the potential to induce financial and human losses. Public administrators challenged by systems management with reduced funding, and

professional and technical industries faced with higher liability and relatively less compensation, are often being required to define "acceptable risk" and "cost benefit" programs commensurate with population increases into "marginal" land areas. Public involvement and support, administrative awareness and management skills, geotechnical professions, and industrial progress within our urban development fields will all play important roles as communities grow into potentially hazardous terrain. Effective grading code enforcement can and should provide cost benefit programs that will mitigate losses due to geologic hazards (Scullin, 1983).

E. GRADING INSPECTION AND THE REVIEW PROCESS

The modern review process is designed to assure public safety and welfare through comprehensive site evaluation prior to issuing building permits, and through quality control inspection during construction. The application of site knowledge to planning, design and grading construction is absolutely essential to ensure a safe building site. The inclusion of grading supervision, control, and code enforcement is a recent sophistication of the review process. The grading review process applies from site planning through plan check, the actual grading of the site, and the rough and fine grade stages of construction.

F. CONSULTING REVIEWERS

Geologic and soil engineering consultants have been retained by builders, developers, and large construction companies to evaluate the soils and geologic conditions on proposed building sites. There have been cases when conflicts of opinion between private consultants and governmental staff has resulted in outside geotechnical reviewers being hired to provide an independent review of the geologic conditions and peer review of the consultant's work. Geotechnical review has contributed safe development of graded sites in grading projects, improvement projects, and both major and minor divisions of land. Geotechnical reviewers act as consultants regarding environmental impact reports (EIR), seismic safety elements of the general plan, planning department projects, geologic hazard areas, waste disposal sites, and as expert witnesses to legal departments.

G. SUMMARY AND ISSUES TO CONSIDER

- Grading can be an effective means for successfully mitigating adverse geologic conditions and hazards. The input from an engineering geologist can be effective in mitigating geologic hazards and should be considered when refining any existing policies.
- In order for proper grading to be performed, oversight by adequate grading code administration and enforcement is necessary. This is especially true now that continued development will encroach on "marginal" lands where significant geologic hazards will likely be encountered. Continual reevaluation of grading code administration and enforcement should be done in order to enhance and improve existing County standards.
- Existing Policy EQ-3.16 addresses the issue of minimizing grading; however, this policy should be refined to include the importance of a stable development site. Minimizing grading is fine as long as geologic hazard mitigation is performed properly.

VIII. SUBSIDENCE AND DIFFERENTIAL SETTLEMENT

A. HAZARD DESCRIPTION

Subsidence is the vertical displacement of the ground surface, which can be localized or over a broad region. Subsidence can be affected by different processes at work and can be naturally induced or human-induced. Regional scale human-induced subsidence generally results from withdrawal of fluids (water, oil or gas) from underground reservoirs. More localized human-induced subsidence can be caused by placement of fills and structures on collapsible soils, saturation of collapsible soils by the human introduction of water into the subsurface, and mining operations. This can be done by pipe breaks, over irrigation and on-site sewage disposal systems. Naturally induced subsidence can also be related to localized settling caused by seismic shaking. Seismic shaking can cause liquefaction or compaction of soils prone to collapse. Differential (uneven) settlement refers to the vertical movement of an engineered structure due to subsidence of the underlying unconsolidated materials.

The most prominent and well-known significant subsidence hazard in Marin County is subsidence of the young bay muds. The placement of fills and structures on bay muds has resulted in human-induced subsidence and seismic shaking has caused naturally induced subsidence of bay muds. In general, bay mud is a soft, slightly organic silty clay containing occasional thins seams or lenses of silt and sand. Its high water content and low pre-consolidation pressure cause it to undergo substantial long-term settlement under sustained loads (Seed, 1969). The upper layer of younger bay mud is unconsolidated and in a semi-fluid state that is sensitive to seismic shaking and an increase in vertical loading (Lee and Praszker, 1969).

Subsidence of natural materials over a time span that would be noticeable in engineered works generally occurs in the low-lying flatland deposits in valley basins and along bays. In Marin County, these areas are located in the flats and valleys on the east side of Marin County adjacent to the Bay and in the flats and valleys associated with drainage outlets to Tomales and Bolinas Bays and outlets to the Pacific Ocean (Exhibits 2 and 3). The areas most susceptible to subsidence and differential settlement in Marin County are in those areas underlain by young Holocene unconsolidated alluvial and colluvial sediments and estuarine muds. Development of these areas should be evaluated and mitigated using appropriate engineering methods. Differential settlement of engineered structures may also occur in upland areas if the slope materials are collapsible or on landslides that are unstable or potentially unstable. The deposits on Exhibits 2 and 3 that may likely be prone to localized subsidence and differential settlement include, East of the SAFZ (Exhibit 2): artificial fill (Qaf), artificial fill over marine and marsh deposits (Qmf), beach sand (Qs), dune sand (Qd), marine and marsh deposits (Qm), landslide deposits (Qls), alluvium (Qal), slope debris and ravine fill (Qar), Undifferentiated surficial deposits (Qu). West of the SAFZ (Exhibit 3): beach sand (Qs), dune sands (Qd), alluvium (Qal) and landslide deposits (Qls). However, other collapsible soils may be present at other locations in the County.

B. HAZARD MITIGATION

The consequences of improper utilization of land prone to subsidence and differential settlement will likely result in significant economic losses. In certain extremely subsidence prone areas, complete avoidance is likely the best mitigative measure. However, this can include usage of the susceptible land to uses that would not be greatly impacted; such as, using the land for agriculture, parkland, open

spaces, or other suitable usages. If the economic cost is not detrimental, developments can be engineered to prevent subsidence and differential settlement. This would require site-specific detailed engineering and geological analysis to properly evaluate and mitigate the unfavorable site conditions.

C. SUMMARY AND ISSUES TO CONSIDER

- Collapsible soils are present in Marin County and are generally located in the low-lying flatland deposits in valley basins and along bays. The most susceptible areas are those underlain by young Holocene unconsolidated alluvial and colluvial sediments and estuarine muds, especially younger bay muds.
- Both human-induced processes and naturally induced processes can cause subsidence and differential settlement of collapsible soils.
- Increased education and awareness of the hazards resulting from collapsible soils by public officials, consultants, developers, homeowners, and contractors will encourage proper geotechnical and engineering geologic investigations, effective foundation design, grading and drainage policies.
- The existing County policies and methodologies for mitigating hazards posed by collapsible soils should be regularly reevaluated for improvements as new information is obtained and new design methods are created.
- Existing Policies EQ-2.62 and EQ-2.62 address the hazard of differential settlement within the Bayfront Conservation Zone as posed by the young bay muds. These policies are still applicable; however, some refinement of these policies, as discussed in Section XIII, should be considered.
- Existing Policies EH-7.1, EH-7.2, EH-7.3 and EH-7.4 and their associated programs specifically address this hazard and are still applicable; however, some refinement of these policies, as discussed in Section XIII, should be considered.

IX. COASTAL BLUFF EROSION

A. HAZARD DESCRIPTION

Much of the Marin County coastline is dominated by erosional processes that predominate over depositional processes; thereby, resulting in coastal bluff erosion. This erosion is a continually on-going process that is more pronounced during periods of intense storm activity. Bluff erosion is a complex erosion process involving many aspects that can vary greatly along the coast (Hampton and Dingler, 1998). The primary component of this process, and the greatest single factor in the erosion rate of a bluff as compared to another, involves the physical characteristics of the bluff materials (Benumof and Griggs, 1999). Different soil and rock materials are susceptible to erosion to varying degrees. Benumof and Griggs (1999) label these physical characteristics of eroding materials as the intrinsic variables involved in bluff erosion, and include the strength of the material, the severity of joints and fractures, and the susceptibility of a material to weathering. Therefore, given the same external influences, a bluff composed of strong, weather resistant rock with no fractures will erode at a slower rate than a weak rock with extensive fracturing that is highly susceptible to weathering. The secondary component of the bluff erosion process involves the extrinsic variables that impact the intrinsic variables. These include wave erosion, amount of precipitation, surface runoff, groundwater seepage, and seismic shaking. The bluffs of Marin County are susceptible, in varying degrees, to all of these intrinsic and extrinsic variables.

The degree of erosion varies over time and significant erosion appears to be episodic in nature when greater than normal storm events cause the greatest erosion. This was observed and well documented during the 1982-83 and 1997-98 El Niño winter storms (Storlazzi and Griggs, 1998; Cannon et al., 1998). These greater than normal storm events result in larger wave heights, higher sea surface elevations and increased precipitation relative to average storm events. As expected, these greater than normal extrinsic variables have a greater impact on the intrinsic variables; thereby, increasing the erosion rates for a limited period. This is an important point when considering the length of time that is evaluated for determining setback lines from eroding bluffs.

Reported bluff erosion rates for the Marin coastline are mostly limited to the Bolinas Peninsula. Erosion rates for the Bolinas Peninsula have been reported in various sources and range from 0.4 to 36 inches per year, which is dependent on the location (Marin County, 2003). Coastal bluff erosion can be more pronounced during periods of heavy storm activity as during El Nino winters; thereby, increasing these retreat rates in a shorter time span (Cannon et al., 1998).

B. HAZARD MITIGATION

The best mitigative measures for bluff erosion is not permitting development near the top of actively eroding coastal bluffs and providing a significant enough setback from the top of bluffs to prevent damage to any structures and their foundations by bluff erosion. Setbacks should be based on known bluff erosion studies and site-specific studies providing design recommendations for development. Setbacks should be determined on a case-by-case basis because of the varying retreat rates along the coast.

New development must be sited far enough away from a bluff so that it is not at risk during its expected economic lifetime and that measures are employed during development to prevent any adverse impacts to the bluffs or adjacent properties. The following two setback methodologies are used by the staff of the California Coastal Commission in evaluating setbacks for bluff top development (Johnsson, 2005). The first method that can be used is based on determining the stability of a bluff; if a bluff is not stable then a setback line can be determined with a slope stability analysis. This setback line, derived from slope stability analysis, is the line that meets the minimum factor of safety deemed appropriate. For residential and commercial structures, this is typically a factor-of-safety of 1.5 (ratio of driving force to resisting force). This type of analysis is very effective for a site-specific study and should include evaluation of the subsurface conditions and the potential for landsliding along planes of weakness.

The second method of determining a setback line is by measuring the long-term bluff retreat rates from historical data and creating setbacks based on the expected economic lifetime of proposed new development. This approach requires determining the maximum erosion rate for a bluff and plugging it into the following formula:

Setback = (expected economic life of structure) x (rate of retreat)

Because of the uncertainty involved in the actual analysis of bluff erosion, it is common for an additional distance to be added to the setback as a safety factor. This can been done using various methods, which are outlined in Johnsson (2005). As an example, the Bolinas Gridded Mesa Plan incorporates an additional safety factor of 45 feet to the above formula:

Setback = (expected economic life of structure) x (rate of retreat) + (safety factor 45 feet)

Uncertainties that are beyond control and difficult to determine, include the effects of sea level rise, the number and severity of future large storm events and the number and severity of future earthquake events. A method useful for addressing some uncertainty and for refining a setback line over time is the use of a rolling setback. A rolling setback is based on the use of updated coastline change information that is reexamined and adjusted as necessary. This ensures that the location of new development evolves with the ever-changing coastline.

C. SUMMARY AND ISSUES TO CONSIDER

- Bluff erosion and landsliding along the coast are due to ongoing active erosional processes on the Marin County coastline and are a potential geologic hazard that must be addressed.
- Any development within the vicinity of a coastal bluff should be preceded by a detailed engineering geologic and geotechnical engineering investigation, which will accurately characterize the site geologic conditions and determine the stability of the slope and bluff retreat rates. This will allow proper setback and/or mitigative recommendations by the project geotechnical engineer.
- A countywide plan policy does not exist regarding coastal bluff erosion and coastal landslide hazards; however, these issues are addressed in the Marin County Development Code for coastal zones.
- The coastal resource management standards, used to implement policies of the Coastal Act and Local Coastal Plans, provide minimum standards that address this issue (Marin County Code – Title 22, Development Code, Chapter 22.70, Coastal Resource Management Standards).
- The minimum standards described in the Coastal Resource Management Standards section 22.70.130 – Shoreline Protection, addresses the issue of slope stability and blufftop retreat rates and provides potentially effective requirement standards for addressing this issue.
- The minimum standards described in the Coastal Resource Management Standards section 22.70.060 – Hazard Areas, should be evaluated in order to determine if the standard can be raised. Currently, a coastal permit application for a site in a designated geologic hazard area requires a report by a qualified registered civil or structural engineer describing the extent of potential geologic hazards at a site. A report requiring the combined knowledge of an engineering geologist with the design and mitigation knowledge of a civil, geotechnical or structural engineer would be a more effective report for addressing coastal geologic hazards.

X. STRUCTURAL HAZARDS DUE TO EARTHQUAKES

A. HAZARD DESCRIPTION

Bertero (2000) states that the philosophy of earthquake design for most structures is well established, and defined by:

- Preventing non-structural damage in frequent minor ground shaking,
- Preventing structural damage and minimizing non-structural damage in occasional moderate ground shaking; and,
- Avoiding collapse or serious damage in rare major ground shaking.

However, the implementation of this philosophy is difficult because of current design methodologies, problems with quantifying the different types of structural and non-structural damage and defining what constitutes frequent minor, occasional moderate and rare major earthquake ground shaking.

A comprehensive design approach should consider the fact that many, if not most, of the previously discussed geologic hazards can result in damage to structures and facilities, including:

- Ground failures (or instabilities due to ground failures)
- Surficial fault rupture
- Vibration of soil (including earthquake generated ground shaking)
- Ground cracking
- Liquefaction
- Ground lurching
- Differential settlement
- Lateral spreading
- Landslides
- Vibrations transmitted from the ground to the structure
- Tsunamis
- Seiches
- Landslides
- Floods
- Fires

From this list it becomes apparent that the design of a structure is influenced by where the structure is to be located and that adequate design methodologies should be considered when evaluating the potential impact these effects may have. The effect of vibration from earthquake shaking is usually what is of greatest concern to the structural engineer, and its effect on common structures is discussed in this section and is taken from Bertero (2000) and the California Seismic Safety Commission (CSSC) (1999). Ground shaking can result in structural failure and possible collapse but usually results in non-structural damage. It also causes building elements and equipment within and outside of a structure to become potential hazards.

The dynamic response of a structure to ground shaking is a very complex behavior that is dependent on a number of inter-related parameters that are often very difficult, if not impossible, to precisely predict. These include: the exact character of the ground shaking that the building will experience; the extent to which the structure will be excited by and respond to the ground shaking; the strength of the materials in the structure; the quality of construction and condition of individual structural elements; the interaction of the structural and non-structural elements of the building; the weight of furnishings and contents present in the building at the time of the earthquake; and other factors. Most of these factors can be estimated, but never precisely known (CSSC, 1999). Thus, it is quite difficult to determine the potential vulnerability that a specific structure will have to ground shaking. However, an approximate vulnerability estimate can be developed by a structural engineer with specialized knowledge of earthquake engineering.

The numerous failures of structures over the years have resulted in development of regulations and guidelines that if used properly result in an effective seismic-resistant design. Proper use of the Uniform Building Code (UBC) in design should result in a structure that will not collapse in the event of an

earthquake; however, this does not rule out the possibility of some non-structural damage. Many buildings in Marin County were built before development of modern codes and therefore may become a hazard during seismic shaking.

The building code sets minimum criteria for the structural design of buildings. For many years, the codes enforced by local governments in California have been based on the UBC, which has been published by the International Conference of Building Officials (ICBO). Since, 1991, California cities and counties have been required to adopt the same edition of this code, as is adapted by the State of California. With the publication of the 1997 edition of the UBC, the ICBO ceased publication of this model code (CSSC, 1999). The code adopted by the State is the California Building Code (CBC), which is also known as Title 24 of the California Code of Regulations. The publication dates of the CBC are established by the California Building Standards Commission (BSC), which is updated and republished in a 3-year cycle. In 2000, the BSC voted to re-adopt the 1997 Uniform Building Code (UBC) as the 2001 California Building Code. All parts of the 2001 CBC became effective November 1, 2002. Currently, the BSC is reviewing the 2004 proposed code changes.

The earthquake design provisions contained in the UBC have traditionally been based on recommendations developed by the Structural Engineers Association of California (SEAOC). These recommendations have adopted a seismic design philosophy intended to protect life safety, but allow for some structural and potentially significant nonstructural damage from earthquake levels as severe as can be expected in active seismic regions such as Marin County. This philosophy was briefly stated in the beginning of this section.

Buildings designed in accordance with the UBC are anticipated to experience significant damage loss, when affected by a major earthquake. Further, the design provisions of the UBC primarily address damage caused by ground shaking. They do not address the effects of other site hazards, such as liquefaction, ground lurching, landslides, ground surface rupture, etc. Any of these types of ground failure can result in excessive damage and potentially, even collapse of buildings meeting the code criteria. Because of the continual experience, California has had with earthquakes over the past few decades major UBC code changes have been made, following the 1994 Northridge earthquake, 1989 Loma Prieta earthquake, and the 1971 San Fernando earthquake.

The following is a general list of some building types and a brief description of some issues related to their earthquake performance (portions of the following are taken from Bertero (2000) and CSSC (1999)):

1. Wood-Frame Structures

Among the materials that are used for construction, wood is considered the most efficient earthquake resistant material for low-rise buildings. During seismic shaking, the response of a structure's foundation greatly depends on the intensity of inertia forces. These forces are the product of mass and acceleration; therefore, it is important to reduce the mass of a structure to a minimum. Thus, wood is a useful material in achieving this goal.

Based on past earthquake experiences the greatest considerations for wood-frame structures are that they should be carefully designed and constructed, provided with lateral bracing and all of their components should be tied together from the roof down to the foundation. A major cause of failure in

older wood-frame structures is failure at the framing/foundation junction in which, the framing is not properly connected to the foundation or the lower portions of the framing are not adequately braced.

2. Unreinforced Masonry Structures (URMs)

It is a well-known fact, based on the historical record of performance in earthquakes that unreinforced masonry is very susceptible to ground shaking. Solid brick masonry is very heavy and its tensile strength is low. Old unreinforced masonry buildings, whose walls are not properly connected to floors, roof, and interior and exterior transverse walls, are an extreme seismic hazard. However, if masonry is properly reinforced it can be used in seismic-resistant construction.

California passed the URM law in 1986 requiring local governments in the highest Seismic Zone 4, which includes Marin County, to provide three things:

- Inventory of URM buildings in their jurisdiction,
- Establish loss reduction programs for URM buildings by 1990; and,
- Report progress to the California Seismic Safety Commission.

The law also recommended that local governments:

- Adopt mandatory strengthening programs by ordinance,
- Establish seismic retrofit standards; and,
- Enact measures to reduce the number of occupants in URM buildings.

The Seismic Safety Commission (2005) reports a total inventory of 118 unreinforced masonry buildings in Marin County and cities within the County boundaries (Table 6). Table 6 shows the number of URMSs for each jurisdiction that satisfy retrofitting in accordance with the 1997 Uniform Code for Building Conservation (UCBC) and those that satisfy requirements in jurisdiction programs. The Building Department for Marin County reported only one unreinforced masonry building in Marin County and that it has been retrofitted (personal communication, Steve Jensen, 2001).

Table 6. URM Inventories within Marin County

Jurisdictions	Inventory Completed	URM's	Mitigation Program Established	UCBC Compliance	Compliance with Jurisdication Program	Partial Compliance/Under Construction	Type of Loss Reduction Program
Belvedere	Yes	0	N/A	N/A	N/A	N/A	N/A
Corte Madera	Yes	3	Yes	/	/	/	Notification Only
Fairfax	Yes	4	Yes	/	4	/	Voluntary Strengthening
Larkspur	Yes	12	Yes	5	5	/	Mandatory Strengthening
Marin County	Yes	1	Yes	/	1	/	Order to strengthen or demolish
Mill Valley	Yes	18	Yes	23	23	1	Mandatory Strengthening
Novato	Yes	1	No	1	/	/	Owner Notified
Ross	Yes	1	Yes	1	/	/	Mandatory Strengthening
San Anselmo	Yes	21	Yes	21	/	/	Mandatory Strengthening
San Rafael	Yes	44	Yes	/	44	/	Partial Mandatory Strengthening
Sausalito	Yes	12	No	1	11	/	Compliance with Jurisdiction Program
Tiburon	Yes	1	No	/	1	/	Compliance with Jurisdiction Program

3. Concrete Structures

Concrete is a relatively heavy material and it has a low tensile strength. It is usually reinforced with steel and when done properly reinforced concrete can be used in seismic-resistant construction. It is very important that beam/column connections be designed, detailed and constructed with the proper amount and type of reinforcing steel to provide ductility. If not constructed properly, drastic failure of a structure may occur during earthquake ground shaking.

Common types of damage during earthquakes include shearing of concrete columns that results from the lack of adequate steel reinforcement and severe cracking of concrete walls, which is common in older, lightly reinforced structures. Multi-story concrete frame buildings built from the 1950s to early 1970s often have inadequate reinforcing in their columns. Consequently, these buildings have the potential for a pancake type collapse (CSSC, 1999).

4. Steel Structures

The strength, ductility and toughness per unit weight are significantly higher than concrete and masonry materials. This makes it a useful construction material. However, because of its high strength per unit weight, the slenderness of steel structural members could result in failure during seismic shaking. Buckling failure of steel members is a common phenomenon during earthquake shaking. Another issue

in steel design is the connection of the structural member, the most common being welds. If steel members are not connected properly to each other then failure may occur. For an effective seismic-resistant design, it is imperative that the compactness requirements for the cross section of the critical regions of steel structural members be greater than those that would be used in a design for normal (non-seismic) loading conditions and the design of connections should take into account seismic loading conditions. The steel frames should be designed with strong column beams such that the ultimate failure mode would be in beams yielding and not columns.

5. Light-Gauge Steel Structures

Light gauge steel is also a very good material for low rise buildings and is now being used exclusively in may new housing tracts in the southwest and midwest. It is lighter than wood, it will not dry rot, it is insect proof, it is noncombustible and because it is a manufactured item made to strict tolerances, framing members remain true when assembled. This eliminates the problems associated with wood products that undergo distortion and volumetric changes that affect finish materials such as drywall and plaster.

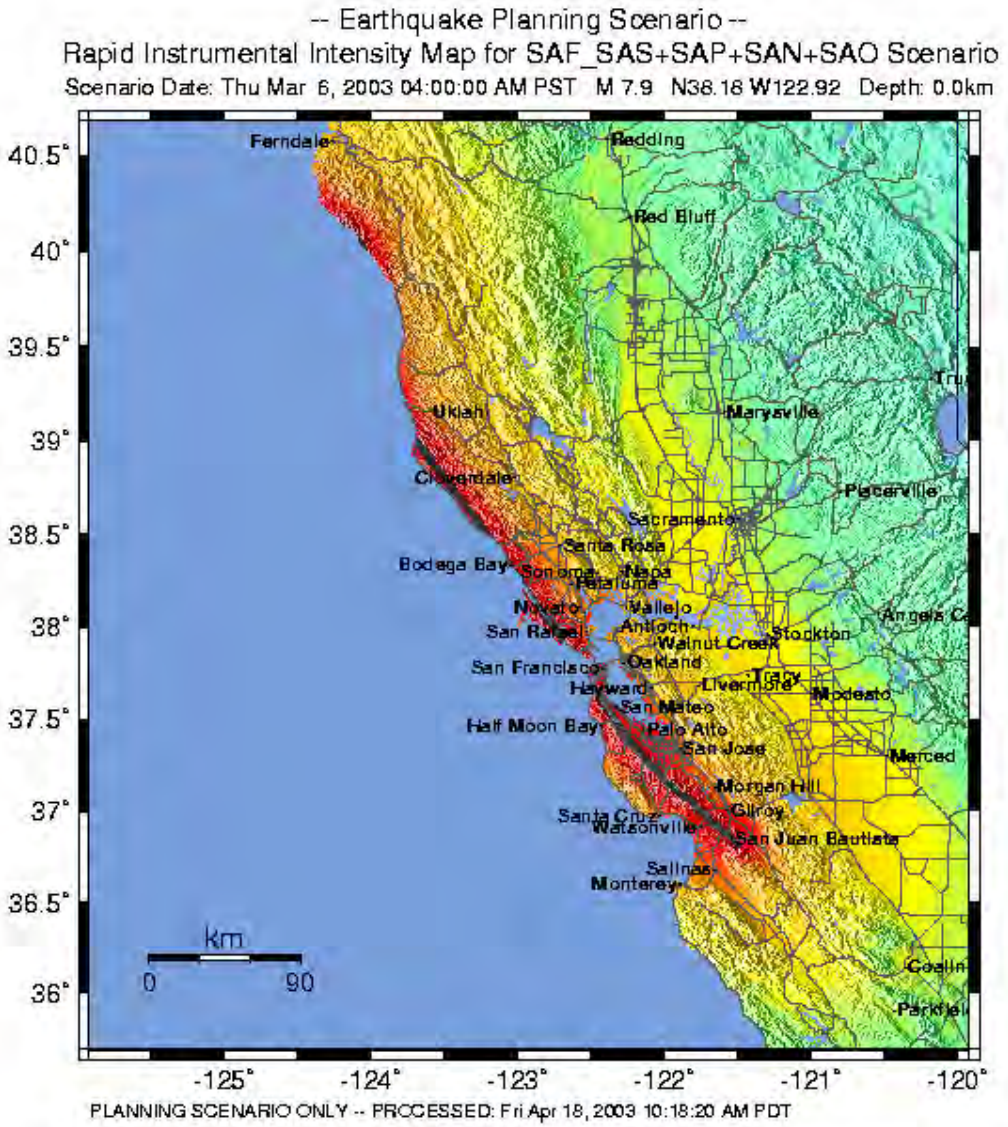
The assembly is similar to wood framing except the members are connected with self-drilling, self-threading screws instead of nails. The lateral strength is developed similarly with plywood diaphragms and shear walls, but may also be strengthened with diagonal steel straps. As with steel structures discussed previously, if members are not connected properly to each other then failure may occur.

Structural Damage Based on Scenario Earthquakes

As discussed in the Fault and Hazards Section of this report several active faults are present in the Bay Region. The degree of shaking varies depending on the magnitude and distance from Marin County of an earthquake event. The following table lists the predicted uninhabitable units for Main County due to rupture of specific earthquake scenarios. The bold entries are those earthquake scenario events shown in Exhibits 7 and 8.

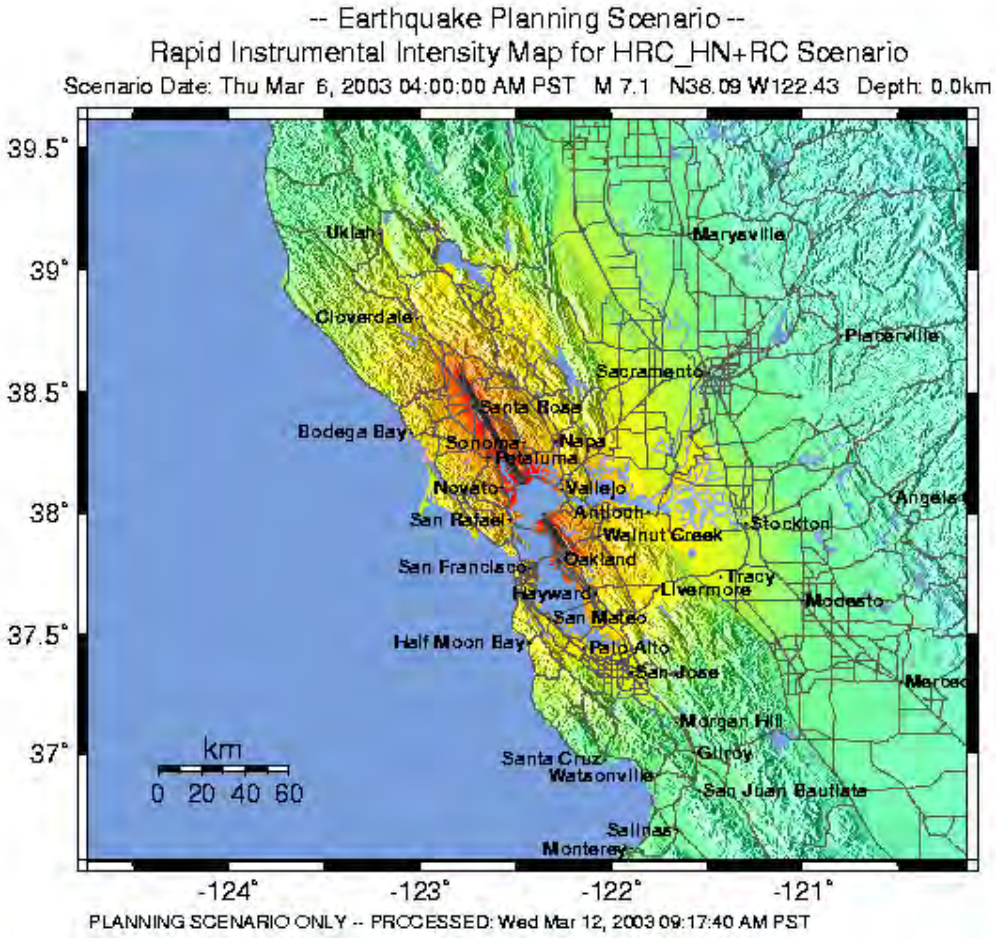
Table 7 is based on Association of Bay Area Government (ABAG)'s modeling of uninhabitable housing units in future earthquake scenarios. This modeling is based on an extensive statistical analysis of the housing damage which occurred as a result of the 1989 Loma Prieta and 1994 Northridge earthquakes. However, the expected percentage of pre-1940 single-family homes rendered uninhabitable used to generate this table is larger than published in 1996. New data on lack of retrofitting and reasons for low damage in the Northridge earthquake cause ABAG to increase the uninhabitable percentages used to create this table for pre-1940 single-family homes to 19% and 25% for MMI IX and X, respectively. The earthquake fault segments listed are based on the ground shaking information published by the USGS in 2003 (ABAG, 2003).

Exhibit 10.
Scenario Earthquake and Potential Groundshaking of a Repeat of the 1906 Earthquake



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Exhibit 11.
Scenario Earthquake and Potential Groundshaking of Rupture on the North Hayward-Rodgers Creek Faults



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Table 7.
Predicted Uninhabitable Units in Marin County and Selected Earthquake Scenarios

Earthquake Scenario	Predicted Number of Uninhabitable Units Following Earthquake event
Santa Cruz Mountains San Andreas	297
Peninsula-Golden Gate San Andreas	1,485
Northern Golden Gate San Andreas	2,988
Entire Bay Area San Andreas	**3,495**
Northern San Gregorio	1,176
South Hayward	1,030
North Hayward	1,653
North and South Hayward	2,125
Rodgers Creek	1,549
Rodgers Creek – North Hayward	**2,691**
South Mayacama	27
West Napa	27
Concord - Green Valley	29
North Calaveras	27
Central Calaveras	27
Mt. Diablo	751
Greenville	27
Monte Vista	16

B. SUMMARY AND ISSUES TO CONSIDER

The following is from the "Existing Buildings Element" and the "New Buildings Element" of the CSSC draft (July 27, 2001) of their "California Earthquake Loss Reduction Plan 2002-2006 (CSSC, 2002):

> "Many existing buildings, including homes, are vulnerable to damage or collapse from earthquakes. Most seismic retrofit projects to date have focused appropriately on life safety and have not significantly reduced the potential loss to property, personal disruption, and productivity. Continuing occurrence of earthquake damage to older and recently constructed buildings clearly demonstrates the need for heightened awareness of the benefit of increased performance levels beyond that of life safety;"
>
> "Earthquake protection of new buildings based on providing life-safety and collapse resistant structures has been reasonably successful in moderate earthquakes. Protection of property and economic loss control has not received as much emphasis and is not yet as successful. As a result, property and economic loss due to earthquake damage to recently completed buildings and contents has been unacceptable. Losses have been due to: 1) limited knowledge of the performance of materials and systems; 2) lack of a complete approach to seismic design including all elements of buildings and their contents; and 3)

> inadequate quality control of design construction. The damage from recent earthquakes clearly demonstrates the need for continued improvement in these three areas to achieve cost-effective seismic performance of new construction."

These two paragraphs provide a summary of the structural hazards due to earthquakes that are present in the State of California and in Marin County and they demonstrate the need for continued reduction of the vulnerability of structures to seismic hazards. The following is a list of structural hazard issues to consider in development of new policies that address this specific issue:

- Many of the buildings throughout Marin County, both existing and new are most likely vulnerable to damage caused by ground shaking and other geologic hazards and could be potentially hazardous.
- The hazard from unreinforced masonry buildings (URM's) has reportedly been mitigated in unincorporated Marin County. However, hazard reduction through retrofitting or removal of some URM buildings under the jurisdiction of local cities and towns in the County has not been conducted.
- As an example of other potentially hazardous buildings: Older concrete tilt-up buildings, constructed without embedded steel ties to roof framing members other than the plywood perimeter nailing to wood ledgers, are also hazards. The walls pull away from the roof diaphragm during moderate to large seismic events. The purlins and rafters are pulled out of their hangers and the roof can collapse at the perimeter bearing walls. Tilt-up buildings permitted prior to 1975 may not have positive steel hardware tying concrete walls to purlins, rafters and girders and should be retrofitted. Retrofitting can be implemented by adopting a mandatory strengthening program by ordinance for these structures.
- Several strategies considered by the CSSC (2002), could be effectively applied in Marin County to reduce the vulnerability of existing and new structures to seismic hazards, and are listed below.
- Providing incentives to retrofitting structural and nonstructural elements of existing buildings in accordance with standards that improve seismic performance.
- Initiate educational efforts for those involved in the retrofit design and construction process about the benefit of retrofitting existing buildings for improved performance including basic structures, non structural components, and operational elements.
- Develop reliable and practical methodologies and codes for minimum prescriptive retrofit standards; and enhanced performance-based retrofit standards for the structural and non-structural elements of all types of existing buildings.
- Upgrade seismically vulnerable buildings by establishing an effective risk reduction program. Buildings providing essential services, schools and hospitals and those buildings located in geologically hazardous areas may be considered first in developing the prioritizing process of a risk reduction program.
- New construction should conform to state-of-the-art seismic safety provisions and state-of-the-art model building codes and amendments in order to reduce vulnerability.
- The design of new structures should be based on an intergrated approach considering all elements of construction (structural and nonstructural) that contribute to seismic performance. Design should also consider the many potential geologic hazards that may be present at a specific location.
- Policies EH-5.1, EH-5.2, EH-5.3, EH-5.4, and their supporting programs address some of the issues discussed above and are still applicable policies toward reducing structural hazards in the County. Some refinements to these policies should be considered. Program EH-5.3b, which deals with URM's, has been effective in reducing this hazard in unincorporated county areas and similar

programs addressing other potentially hazardous structures (e.g. older tilt-up buildings) would be useful for reducing structural hazards.

XI. MINERAL RESOURCES

A. INTRODUCTION

The State Mining and Reclamation Act of 1975 requires that the County adopt policies to protect certain State-designated mineral resource sites from land uses which preclude or inhibit mineral extraction needed for satisfying local market demand on a timely basis. The purpose of the Act is to ensure that construction materials will be available to all areas of the State at a reasonable cost. Eight sites in Marin County have been "designated" by the California State Department of Conservation Division of Mines and Geology as having significant mineral resources for the North Bay region. Sites were designated which contained deposits that were l) suitable as marketable commodities, and 2) meeting a threshold value defined as a gross selling price of at least $5 million in 1978 dollars.

B. POTENTIAL MINERAL RESOURCE SITES

Of the eight mineral resource sites designated in Marin County, two no longer meet the minimum threshold requirements and are exempt from application of mineral resource policies. Of the remaining six sites, four are located within incorporated areas. The State has designated one of the resource sites, Ring Mountain, as a scientific resource zone and 300 acres have been preserved as open space.

The North San Francisco Bay Production-Consumption Region includes Sonoma, Marin and Napa Counties. The Region is dependant upon both crushed stone and alluvial deposits for construction, in particular asphaltic concrete, aggregate, road base or subbase materials and Portland Cement Concrete. Total aggregate consumption through the year 2030 is estimated to 478 million tons for the North Bay region based on consumption records and population estimates from the past 28 years.

Ring Mountain is considered to be a Scientific Resource Zone (SZ) rather than a production site due to the rare geologic formations found there. Seven other sites in Marin County have been identified as Mineral Resource Zone Class 2 or MRZ-2. The eight sites include:

1. Ring Mountain, Tiburon

This 190-acre site is located at the base of the Tiburon Peninsula and would be precluded from further development as a result of these policies. It contains rare, colorful and enigmatic metamorphic rock as well as many species of rare plants. This preserve is the type location for the mineral Lawsonite. Lawsonite was named in honor of Professor Andrew Lawson of the University of California. Lawsonite is known for its hardness and is a mineral of the glaucophane schist facies associated with chlorite, epidote, sphene, glaucophane, garnet, and quartz. It is formed under low temperature and high pressure. One of the mineral resource sites (near Pt. Reyes) is located in the unincorporated county and subject to the policies of this plan.

2. (Sector D-1) Novato Conglomerate-Black Point

This site is located within the city limits of Novato and is an alluvial resource, which contains a thick accumulation of well-rounded pebbles, cobbles and boulders in a well-cemented sandy matrix. This material has been found to be suitable for the use of Portland Concrete Cement. It is calculated that this deposit could potentially yield 18.47 million tons of material. The high degree of weathering in the deposit has required a thorough washing of the aggregate. Field geologic mapping indicates that this mineral deposit is relatively evenly distributed over the subject area. This deposit is primarily urbanized except for outcroppings located to each distal edge. This sector would be subject to mineral resource policies adopted into the Novato General Plan only.

3. (Sector D-2) Novato Conglomerate-Black Point

This site is located at the Renaissance Faire/Living History Centre and was once quarried for the conglomerate it contains. The material in this sector is a similar alluvial deposit as in Sector D-1. This supply is estimated to have the potential yield of 10.64 million tons. It is also subject to mineral resource policies adopted into the Novato General Plan only.

4. (Sector I) Franciscan Complex Sandstone – San Pedro Hill

This site is located at the tip of the San Pedro Peninsula just outside San Rafael City limits and has been mined since the turn of the century. The site has yielded crushed stone suitable for Portland Cement Concrete aggregate and rip rap. Shale deposits are also present and these materials have been developed by several quarries throughout the years to supply bricks, tile and lightweight aggregate. A reclamation plan was filed in 1976 and amended in 1982. San Rafael's policies for the reclamation of the site are expressed in the City's Peacock Gap Neighborhood Plan.

5. (Sector J) Sonoma Volcanics Andesite – Burdell Mountain

This 50-acre site is located on the east side of Mount Burdell and contains a large block of andesite, which occurs within landslide debris. Crushed rock from this mass has been shown to be suitable for asphaltic concrete aggregate or road base material. The presence of sufficient andesite was disputed by the owner, Mt. Burdell Partners, who presented a study by a qualified geologist confirming that most of this material had already been extracted over a 20-year period ending in 1977. After considering this testimony, the Planning Commission has recommended that this site be exempted from the application of Mineral Resource Preservation Policies.

6. (Sector L) Franciscan Complex – Borello Quarry

This site is located 3.5 miles north of Point Reyes Station and contains sandstone, shale, greenstone, chert and pillow lavas. Greenstone and pillow lavas are mined and sold for road base material and drain rock.

7. (Sector M) Franciscan Complex Serpentinite – Ghilotti Quarry

Located on the southwest slope of Burdell Mountain and 3 miles northwest of downtown Novato, this site contains serpentinite, dark green to grayish-green in color, suitable for subbase material after crushing. The State Division of Mines and Geology confirmed in their letter of April 20, 1988, that this site no longer contains sufficient mineral deposits to meet the minimum to be designated as a regionally

significant deposit. The Board of Supervisors has therefore, exempted this site from the application of Mineral Resource Preservation Policies.

8. (Sector V) Sonoma Volcanics Andesite – Burdell Mountain Open Space Preserve

Adjacent to Sector J., this site also contains hard, dense andesite suitable for asphaltic concrete aggregate. It is owned by the Marin County Open Space District and located within Novato city limits. It is a management policy of the District to prohibit the collection or exploitation of minerals from its lands, as these activities are incompatible with the Open Space use of the land.

C. ADDITIONAL POLICY DISCUSSION

The policy framework recommended in a previous technical report (*Environmental Quality Element Technical Report #2 Mining Resource Preservation in Marin*) for general plan amendment serves to protect the above listed mineral resource sites from untimely development and incompatible land uses while ensuring that all mining operations provide adequate reclamation plans. Implementation measures would apply a new overlay zone "Designated Mineral Resource" to the identified sites in unincorporated Marin County.

The overlay zone would prohibit any temporary or permanent land uses, which would preclude eventual extraction of the mineral resource and would require the creation of buffer land uses between the potential extraction areas and surrounding areas. Notice would be recorded on property titles identifying the presence of important mineral resources. Implementation would also include amendments to Chapter 23.06 of the Marin County Code to require quarry permit applications to report how nuisances, hazards and adverse environmental impacts created by the mining operation would be mitigated including the protection of wetlands and the reduction of negative visual impacts. All new quarry permit applications would be subject to an Initial Study to determine if an Environmental Impact Report should be required.

Once a site is mined and satisfactory evidence is presented to the Planning Department that it no longer contains the threshold amount of mineral resource, the County shall institute action to remove the site from the application of its Mineral Resource Preservation Policies.

D. SUMMARY AND ISSUES TO CONSIDER

- There are six potential mineral resource sites in the County. Four of these sites are located in unincorporated Marin County.
- Two sites were “designated” as having significant mineral resources, but are now exempt from application of mineral resource policies.
- The current County policies and associated programs regarding mineral resource areas are still applicable (Policies EQ-2.81, EQ-2.82, EQ-2.83, EQ-2.84, EQ-2.85, EQ-2.86).

XII. HAZARDOUS MATERIALS

A. Introduction

Environmental hazards are not the only public safety risk in Marin County. Man-made safety risks have resulted from the use and disposal of hazardous materials. These man-made conditions can be encroached upon by development, and conditions that are otherwise secure, can become destabilized by environmental hazards such as geologic, seismic, flood and fire hazards.

Within Marin County's Department of Public Works is the Certified Unified Program Agency (CUPA). CUPA was established to provide a unified hazardous waste and hazardous materials management program. This program deals with most of the day-to-day programs required to protect the public from unsafe use practices and provide a coordinated emergency response in the case of an accidental release.

This section of the technical background report gives a brief overview of hazardous materials relative to planning issues in Marin County. It also emphasizes their management based on the greatest potential for impact on land development within Marin County. The greatest potential for impact is:

- Development encroachment on exiting sites, and
- Releases of hazardous materials caused by environmental hazards.

1. Relationship to other County Wide Plan Elements

The nature of hazardous materials and increased public concerns about them has made them one of the most intensely scrutinized and highly regulated classes of materials in California. Because of this, they are relevant to many sections of the Marin Countywide Plan.

The discussion of hazardous materials is relevant to other Marin Countywide Plan Elements that address hazardous materials issues in the following manners:

- Community Facilities Element: Discusses the urban wastewater services and rural septic system issues.
- Environmental Hazards Element: Discusses hazards that can trigger hazardous material releases.
- Environmental Quality Element: Discusses the concept of different environmental corridors and resource conservation areas. Resources most relevant to accidental hazardous material releases in Marin County are the air and surface waters.
- Transportation Element: Discusses the movement of hazardous materials.
- Agriculture Element: Discusses livestock and farm management issues.

2. Excluded Hazards

Other public safety issues relating to hazardous materials do exist, but are not covered in this technical background report. This report does not discuss the planning issues related to nuclear radiation or military ordinance, which come under federal regulation. Site-specific hazards such as asbestos, lead paint or biohazards are not relevant to planning issues. Those seeking information on site-specific hazards should contact the appropriate County office.

B. Background

1. Introduction To Hazardous Materials And Wastes

Reflected in Marin County's lifestyle and local economy are the types and quantities of materials found there. The benefits of a modern industrialized County are significant, but with this benefit come the responsibility of proper management of some substances that can cause health, safety, and environmental impacts.

a. Hazardous materials defined

Presently, the U. S. Environmental Protection Agency (USEPA) tracks approximately 75,000 named industrial chemicals used in the United States (USEPA, 1999). A hazardous material is defined in Marin County's Hazardous Waste Management Plan (HWMP) as: "A substance or combination of substances which, because of its quantity, concentration, or physical, chemical or infectious characteristics, may either:

- Cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
- Pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported or disposed of or otherwise managed." (Marin County, 1988)

A hazardous material becomes a hazardous waste when either of the following occurs:

- The material has been used for its original intended purpose, and
- When there is no use or intended use for the material and it is to be discarded.

A non-hazardous substance can become a hazardous waste if during its normal use it comes to meet the definition of a hazardous material or hazardous substance. Hazardous substances are substances that have been designated in government codes and regulations or that exhibit certain characteristics such as being toxic, corrosive, flammable, reactive, or explosive. Thus, there can be more hazardous waste generated in an area than there are hazardous materials consumed.

Since hazardous wastes and hazardous substances fit the definition of being a hazardous material, the broader term hazardous material will be used throughout this technical background report.

b. Waste streams

Because people continue to recognize additional interrelationships between society and the earth's four environmental spheres, new wastes and waste streams will also continue to be identified (CIWMB, 2001).

Recently the federal and state authorities have formally recognized a new waste stream by creating the "Universal Waste" designation. Universal Wastes are "lower risk hazardous wastes that are generated by a wide variety of people rather than the industrial businesses" (CalEPA, 2000). As an example of societies increasing recognition of environmental interrelationships, California Environmental Protection Agency, Department of Toxic Substances Control recently designated cathode ray tubes (CRTs – television and computer monitor screens) as a universal waste because they can contain between 2 and 5 pounds of the toxic element lead (CalEPA, 2001). This lead, which is particularly

harmful to young children, could potentially contaminate soil and groundwater if CRTs are disposed of in a municipal landfill.

Additionally, unexpected wastes, waste streams, or consequences should be expected to result from new industries or industrial processes. A recent example of this has been the contamination of groundwater wells from the relatively recent introduction of metratetrabutylether (MTBE) as a gasoline additive.

C. LEGISLATION AND REGULATION OVERVIEW

Industry, agriculture, and even household activities have contributed to the amount of hazardous materials present everyday in Marin County. Because of the vastness of their use and the range in their physical properties, there is no one organization that can create a "one size fits all" set of regulations. As the volume of hazardous materials increased, actual damages caused by them increased as well as the public's recognition of their potential hazards. This increase in public concern about hazardous materials leads to a desire for tighter controls.

The result has been the formation of a complex web of law, code, policies, rules and regulations that has created many overlapping jurisdictions. Additionally, much of the hazardous materials regulations are indirect, being contained in laws and programs addressing other issues.

Presently, most hazardous materials regulations originate at the State and Federal level, with local County and City agencies enforcing these regulations. The State and Federal level provides a consistent level of control, while the use of County or City agencies allows for more effective enforcement since they better understand the local conditions.

This summary is not intended to be a complete review of the existing hazardous materials regulations. It presents some of the more common agencies and regulations.

1. Federal Agencies and Legislation

The USEPA is the federal agency designated to oversee hazardous materials. The USEPA derives legal basis through more than a dozen major statues and laws (USEPA, 2001). Several of the policies relevant to hazardous materials are:

- Toxic Substances Control Act (TSCA) of 1976 (15 U.S.C. s/s 2601 et seq.): This gives the USEPA the ability to screen, track and control chemicals as necessary to protect public safety and the environment.
- Resource Conservation and Recovery Act (RCRA) of 1976 (42 U.S.C s/s 6901 et seq.). This act gives the USEPA authority to regulate all aspects of hazardous waste including generation, transportation, treatment, storage and disposal ("cradle-to-grave"). The disposal section of this act deals only with active and future disposal sites.
- The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) created broad federal authority to respond directly to hazardous materials releases or threatened releases that would affect public safety. Commonly known as Superfund, it establishes hazardous waste site closure standards, creates liability for waste site operators and uses a trust fund to clean up abandoned sites.

- The Superfund Amendments and Reauthorization Act (SARA) amended CERCLA in 1986. SARA extended the life of CERCLA and made revisions that allows CERCLA to better meet its goals.
- Emergency Planning and Community Right-to-Know Act (EPCRA) is a part of SARA. It is designed as a national legislation to help local communities protect public safety and the environment from hazardous substances.

2. State Agencies and Legislation

The California Environmental Protections Agency (Cal/EPA) was created in 1991. It acts as a centralized environmental concerns (umbrella) agency for six environmentally related boards and agencies created in the State of California (Cal/EPA, 2003). These agencies and their duties include:

- The Air Resources Board (ARB) is responsible for reducing air pollution in the state.
- The Department of Pesticide Regulation (DPR) protects human health and the environment by regulating pesticide sales and use and fostering reduced-risk pest management. DPR's strict oversight includes product evaluation and registration, environmental monitoring, residue testing of fresh produce, and local use enforcement through the County agricultural commissioners (DPR, 2003).
- The Department of Toxic Substances Control (DTSC) regulates those who produce, transport or store toxic substances including hazardous waste facilities (DTSC, 2003). Through its Hazardous Waste Management Program, DTSC implements the Federal RCRA regulations. Through DTSC's Hazardous Waste Facility Permits, it implements a five-tiered permitting program. This program "matches the statutory/regulatory requirements imposed upon each category of hazardous waste facility to the degree of risk posed by them" (DTCS, 1998). The DTSC's permitting process includes all RCRA wastes and some non-RCRA wastes added by the state of California.
- The California Integrated Waste Management Board (CIWMB) is responsible for managing the state's solid waste. CIWMB "works in partnership with local government, industry, and the public to reduce waste disposal and ensure environmentally safe landfills" (CIWMB, 2001).
- The State Water Resources Control Board (SWRCB) protects all water resources in California (SWRCB, 2000). The SWRCB is organized into nine Regional Water Quality Control Boards (RWQCB) that perform the actual protection through the use of region specific plans.
- The Office of Environmental Health Hazard Assessment (OEHHA) works to protect public health and the environment by objectively using "scientific evaluation of risks posed by hazardous substances" (OEHHA, 1999).

3. Marin County

Regulation and enforcement of hazardous materials in Marin County fall primarily under the Department of Public Works and the Community Development agency. The Certified Unified Program Agency (CUPA) and Waste Management are within the Department of Public Works while Environmental Health is within the Community Development Agency.

- CUPA consolidates, coordinates and makes consistent" portions of six existing programs pertinent to hazardous substances (Marin County CUPA, 2004). CUPA is the local agency that "regulates, inspects and permits over 500 Marin businesses" (Marin County CUPA, 2004). Emergency response, as coordinated with the State Office of Emergency Services (OES), is also included under CUPA.

- The Waste Management division administers solid waste franchises and provides staff for the regional waste agency. This regional waste agency, The Marin County Solid and Hazardous Waste Joint Powers Authority (JPA), was created to reduce landfill disposal and encourage recycling. JPA also develops and implements Marin County's Regional Integrated Waste Management Plan.
- The Department of Public Works also administers Marin County's Hazardous Waste Management Plan (HWMP), which shoulders the responsibility for managing hazardous wastes in accordance with legislated regulations (Marin County, 1988). The HWMP focuses on regulating hazardous wastes by permitting, enforcement, and the unified program activities to assure the safe storage, treatment, transportation and disposal of hazardous wastes. The HWMP also provides for the management of hazardous wastes through waste reduction, siting criteria, and projected handling need policies and programs.
- Environmental Health Services (EHS) protects the public health through a series of programs designed to control hazardous materials and other risks (Marin County EHS, 2005). The Solid Waste Program has been certified by the CIWMB as Local Enforcement Agency (LEA) for Marin County. EHS's LEA certification allows it to permit, inspect, and enforce regulations at solid waste disposal sites, transformation stations, transfer and processing stations, and material recovery facilities. EHS also oversees septic systems and medical wastes within the county.

4. Future Trends

In recent years, the State of California has attempted to reduce overlap and redundancy within the hazardous materials regulations and enforcement efforts. Since the formation of Cal/EPA, the State has made improvements in protecting the public health and environment while maintaining the State's economic vitality. The creation of a simplified tiered permitting processes and allowing health based risk analysis signal that the improvements will continue. Cal/EPA has formed CalGOLD, an online permitting assistance providing businesses the information they need to comply with environmental and other regulatory and permitting requirements (CalGold, 2005). The formation of OEHHA will likely allow the widespread determination of site-specific health based risk analysis cleanup standards, rather than using the broad and necessarily conservative regulation standards.

D. PRESENT CONDITIONS IN MARIN COUNTY

1. Summary of Existing Conditions

This section summarizes existing Marin County conditions in terms of their potential for impact on planning.

One of the goals of the Marin County Board of Supervisors has been to retain clean business and industry (Marin County, 2001). Coupled with the existing hazardous materials policies of other agencies, the result is that there are relatively few serious hazardous materials issues present in the county. Marin County has also begun to reduce overlap and redundancy in its hazardous materials regulations and enforcement similar to the State by creating CUPA. Therefore, the threat of serious hazardous materials impacts are minimal, but several planning issues still exist.

2. Summary of Existing Hazardous Materials Sites

This summary is not intended to be a complete list of every site relevant to this section of the technical background report. If interested, the reader can consult the local agency or division for additional information.

a. Solid Waste

Information provided by County and State agencies indicated that there are approximately 20 known solid waste sites in Marin County. Planning should expect this number to increase as described below. A list of known sites is available from the Integrated Waste Management Board at their website: http://www.ciwmb.ca.gov/SWIS/.

Presently, there are two active solid waste landfills, two active composting facilities and one active large volume transfer and processing facility.

There is one known inactive solid waste disposal sites The remaining sites are closed solid waste sites. Two of the closed sites were used as burn dump facilities and at least three appear to have been encroached upon by development (Janofsky, 2001). A query of the USEPA's Superfund database returned three sites listed as active Superfund sites (USEPA, 2005).

Due to its rural and agricultural nature, unknown sites will most likely be identified in Marin County's future. These sites will be identified as urban development occurs in rural and agricultural areas, as sites abandoned long before the introduction of solid waste regulations are encountered during construction. It is expected that these new sites will be small private family and farm sites.

b. Hazardous Wastes and Materials Use

The vast majority of Marin County's hazardous waste is produced by "small quantity generators" which are defined as solid quantities of less than 500 pounds or liquid quantities of less than 55 gallons of any one type or a total aggregate amount of 275 gallons (Unidocs, 2002). These wastes are "primarily generated by the businesses in the retail, manufacturing and services sectors" with waste oil being the primary constituent (Marin County, 1988).

Marin County's CUPA currently regulates, inspects and permits over 500 Marin County businesses (Marin County CUPA, 2004). These businesses have been identified based on their hazardous material registration forms and hazardous materials business plans (HMBP). A list of business sites with HMBPs can be obtained from Marin County Department of Public Works, Certified Unified Program Agency.

Relevant classifications for businesses on this list include those:

- With underground storage tanks (USTs),
- With above ground storage tanks (ASTs),
- In the Accidental Release Program (Cal/ARP),
- Required to complete a HMBP,
- That generate hazardous waste and/or
- Required to complete a tiered permit.

c. Rural Issues

Approximately 40% of Marin County is in agricultural use with dairy farming being the major activity (Marin Count, 1994). Hazardous materials issues related to agriculture include:

- nuisance items such as odors and noise, and

- health hazards such as impacted soil, surface water, groundwater, vector control, and dust suppression.
- Locations of abandoned and existing aboveground diesel tanks for fueling farm vehicles.

Although three small municipal sewer systems are present, most homes and communities with in rural west Marin County rely on private water wells and septic systems (Marin County, 1994). Failure of septic systems can pollute the soil and groundwater. Although extremely limited, the possibility exists that private homes could also have heating oil USTs present in rural areas.

3. Types Of Hazardous Material Threats

a. Types of impacts

The types of impacts created in Marin County by hazardous materials are public health concerns and a degraded environment.

Public health in Marin County can be threatened by hazardous materials in two ways:

- By long term exposure to a contaminated medium, and
- By releases of highly mobile hazardous materials to highly mobile mediums. Called secondary disasters, these events can be triggered by hazardous material releases caused by accidents and natural disasters within or adjacent to Marin County.

When hazardous materials have previously degraded Marin County's environment, it has often been the result of a long-term condition resulting from the improper use, storage or disposal of these materials. Most of these past conditions have been identified and mitigated by the present regulations.

b. Impacted mediums

Based on the hazardous materials present in Marin County, they could be released as gases, liquids and/or solids. Depending on how they are released, hazardous materials could affect the following mediums:

- The air,
- Surface waters such as streams, lakes, and the bay,
- Groundwater and watersheds, and
- The soil.

These impacted mediums could degrade the natural resource of Marin County and affect the County's public health.

c. Area of impact and degree of planning importance

The area impacted by a hazardous material release in Marin County would depend on many controlling factors. Most important of these are the quantity and toxicity of the material released and the medium that has been impacted.

Most of the hazardous materials present in the County are in small quantities and of relatively low toxicity. The environment is able to rebound rather quickly and threats to public health are often easily mitigated from impacts associated with these types of releases.

The impacted media also greatly influences the area of impact. Air is the most vulnerable media in Marin County. Hazardous materials released into the air will result in rapid movement of the material, with rates being measured in minutes and hours. However, for small amounts, these releases typically dissipate rapidly resulting in relatively small area being impacted.

The spreading rate of hazardous materials released to Marin County's surface and ground waters depends on if the material dissolves in (mixes with) the water or remains in its "pure" form and flows on the surface. Dissolved materials move at about the same rate as the water. Immiscible liquids (liquid materials that slowly dissolve in water) will spread out on the water surface at a rate dependant upon their viscosity and the surface's slope. Surface water and immiscible liquid movements will also be measured in terms of minutes and hours, however groundwater movement is typically measured in terms of days to millennium. Releases to surface waters would produce the second most critical situation of a hazardous materials release in Marin County, especially in remote rural areas.

Since soils are a solid, they are essentially immobile. However, if the hazardous material can be transported by another medium, then the impacted area can be larger. Both air and water do penetrate Marin County's soil and thus could enlarge the area of impact. Releases to soil are considered to have minimal impact on Marin County in terms of planning except for large releases and waste disposal sites.

d. General examples relevant to planning

Hazardous materials releases are relevant to planning issues because of their threat to public health and the environment. Examples of some releases spreading in different mediums and ecosystems present within Marin County include:

- A gaseous hazardous material is released to the atmosphere, mixes with the air and drifts down wind from the release site.
- A hazardous material is released to a surface water body. This material spreads out on the surface and is also carried along as the water flows. This material can also dissolve in and contaminate the water, spreading beyond the visibly impacted area as the water flows.
- An immiscible liquid hazardous material (such as gasoline) is released to the soil. It flows downward under the influence of gravity until it reaches the groundwater. At the groundwater surface it begins to spread laterally and begins slowly dissolving in the groundwater. If this liquid is volatile (evaporates quickly and easily), it can also evaporate into the soil atmosphere and contaminate it.
- A hazardous material is released to a soil surface. It can spread as wind blown dust and by tracking on people, animals and equipment. Water can flow across the contaminated soil spreading it out on the surface and washing it into stream channels and surface water bodies.
- A hazardous material is buried in the ground. Water percolating through the soil (moving down under the influence of gravity) can leach the hazardous material out of the soil and into the groundwater. Once in the groundwater, the hazardous material can spread laterally with the groundwater as it flows.

- A hazardous material is released to the environment where living organisms absorb or ingest the material. As the organisms become sick or die, other organisms are indirectly impacted by changes to the areas food web.

4. Relationship of Hazardous Material Sites to Marin County's Three Environmental Corridors

The 1973 Marin Countywide Plan established three environmental corridors that were based on the County's natural features and existing land uses (Marin County, 1994). Based on the designated use, each corridor has a predisposition towards certain hazard material uses and their associated risks. These risks should be considered in the planning process.

a. The City-Centered Corridor:

Although most of the land in this corridor lies outside of the jurisdiction of the county, it is adjacent to the county and movement of a hazardous material onto county land is a concern. This corridor is considered most susceptible to public health concerns and environmental degradation caused by long-term conditions and by secondary disasters.

By design, this corridor has the greatest concentration of people and industry in the county. As population density and industrial activities increase, so do the use of hazardous materials. Businesses and activities expected to be present in this corridor would include:

- Industrial manufacturing businesses that use and produce hazardous materials and wastes.
- Fuel storage facilities that use ASTs and USTs for commercial, County, and private vehicles.
- Commercial service business such as automotive service facilities and dry cleaners.
- Retail supply businesses such as hardware, paint, and drug stores.
- The transportation of bulk quantities of hazardous materials by truck, rail, or pipelines.
- Infrastructure support services that use ASTs and USTs for emergency power backup sources.
- Waste treatment and disposal sites.

b. The Inland Rural Corridor

This corridor is considered most susceptible to public health concerns and environmental degradation caused by long-term conditions. However, one of the greatest risks for hazardous materials releases in Marin County is the transportation of these materials. This is especially true of the Rural Inland corridor where response times would be great, sensitive environmental receptors are abundant, and the roads are often narrow and twisty.

Businesses and activities expected to be present in this corridor would include:

- The transportation of bulk quantities of hazardous materials by truck, rail, or pipelines.
- Waste treatment and disposal sites.
- Agricultural farming activities that store and use fertilizers and pesticides.
- Agriculture livestock (dairy farms) and recreational animal (horse stables) activities where large numbers of animals are contained in unlined yards or holding areas.
- Rural residential living that use septic systems and heating oil tanks.
- Rural recreational facilities that use septic systems.

- Recreational facilities that have motorized vehicle use.

Smaller pockets of some businesses found in the City-Centered Corridor could expect to be found in this corridor as well.

c. The Coastal Recreation Corridor

This corridor is most susceptible to public health concerns and environmental degradation caused by long-term conditions.

Business and activities expected to be present in this corridor would include:

- Rural residential living that use septic systems and heating oil tanks.
- Rural recreational facilities that use septic systems.
- Recreational facilities that have motorized vehicle use.

E. ADDITIONAL POLICY DISCUSSION

Hazardous materials and land planning issues in Marin County can be viewed in terms of limiting the threat to public health and safety and protecting the environment. Consideration should be given to the adoption of countywide policies that would promote the following:

1. Reduce the potential for public and natural resource exposure to hazardous materials

The preferred method for reducing exposure to hazardous materials is to reduce the use of these materials. All levels of regulation are pursuing this method wherever possible. Development plans should support the existing regulations prepared by other entities.

Screening of rural areas prior to development for abandoned waste sites and other potential hazards is a second way to reduce the potential for public and natural resource exposure to hazardous materials.

2. Reduce the potential for public exposure to hazardous material releases following emergencies

In the event that a major damaging environmental hazard triggered one or more hazardous materials releases in Marin County, the coordinated emergency response established by other agencies could be expected to be at or near peak demand. Safety factors could be added at the county level by planning for this situation in cooperation with the adjacent cities by:

- Preventing the use of seismically unsafe buildings for hazardous materials storage or use,
- Promoting compatible development, and
- Monitoring county adjacent projects for the potential for air impacts associated with secondary disasters.

As mixed-use developments become more common, Countywide policies should be considered that would encourage coordination with the cities to prevent placement of hazardous materials near sensitive receptors such as schools, hospitals, high occupancy buildings or nursing homes.

Marin's Countywide Plan should also support existing regulations by other entities and encourage public education of the possible hazards present.

3. Promote Safe Transportation of Hazardous Materials

Since transportation routes are already established, Countywide policies should be considered to prevent placement of sensitive receptors near them. Plans should also support existing regulations, encourage the ability for a coordinated regional response, and encourage public education of possible hazards present.

4. Promote the Safe Use and Storage of Hazardous Substances to Protect the Public and Environment

Countywide policies should be considered to identify hazardous material storage areas in unsuitable buildings. Plans should also support existing regulations, encourage the ability for a coordinated response, and encourage public education of possible hazards present.

5. Encourage Regional Disposal Solutions

Countywide policies should recognize the need for regional disposal solutions following fair share principles. Plans should support Marin County's Regional Integrated Waste Management Plan.

F. Development Scenarios

The following development scenarios involve hazardous materials impacts that could occur within the county. They are presented in the order of the most- to least- likely to occur. They are based on the urban service area concept, which states that the areas within an existing city's sphere of influence will be the most likely to be developed in the immediate future (Marin County, 1994).

Each scenario has been created using a combination of what is currently present and what is a logical future development pattern. The negative impacts of each of these scenarios can be reduced by advanced land planning controls, as presented in the "Development Considerations" section. Some of these controls will involve coordinating planning efforts with the adjacent cities, especially for potential impacts involving the air medium.

1. Solid Waste Site – Closed Site with Encroaching Development

As urban service areas are developed, the potential exists that closed solid waste sites will be encroached upon. The resulting impacts could be significant depending upon the nature of the waste and the planned land use. An unidentified burn dump planned to become a school will require more effort to remediate than an inert construction debris dump becoming a parking lot.

An encroached waste site could be either an identified or unidentified solid waste location. When this occurs, a hazard mitigation plan should be prepared to evaluate and minimize the hazards present. The hazard mitigation plan should be based on what is present in the encroached site. For well-documented sites, the hazard mitigation plan could be developed based on existing information. For sites with little or no information, the contents and the nature of the materials in the site will need to be evaluated before a hazard mitigation plan can be made.

Hazard mitigation plans could include removing the impacted materials, designing engineered controls, or leaving appropriate buffer zones from the encroaching development.

Advanced planning with the Department of Public Works could identify areas where the potential for this type of scenario exists before development begins. Once identified, Planning should work with other departments to assure that the existing requirements are met.

2. Agricultural Impacts – Dairy Farm Site With Encroaching Development

As urban service areas are developed, the potential exists that diary farm sites could be encroached upon. In this case, advance planning should consider nuisance and health hazard issues.

Nuisance issues could include such items as odors and noise. Health hazard issues could include:

- Impacted soil, surface water, and groundwater
- Vector control, and
- Dust suppression.

If nuisance or health hazard issues are present, mitigation efforts should be undertaken.

Advanced planning in the diary agriculture regions of Marin County could identify potential locations where mitigation efforts may be required. The planning should be coordinated with the policies and programs established in the agricultural section of the Countywide Plan.

3. Rural Impacts – Septic System Failures

Most of rural Marin County populations are served by septic tank systems. Contaminates associated with previous Marin County septic system failures include nitrates and microorganisms in the soil and groundwater. As the rural population of Marin County increases, so does the likelihood that there will be failures. Historically, where one system fails, others typically fail too compounding the impacts.

Planning controls can limit the density of such development and work with other agencies to ensure enforcement of existing regulations. Planning can also cautiously encourage the use of alternative wastewater systems. Although there have been significant advances in alternative wastewater systems, they are by nature experimental and lack a long-term record.

4. Secondary Disasters – Seismic Event

Hazardous materials secondary disasters will occur in Marin County at a time of stressed emergency response due to poor communication, distressed roadways, and overloaded care facilities.

RCRA permitted facilities are required to evaluate this as part of their permit but smaller facilities may be exempt from this requirement. However, these facilities can still have a significant impact because of the potential for a cumulative effect from multiple smaller facilities. A release of hazardous material to the highly mobile air media of Marin County would be one of the greatest concerns.

This scenario also has the increased potential for producing releases to soil or water media that would not be immediately addressed. Damaged storage or containment structures in Marin County and

adjacent areas could release hazardous materials in an undetectable manner while emergency response crews were addressing more visible hazards.

Although the prevailing wind patterns would allow some predictability of impact direction, planning controls could ensure that sensitive receptors are not developed adjacent to or in the direction of Marin County's prevailing downwind air patterns. A scenario like this should be considered when planning mixed-use developments and in evaluating the concentrations of hazardous material businesses in county areas adjacent to the City-Centered Corridor.

5. Secondary Disaster – Industrial Fire

Similar to a secondary disaster triggered by an environmental hazard, an industrial fire could release hazardous materials to the highly mobile air media. It too could release hazardous materials in an undetectable manner while emergency response crews were addressing more visible hazards.

Most RCRA permitted facilities are required to evaluate this as part of their permitting process. However, smaller business may not be required.

Although the prevailing wind patterns would allow some predictability of impact direction, planning controls could ensure that sensitive receptors are not developed adjacent to or in the direction of prevailing downwind air patterns. A scenario like this should be considered when planning mixed-use developments and in evaluating the concentrations of hazardous material businesses in a given area.

G. SUMMARY AND ISSUES TO CONSIDER

Hazardous Materials are already one of the most regulated items in Marin County. Business complaints of over regulation are being met by current trends of consolidating hazardous materials regulations into a single coordinating agency such as CUPA wherever possible. However, the huge amount of concern about hazardous materials and their all encompassing use in a modern industrialized society, all but guarantees that a single agency will never be able to address all of the issues related to hazardous materials.

Marin County's greatest concerns relative to planning issues about hazardous materials are:

- Encroachment by development of abandoned waste or agricultural sites, and
- Secondary disasters caused by accidental releases.

As county land in Marin County's 11 cites' sphere of influence and particularly within their Urban Service areas is considered for development, a review for potential development issues should be performed as outlined below.

Hazardous Materials Review Policy

Hazardous materials issues should be identified in the County's planning and development review process. Appropriate modifications and mitigation measures should be required.

The following issues should be reviewed for each proposed development:
- Proximity to known solid waste sites,
- Proximity to known agricultural sites, and:

- Proximity to hazardous materials locations.

Known solid waste sites: As part of the permitting or planning process, the relationship of proposed development to known solid waste sites should be identified. Any potential impacts should be discussed and mitigating plans should be made.

Known agricultural sites: As part of the planning process, the potential impacts of known agricultural sites should be identified and mitigating plans made. Agricultural sites being developed should be reviewed for potential impacts to the soils and waters such as unknown solid waste disposal locations and/or nitrates or microorganisms. Development adjacent to active agricultural sites should review the possibility that nuisance issues could arise such as odors and noise.

Proximity to hazardous materials locations: To reduce the potential for public exposure to hazardous materials County policy should promote compatible development (preventing sensitive receptors from being located near hazardous materials and vice versa), and monitor county adjacent projects for compatible development.

XIII. MARIN COUNTYWIDE PLAN REVIEW

Existing County policies of the 1994 Marin Countywide Plan are reviewed in this section and suggestions are provided for those policies that need refinement.

Table 8.
Evaluation of Existing Countywide Plan Geology, Mineral Resources and Hazardous Materials Policies and Programs

Environmental Quality Element

RESOURCE CONSERVATION AREAS	
1. Stream and Creekside Conservation Areas	
Policy EQ-2.37 Geologic Hazards. Geologic hazards in locations where dams, ponds, and other water impoundments exist or are proposed should be identified in the environmental review process. Appropriate modifications and mitigation measures should be required.	Needs Refinement – Should include a geotechnical investigation as a requirement.
Policy EQ-2.49 Planned District Development Review with Environmental Assessment. The County shall review all proposed development within the Bayfront Conservation Zone in accordance with the planned district review procedure in order to ensure maximum possible habitat restoration and protection. An Environmental Assessment of existing environmental conditions (biologic, geologic, hazard, and aesthetic) shall be required prior to submittal of development plans.	Still Applicable.
Program EQ-2.49a Environmental Assessment of Bayfront Lands. Environmental assessment (biologic, geologic, hazard, and aesthetic) of existing conditions on proposed development sites will be completed prior to preparation of master plans and development plans. These assessments will include recommendations for siting and design that will avoid adverse environmental impacts. When it is not possible to avoid impact, recommendations shall include provisions for minimizing environmental impact. The assessment should serve as a portion of the Environmental Impact Report on the project and recommendations should be incorporated into the project itself. Refer to Program 2.43a for detailed criteria to be used in formulating recommendations for siting and design.	Needs Refinement – Discussion of assessments should include reference to appropriate investigations for siting and design.

Policy EQ-2.61 Consistency with Environmental Hazards Element. Any development proposed for lands within the Bayfront Conservation Zone must be consistent with policies and proposals of the Environmental Hazards Element, including avoidance of areas that pose hazards such as: • differential settlement • slope instability • liquefaction • ground shaking • ground rupture • tsunami, and • other types of ground failures.	Still Applicable.
Policy EQ-2.62 Areas Underlain by Deposits of Bay Muds. Those areas underlain by deposits of "young muds" should be reserved for water-related recreational opportunities, habitat, open space, or limited development subject to approval by the Corps of Engineers and other trustee agencies.	Needs Refinement – Should mention the use of detailed geotechnical investigation for limited development.
Policy EQ-2.63 Sites with Poor Soil Conditions or Seismically Active. Any development (within the watershed areas) proposed for sites that have poor soil conditions for construction or that are seismically active should be designed to minimize: • earth disturbance • erosion • water pollution, and • hazards to public safety.	Needs Refinement – Should indicate the use of proper investigation for determining design parameters and minimizing the listed impacts.
5. **Mineral Resources**	
Policy EQ-2.81 Protection of Designated Mineral Resource Sites. The County shall protect designated sites from temporary or permanent land uses which would preclude or inhibit timely mineral extraction to meet market demand.	Still Applicable.
Program EQ-2.81a Designated Mineral Resource Sites Identified. The County shall assign the label "Designated Mineral Resource" and shall create and map an overlay zoning district for all Sectors designated by the California Division of Mines and Geology within unincorporated Marin County. These sites include all or portions of the following parcels, identified by Assessor Parcel Numbers: 184-01-15,16,52 (San Pedro Hill), 125-180-62 (Mt. Burdell), 119-010-08 and 119-060-12 (Borello), 125-150-26 (Ghilotti). Further reference may be found in Part III. Classification of Aggregate Resource Areas North San Francisco Bay Production-Consumption Region. Special Report 146 by the California Department of Conservation, Division of Mines and Geology, 1983. Designated Sector J (APN 125-180-62, Mt. Burdell) and Sector M (APN 125-150-26, Ghilotti Quarry) have been exempted from these policies because convincing evidence has been presented to indicate that these sites do not contain sufficient material to meet the state defined thresholds for designated MRZ-2 sites.	Still Applicable.

Program EQ-2.81b Ring Mountain, Designated Mineral Resource – Scientific Zone. The County shall assign the label "Designated Mineral Resource-Scientific Zone" to all or portions of the following parcels (Ring Mountain) 038-182-31,32,36,37 to preclude future development or mining operations on this unique resource and indicate affected areas on County zoning maps.	Still Applicable – Should mention that the mineral Lawsonite is being protected.
Program EQ-2.81c Notice on Property Titles of Mineral Resource Areas. The County shall record the presence of important mineral resources on property titles in mineral resource areas.	Still Applicable.
Policy EQ-2.82 Buffer Between Potential Mineral Extraction Areas and Incompatible Land Uses. The County shall further protect designated mineral resource sites by creating a buffer of land uses between potential mineral extraction areas and areas with land uses incompatible with mining.	Still Applicable.
Program EQ-2.82a Designated Mineral Resource Overlay Zone District. The County shall include requirements in its "Designated Mineral Resource" overlay zone district to require a sufficient buffer between mining and land uses incompatible with mining.	Still Applicable.
Policy EQ-2.83 Nuisances, Hazards or Adverse Environmental Impacts of Mining Operations. The County shall assure that, after mitigation measures are taken, a proposed mining operation will not create significant nuisances, hazards, or adverse environmental impacts.	Still Applicable.
Program EQ-2.83a Mitigation to Address Nuisances. The County shall amend Marin County Code Section 23.06.040 application (for mining permit) to require applicants to list what mitigation will be taken to address nuisances to neighboring properties for proposed mining operations.	Still Applicable.
Program EQ-2.83b Environmental Review. The County shall require an Initial Study and may require an Environmental Impact Report on all mining or quarrying permits requested after the date of adoption of these policies.	Still Applicable.
Policy EQ-2.84 Reclamation of Mined Lands. The County shall assure that all mining operations provide for adequate reclamation of mined lands before issuing mining or quarrying permits.	Still Applicable.
Program EQ-2.84a Reclamation Requirements. The County shall continue to enforce the reclamation requirements of Marin County Code Section 23.06.	Still Applicable.
Program EQ-2.84b Wetlands. The County shall augment Section 23.06.40(5) Application to require Reclamation Plans to include a) protection of wetlands, if any and b) reduction of negative visual impacts.	Still Applicable.
Policy EQ-2.85 Excavation of Wetlands. Wetlands proposed for excavation shall be reviewed for significant habitat value and will be protected in lieu of mining where significant mineral resources have been identified.	Still Applicable.
Program EQ-2.85a Return to Wetland Status. Wetlands that are mined shall be reclaimed and returned to wetland status after conclusion of mining operations.	Still Applicable.

Policy EQ-2.86 Removing a Site from Application of these Policies. When a site is mined and satisfactory evidence is presented that it no longer contains the threshold amount of resource, the County shall institute action to remove the site from the application of these mineral resource preservation policies.	Still Applicable.
THE BUILT ENVIRONMENT	
1. General Policies	
Policy EQ-3.7 Avoidance of Hazards from Earthquake, Erosion, Landslide, Floods, and Fires. Construction and operations shall be located and designed to avoid or minimize the hazards from earthquake, erosion, landslides, floods, fire, and accidents consistent with policies and programs in the Environmental Hazards Element.	Needs Refinement – Should mention use of proper investigation and list expansive soils as a hazard.
Policy EQ-3.16 Minimize Excavating, Grading, and Filling. New development in the County shall adhere to the standards of the Department of Public Works in order to minimize excavating, grading, and filling, while allowing for adequate access.	Needs Refinement – Needs to indicate that minimizing does not preclude a stable development site. Hazards still need to be properly mitigated.
Environmental Hazards Element	
Policy EH-l.l Support for Public Awareness. The County should advise citizens on the availability of countywide and local area environmental hazards studies, sources of hazard information, and public services.	Still Applicable.
Program EH-l.la Public Information. The County should prepare a handout informing prospective property owners about safety hazards that may exist on properties within Marin County .This document could be distributed by members of the Marin Association of Realtors to prospective and existing Marin residents.	Still Applicable.
Program EH-l.lb Maps Available. Maps depicting the areas covered by the Alquist-Priolo Special Studies Zone Act should be made publicly available at County offices and the County Community Development Agency.	Needs Refinement – "Special Studies Zone" needs to be replaced with "Earthquake Fault Zoning" and policy must include the Seismic Hazards Mapping Act.
Program EH-l.lc Improve Soils Information. The County should develop a systematic and accessible compilation of existing drilling log data in filled and bay mud areas.	Needs Refinement – This information should be provided to the CDMG for their use.
Policy EH-l.2 Support Scientific Geologic Investigations. The County should continue to support scientific geologic investigations, which refine, enlarge and improve the body of knowledge on active fault zones, unstable areas, severe ground shaking, and similar hazardous conditions in Marin County.	Needs Refinement – Should provide access to public lands as deemed appropriate to allow scientific studies.
Policy EH-2.1 Location of Public Structures. Structures necessary for the protection of public safety and/or the provision of emergency services should not be located in areas subject to inundation, subsidence, slope failure, or ground failure in a seismic event. An exception to this policy may be granted if the only alternative location would be so distant as to jeopardize the safety of the community, given that adequate precautions are taken to protect the facility.	Still Applicable.

Program EH-2.1a Project Review Procedures. The County Community Development Agency shall facilitate project review by providing reference maps on seismic study areas. Public structures shall be located outside such study areas.	Need Refinement – Unclear what studies areas are and should include maps of Earthquake Fault Zones and Seismic Hazard Zones. Public structures should be located outside these zones or adequately investigated and sited in accordance with state guidelines.
Policy EH-2.2 Emergency Building Design. Emergency buildings and vital utilities, communication systems, streets and other public facilities should be designed in a manner which allows them to remain operational during and after an earthquake, or any other disaster .	Needs Refinement – Needs to be investigated properly and in accordance with State regulations and guidelines.
Policy EH-2.3 Critical Facilities. Within designated fault zones, the following critical public uses should be prohibited: schools, hospitals, utility and public safety facilities, high density housing and reservoirs.	Still Applicable.
Policy EH-3.1 Location of Future Development. New development shall be sited in a manner which avoids or minimizes the potential of hazards from earthquake, erosion, landslide, floods and fire. Development should not be endangered by nor contribute to hazardous conditions on the site or on adjoining properties.	Needs Refinement – Expansive soils should be listed as a hazard. Assessments of hazards should be based upon a detailed geotechnical investigation.
Program EH-3.1a Protect Review. The Community Development Agency shall continue to review the impact of a project on the site and surrounding properties potentially affected by the development.	Still Applicable.
Policy EH-3.2 New Development Approval. New development will be approved in identified geologic hazard areas only if the hazards can be reduced to acceptable levels through mitigation measures which are appropriate [at] the site, and consistent with other policies in the Countywide Plan.	Still Applicable – typo. Should be fixed: [at].
Program EH-3 .2a Mitigation. The County Community Development agency should continue to require mitigation measures for projects proposed in areas with identified geologic hazards.	Needs Refinement – should require a geotechnical investigation in order to assess hazards.
Policy EH-3.3 Disaster Protection Measures. At places of employment, residence, and public gatherings, safety measures shall be taken to protect the public health and safety during and following a disaster. These measures shall include provisions for the health and safety of people with disabilities.	Still Applicable
Program EH-3.3a Protect Review. Criteria for project review should provide for the health and safety of members of the public.	Still Applicable
Policy EH-4.1 Alquist-Priolo Special Study Zones. The Alquist-Priolo Special Studies Zone Act shall continue to be implemented by the County and efforts should be made to inform applicants early in the development process of the existence of known fault traces which might affect their property , site development, and design.	Needs Refinement – "Special Studies Zones" needs to be replaced with "Earthquake Fault Zones (Zoning)". A new policy must be implemented to include Seismic Hazards Zones as defined by the Seismic Hazards Mapping Act.

Policy EH-4.2 Location of Structures. No public or private structure built for human occupancy, or with the potential to imperil structures built for human occupancy, shall be permitted to be placed across the trace of a confirmed active fault. This policy shall not be interpreted as being more restrictive of single-family residential construction than the Alquist-Priolo Act. It is assumed that the area within fifty (50) feet of an active fault is underlain by active branches of that fault unless and until proven otherwise by an appropriate geologic investigation.	Still Applicable- "Alquist-Priolo Act" should be listed by its full name "Alquist-Priolo Earthquake Fault Zoning Act."
Program EH-4.2a Protect Review Procedures. The Department of Public Works should continue to determine the applicability of the Alquist-Priolo Act, and if necessary, require a site investigation report by a registered geologist.	Still Applicable- "Alquist-Priolo Act" should be listed by its full name "Alquist-Priolo Earthquake Fault Zoning Act." Also should be noted that determination is made by CDA, not DPW.
Policy EH-4.3 Public Financing Support. Public financing or support should be withheld from buildings located in an Alquist-Priolo Special Studies Zone with a confirmed fault trace, unless there is no possibility of surface fault displacement or ground rupture that would injure the public investment.	Needs Refinement – "Special Studies Zone" needs to be replaced with "Earthquake Fault Zone." Should indicate that this is determined by an appropriate investigation by a registered geologist.
Policy EH-4.4 Geologic Investigation Requirement. No new building sites should be created within the Alquist-Priolo Special Studies Zone, unless an appropriate geologic investigation establishes sufficient and suitable land area for development according to existing zoning and other applicable County ordinances.	Needs Refinement – "Special Studies Zone" needs to be replaced with "Earthquake Fault Zone." Should indicate that this is determined by an appropriate investigation by a registered geologist.
Program EH-4.4a Applications for Development. Applicants proposing to develop land or divide land into two or more parcels located within the Alquist-Priolo Special Studies Zone must submit a geologic report to the County. The report shall be prepared by an engineering geologist and directed to the problem of potential surface fault displacement through the project site unless a waiver has been approved by the State Geologist.	Needs Refinement – "Special Studies Zone" needs to be replaced with "Earthquake Fault Zone." Should indicate that a report is to be prepared by a certified engineering geologist.
Policy EH-5.1 Mitigation of Risk. Construction of all new habitable structures, including those for residential, commercial, and industrial use, shall employ engineering measures that mitigate against life safety risks from ground shaking. At minimum, new structures shall meet standards specified in Title 19, Marin County Code.	Still Applicable – should mention the Uniform Building Code in addition to Title 19.
Policy EH-5.2 Geotechnical Investigation Requirements. Applications for proposed developments sited on landslide deposits, non- engineered fill, or bay mud shall be accompanied by a geotechnical engineering investigation which focuses on the problem of ground shaking and ground failure.	Needs refinement – should include term engineering geologic as part of investigation and mention deposits with high susceptibility to ground shaking and high susceptibility to liquefaction.
Program EH-5.2a Requirements for Soils and Geologic Reports. The Community Development Agency shall require that soils and geologic reports be submitted with master plan applications, and that soils and/or geologic reports accompany subdivision applications.	Still Applicable.

Policy EH-5.3 Potential Earthquake Hazard in Existing Buildings. The County should minimize potential earthquake damage from existing publicly owned buildings through strengthening building structure, eliminating hazardous features, or relocating buildings.	Still Applicable.
Program EH-5.3a Structural Improvements. The Department of Public Works should identify structural improvements needed for safety in public buildings and develop measures to institute the necessary improvements.	Needs refinement. "Public buildings is very broad. DPW can undertake this only in "county buildings"..
Program EH-5.3b Compliance with SB 547. In compliance with SB 547, the Department of Public Works should identify unreinforced masonry buildings in unincorporated county areas and require strengthening of structurally unsound buildings.	Needs refinement. Chief Building Official, who is in CDA handles this, not DPW..
Policy EH-5.4 Location and Design of High-Occupancy Structures. The design and siting of structures occupied by a large number of people, such as restaurants and hotels, shall consider site constraints. Site constraints and appropriate safety measures for design and siting shall be determined by the engineering geologist and civil engineer conducting the site investigation.	Still Applicable.
Program EH-5.4a High Density Structures. The Department of Public Works should determine that structures which are to be occupied by a large number of people (as described in Policy EH-5.4) are designed to be as safe as similar structures in locations not subject to excessive ground shaking or other geologic hazard.	Needs refinement. This determination is not made by DPW, probably made by the Chief Building Official during the permit review process.
Policy EH-6.1 Evaluate Projects in Stability Zones 3 or 4. Prior to consideration of site design or use, the Department of Public Works shall evaluate projects proposed in zones 3 or 4 (see EH II.B.l) in stability and landslide potential according to the California Division of Mines and Geology Classification 9. Project proposals shall be accompanied by a report prepared by a civil engineer with soils engineering expertise or a soils certified engineering geologist. The soils evaluation should address the structural foundation engineering of the actual site, the impact of the project on adjacent lands, and impacts of off- site conditions on the site. Project applicants may need to consult with a soils engineer to determine whether their parcel falls within Stability Zones 3 or 4.	Needs Refinement – Should mention that proposals should be based upon a detailed subsurface investigation and that reports should be signed by both a civil engineer and engineering geologist. Perhaps policy should be less specific as to who conducts studies. The Countywide Plan should be a framework and actual specifics should be contained in the Marin County code.
Policy EH-6.2 Construction Observation and Certification. For work undertaken to correct slope instability, the County should require that the work is supervised and certified by a geotechnical engineer and, when necessary, an engineering geologist.	Needs Refinement – Work should be by a geotechnical engineer and an engineering geologist. Perhaps policy should be less specific as to who conducts studies. The Countywide Plan should be a framework and actual specifics should be contained in the Marin County code

Policy EH-6.3 Projects on Known Landslides and Landslide-Prone Deposits. New development should not occur on known landslides and landslide-prone deposits on steep slopes, except where an engineering geologic site investigation indicates that such sites are stable, or can be made stable through appropriate mitigation measures. In such cases, it must be shown that the risk to persons, property, or public liability can be minimized to a degree acceptable to the County.	Needs Refinement – Should include an engineering geologic and geotechnical engineering investigation.
Program EH-6.3a Project Review. The County should continue project review procedures that may require soils and/or geologic reports to be reviewed by the Department of Public Works.	Still Applicable.
Policy EH-7.1 Filled Land Underlain by Compressible Materials. Soils investigations for projects on filled land underlain by compressible materials (bay mud, marsh, slough) should delineate those areas where settlement will be greatest and subsidence may occur. Soils investigations should include: recommended site preparation techniques employed to preclude hazard; borings; identification of former sloughs; and a list of other factors which would accentuate differential settlement.	Still Applicable.
Policy EH-7.2 Minimize Differential Settlement. In the areas with great potential for differential settlement, uses should be planned which would not be damaged by settlement and which would provide minimum inducement to settlement that is detrimental to persons, property and public investment.	Needs Refinement – Need to list some potential sites, such as, those areas underlain by bay mud.
Program EH- 7 .2a Soils Report Requirement. The County shall continue to address differential settlement and subsidence in required geologic reports.	Needs Refinement – "Soils" and "geologic" should be replaced with "geotechnical/engineering geologic."
Program EH-7 .2b Findings Requirement. The Public Works staff must make a finding that the proposed fill, excavation, or grading will not unduly or unnecessarily create a safety hazard in areas susceptible to differential settlement. The staff finding may be appealed to the Planning Commission.	Needs Refinement. Should be revised as follows: *Requirement.* Proposed fill, excavation, or grading shall not unduly or unnecessarily create a safety hazards in areas susceptible to differential settlement.
Program EH-7 .2c Site Preparation Requirements. When recommended by the consulting geotechnical engineer, site preparation shall include settlement monitoring for a period of time sufficient for evaluating the particular site characteristics as needed for detailed foundation engineering and site planning.	Still Applicable.
Policy EH- 7.3 Structural Design of Foundations and Utilities. The structural design of foundations and utilities shall recognize the potential for differential settlement and subsidence.	Needs Refinement – Include potential for expansive soil movement.
Program EH- 7 .3a Enforce Development Standards. The Department of Public Works should continue to enforce development standards with regard to minimum elevations and ultimate settlement. The Building Inspection Department should continue to enforce building code requirements for structural design of foundations and utilities.	Still Applicable.
Program EH 7 .3b Augmented Expertise. The Department of Public Works should continue to hire consultants in soils engineering as necessary for evaluating specific developments proposed on bay mud and fill.	Still Applicable.

Policy EH- 7.4 Identify Inadequately Engineered Fills. The Department of Public Works should continue to determine the adequacy of engineered fills prior to the construction of structures.	Still Applicable.
Policy EH-8.1 Location of Critical Facilities. Public safety structures should not be located within the range of a tsunami.	Still Applicable.
Program EH-8.1a Review Procedures. The County should utilize the California Environmental Quality Act environmental review procedure to review and direct the siting of critical facilities structures in tsunami hazard areas.	Still Applicable.
Policy EH-9.1 Dam and Levee Design. The design and location of dams and levees shall be in accordance with all applicable design standards and specifications and accepted state of the art design and construction practices.	Still Applicable.
Program EH-9.1a Enforce County ~The County shall continue to enforce the provisions of Title 11.04 (Dams) and Title 23:08 (Excavation) which allow the County to review applications for dam permits when the dam size is smaller than the minimum size requiring a permit from the State of California.	Still Applicable.
Program EH-9.1b Inspect Levees. The County should continue to review new levees for seismic and hydrologic safety.	Still Applicable.
Policy EH-9.2 Notify property Owners. Property owners who are located in areas of possible inundation from failure at one of eight major dams should be notified regarding susceptibility to flood hazard.	Still Applicable.
Program EH-9.2a Public Information Regarding Dam Inundation Areas. Information on the location of dam inundation areas, for the eight major dams, should be made publicly available in the County Community Development Agency.	Still Applicable.

XIV. APPENDIX – REFERENCES

A. Persons Consulted

Steve Jensen, Chief Building Official, Marin County

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APPENDIX 1-L

HYDROLOGY AND WATER QUALITY BACKGROUND REPORT, AUGUST 2002, UPDATED NOVEMBER 2005

MARIN COUNTYWIDE PLAN

Hydrology and Water Quality Technical Background Report

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1. HYDROLOGY AND WATER QUALITY

A. PURPOSE AND BACKGROUND

This Environmental Quality Technical Report on Hydrology and Water Quality in the Marin Countywide Planning Area (CWPA) updates the previous edition which was prepared in 1991. That report described the existing hydrologic environment, the regulatory framework affecting surface and ground waters, including stream conservation areas (SCAs) and other resource conservation zones, the composition and responsibilities of the Marin County Flood Control and Water Conservation District (MCFCWCD), and the status of water quality in the region's streams and bays. It also incorporated an assessment of the policies and programs adopted in the 1977 Environmental Quality Element. The current report has four primary objectives:

1. Update the discussion of the regulatory environment, particularly as it pertains to surface and groundwater quality, water supply, and habitat preservation;
2. Assess the current hydrologic conditions and water quality in the waters of the CWPA, as well as the status of the region's drinking water supplies;
3. Evaluate the performance of the policies and programs pertinent to water resources in the Environmental Quality Element of the 1991 Countywide Plan.
4. Recommend revisions or refinements to the 1991 CWP policies and programs which would enhance water quality and aquatic habitat, improve channel stability, and maximize the County's ability to mitigate the effects of future development on water resources.

B. REGULATORY FRAMEWORK

1. Water Supply

The Marin Municipal Water District (MMWD) was formed under the provisions of the Municipal Water District Act of 1911. At the state level, water districts are under the authority of numerous sections of the California Water Code, related to potable water. Code regulations regarding the use of reclaimed water also apply to MMWD and NMWD (North Marin Water District). The State Department of Health Services has the primary responsibility for overseeing water district compliance with potable and reclaimed water standards. The California Department of Water Resources (DWR) regulates the construction and operation of the larger water supply dams in the MMWD and NMWD systems through the auspices of its Division of Safety of Dams. DWR's Division of Water Rights sets requirements for the purchase and maintenance of water rights. Both the State Water Resources Control Board (SWRCB) and its local Regional Water Quality Control Boards (RWQCB) have regulatory authority over the districts in matters related to instream flow requirements and reservoir releases, as well as enforcement authority in the event of chemical spills, and general water quality abatement. Finally, the California Department of Fish and Game (CDFG) has advisory and permitting authority regarding stream stabilization, restoration, and general construction activities that are conducted within a defined stream channel.

MMWD and NMWD staff must keep abreast of current revisions to the CA. Water Code, which undergoes continual amendment, and other regulatory requirements. For example, MMWD's water quality department follows developments in water quality regulations issued by the U.S. Environmental Protection Agency (EPA), SWRCB and RWQCB. Similarly, MMWD's Watershed Department follows endangered species regulations that affect water district operations and watershed management functions. The California Association of Water Agencies acts as an information clearinghouse for local water districts and water agencies.

Several bills pertaining to natural and municipal water systems and municipal water agencies have been enacted during 2004 and 2005 by the State legislature. Below is a list of bills, along with brief descriptions of the bills, obtained from the Association of California Water Agencies.

2004

Assembly Bill No. 2470 (Kehoe) "Authorizes a local agency to educate the public about water conservation by distributing an informational booklet or materials to buyers of real estate containing up to four residential units. Provides that if an informational booklet or materials are delivered to a buyer, that information shall be deemed adequate and the seller or broker is not required to provide additional information concerning water conservation and conservation programs."

Assembly Bill No. 2717 (Laird) "California Urban Water Conservation Council: stakeholders. Declares the Legislature's intent that the California Urban Water Conservation Council convene a stakeholder workgroup composed of public and private agencies, and associations to evaluate and recommend proposals for improving the efficiency of water use in new and existing urban irrigated landscapes in the state. Contains other related provisions."

Assembly Bill No. 2918 (Laird) "Requires the Public Utilities Commission to evaluate the interrelationship between the commission's electricity policies and water policies as they relate to saline water conversion through ocean desalination, and to report to the Governor and the Legislature, on or before January 1, 2006, on the balance between electricity ratepayers and water ratepayers. The commission is required to invite the Department of Water Resources, the State Water Resources Control Board, the Department of Fish and Game, the State Energy Resources Conservation and Development Commission, and the California Coastal Commission, to participate in the evaluation."

Assembly Bill No. 318 (Alpert) "Requires that urban water management plans developed by urban water suppliers pursuant to the Urban Water Management Planning Act describe the opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply."

Assembly Bill No. 2528 (Lowenthal) "Deletes the requirement in the California Safe Drinking Water Act that every public water system serving more than 10,000 service connections and detecting one or more contaminants in drinking water exceeding the public health goal must prepare a brief written report. Requires instead that the operator of wholesale or retail public water systems, as defined, must provide notice relating to contamination of any drinking water that exceeds the maximum containment level, a response level, or a notification level, as defined, including, but not limited to, notification to the

Public Utilities Commission if the public water system is a regulated public utility. Contains other related provisions and other existing laws."

Assembly Bill No. 2121 (Committee on Budget) "Requires the State Water Resources Control Board to prepare an annual written summary, in chart form, of pending applications to appropriate water in the Counties of Marin, Napa, Sonoma, Mendocino, and Humboldt, and would require certain information to be included in that summary. Authorizes the board to post that information on its Web site. Requires the board, on or before January 1, 2007, to adopt principles and guidelines for maintaining instream flows in certain streams in accordance with state policy for water quality control, for the purposes of water right administration, and authorizes the board to adopt principles and guidelines for maintaining instream flows in other streams for those purposes."

Assembly Bill No. 107 (Steinberg) "Authorizes flood control districts that are authorized to construct, manage, maintain, or repair levees and other flood control works under the jurisdiction of the Reclamation Board to adopt more stringent standards, for prospective application, for the operation and maintenance of those flood control works. The standards adopted by the governing body of the public entity will become effective upon approval by the Reclamation Board. Authorizes the Reclamation Board to unilaterally revise these standards upon 90 days' written notice to the public entity."

Assembly Bill No. 2733 (Strickland) "On and after January 1, 2005, requires persons extracting groundwater in a board-designated local area to file the required notice with a board-designated local public agency or court-appointed watermaster instead of the State Water Resources Control Board. Designated local agencies can impose a fee to pay for related administrative expenses."

Senate Bill No. 1514 (Poochigian) "Requires that a water district or any other local agency make a reasonable effort to obtain names and addresses of holders of interest in delinquent property that the district or agency takes title of and terminates the party's interest in the delinquent real property. Reasonable effort is defined as obtaining a preliminary title report, litigation guarantee, lot book guarantee or similar report from a title company, or county record searches. Related costs will be added to the amount of the delinquency that will be paid in order to clear the delinquency and/or redeem the delinquent property."

Senate Bill No. 1107 (Committee on Budget and Fiscal Review) "Resources budget trailer bill. Increases the share of costs, from 50% to 100%, that water right holders are required to pay for the administration and distribution of water in watermaster service areas and establishes new grant programs for public agencies and nonprofit organizations that implement specified projects. Includes other provisions related to resources." (Urgency statute effective August 16, 2004.)

Assembly Bill No. 2572 (Kehoe) "Requires an urban water supplier, as defined, on or before January 1, 2025, to install water meters on all municipal and industrial water service connections that are located in its service area. Contains certain exemptions and other related provisions."

Assembly Bill No. 2529 (Kehoe) "Establishes a program for marine managed areas pursuant to which the State Water Resources Control Board would award grants, upon the appropriation of funds for that purpose, to local public agencies and nonprofit organizations to restore and protect the water quality

and environment of marine managed areas. Requires the State Water Resources Control Board to appoint a marine managed areas water quality task force for the purpose of recommending projects to fund in connection with that program."

2005

Senate Bill No. 1110 (Committee on Natural Resources and Water) "Deletes several obsolete provisions and makes non-controversial changes in state law relating to public resources, including provisions regarding the Department of Fish and Game and public works projects."

Senate Bill No. 796 (Figueroa) "Establishes the Government Modernization, Efficiency, Accountability, and Transparency Act of 2005, and requires state agencies to provide specified information on their web sites to assist consumers in obtaining government services and participating in the regulatory process."

2. Water Quality

a. Surface water quality

1. Federal and Regional Water Quality Regulations

Addressing its legal mandates from the U.S Environmental Protection Agency (EPA) and the state's Porter-Cologne Act, the San Francisco Bay Regional Water Quality Control Board (RWQCB, or "Regional Board") developed and adopted the first *Water Quality Control Plan for the San Francisco Bay Basin* ("Basin Plan") in 1968. [1] After several revisions and an extensive public hearing process, the current Basin Plan was adopted in 1995 (1995 Basin Plan). The 1995 Basin Plan describes beneficial uses that the RWQCB will protect and water quality objectives required to achieve these beneficial uses. Beneficial uses are categorized for the principal streams, lakes/reservoirs and embayments within the CWPA, including those identified in the Central, San Pablo and Marin Coastal Basins (Tables 2-3, 2-5 and 2-6). Table 1 lists the existing ("E") beneficial uses for these waterways. Regional Board staff indicated that potential ("P") and limited ("L") beneficial uses were not investigated fully in the Basin Plan due to inadequate resources and funding priorities. Thus, the absence of the "P" designation in Table 1 does not necessarily mean that there is no potential for enhancing or restoring a particular beneficial use.

The Federal Water Pollution Control Act (commonly referred to as the Clean Water Act [CWA]) of 1972, as amended in 1987, prohibits the discharge of pollutants into waters of the United States unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. Section 402(p) of the 1987 amendments established a framework for regulating municipal, industrial and construction stormwater discharges under the NPDES program. In California, NPDES permits are issued through the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs). To date, communities with populations over 100,000, high-risk industries identified by the US Environmental Protection Agency (EPA), and construction projects of five acres or more must obtain an NPDES permit. [2]

Table 1 – Beneficial Uses for Principal Streams, Lakes and Embayments

Basin	Waterbody	REC-1	REC-2	SHELL	SPWN	WARM	WILD
San Pablo Bay Basin							
	San Pablo Bay	E	E	E	E		E
	Miller Creek	E	E		E	E	E
	Gallinas Creek		E			E	E
	Novato Creek	P	P		P	P	E
	Stafford Lake	E	E		E	E	E
Central Basin – S.F. Bay							
	S.F. Bay – Central	E	E	E	E		E
	San Rafael Creek		E			E	E
	Corte Madera Creek	P	E		P	E	E
	Phoenix Lake	E	E		E	E	E
Richardson Bay		E	E	E	E		E
	Arroyo Corte Madera	P	E	E	E		E
	Del Presidio						
Pacific Ocean (Marin)							
Drakes Estero		E	E				E
	First Valley Creek	P	E				E
Limantour Estero		E	E	E	E		E
Bolinas Bay							
	Bolinas Lagoon	E	E	E	E		E
	Easkot Creek						
Redwood Creek		E	E	E	E	E	E

Source: 1985 Basin Plan (RWQCB)

E – existing beneficial use

P – potential beneficial use

AGR = Agricultural Supply

COLD = Cold Freshwater Habitat

COMM = Ocean, Commercial & Sport Fishing

EST = Estuarine Habitat

FRSH = Freshwater Replenishment

IND = Industrial Service Supply

MAR = Marine Habitat

MIGR = Fish Migration

MUN = Municipal and Domestic Supply

NAV = Navigation

PROC = Industrial Process Supply

Table 1 (Continued)– Beneficial Uses for Principal Streams, Lakes and Embayments

Basin	Waterbody	REC-1	REC-2	SHELL	SPWN	WARM	WILD
Tomales Bay							
	Tomales Bay Estuary		E	E		E	
	Milarton Gulch						
	Lagunitas Creek	E	E		E	E	E
Walker Creek							
	Walker Creek	P	P		E	E	E
	Salmon Creek						
	Soulajoule Reservoir	E	E			E	E
Lagunitas Creek		E	E		E	E	E
	Kent Lake	E	E		E	E	E
	Nicasio Reservoir	E	E		E	E	E
	Nicasio Creek	E	E		E		E
	Alpine Lake	E	E		E	E	E
	Bon Tempe Lake	E	E		E	E	E
	Lake Lagunitas	E	E		E	E	E
	Olema Creek	E			E	E	E
	Pine Gulch Creek		E		E	E	E

RARE = Preservation of Rare and Endang. Species
REC 1 = Water Contact Recreation
REC 2 = Noncontact Water Recreation
SHELL = Shellfish Harvesting
SPWN = Fish Spawning
WARM = Warm Freshwater Habitat
WILD = Wildlife Habitat

Table 1 (Continued)– Beneficial Uses for Principal Streams, Lakes and Embayments

Basin	Waterbody	ARG	COLD	COMM	EST	FRSH	IND	MAR	MIGR	MUN	NAV	PROC	RARE
San Pablo Bay Basin													
	San Pablo Bay			E	E		E		E		E		E
	Miller Creek		E						E				E
	Gallinas Creek		E										E
	Novato Creek		P						P	E			E
	Stafford Lake		E							E			
Central Basin – S.F. Bay													
	S.F. Bay – Central			E	E		E		E		E	E	E
	San Rafael Creek		E								E		
	Corte Madera Creek		E						P				E
	Phoenix Lake		E							E			
Richardson Bay				E	E		E		E		E		E
	Arroyo Corte Madera		E										
	Del Pesidio												
Pacific Ocean (Marin)													
Drakes Estero				E				E		E			E
	First Valley Creek		E										
Limantour Estero				E				E					E
Bolinas Bay													
	Bolinas Lagoon			E				E	E				E
	Easkot Creek												
Redwood Creek		E	E			E				E			

Table 1 (Continued)– Beneficial Uses for Principal Streams, Lakes and Embayments

Basin	Waterbody	ARG	COLD	COMM	EST	FRSH	IND	MAR	MIGR	MUN	NAV	PROC	RARE
Tomales Bay													
	Tomales Bay Estuary												
	Milarton Gulch												
	Lagunitas Creek	E	E						E	E			E
Walker Creek													
	Walker Creek		E						E				E
	Salmon Creek												
	Soulajoule Reservoir					E				E			
Lagunitas Creek		E	E						E	E			E
	Kent Lake		E							E			
	Nicasio Reservoir		P			E				E			
	Nicasio Creek		E			E			E	E			
	Alpine Lake		E							E			
	Bon Tempe Lake		E							E			
	Lake Lagunitas		E							E			
	Olema Creek		E						E		E		
	Pine Gulch Creek		E						E	E			

In August 1999, the SWRCB reissued the General Construction Activity Storm Water Permit (Water Quality Order 99-08-DWQ referred to as "General Permit"). As the result of subsequent litigation (*San Francisco Bay Keeper et al. vs. State Water Resources Control Board*), the Monitoring Program and Reporting Requirements section of the current General Permit was modified in April 2001 (SWRCB Resolution 2001-46). For all construction projects conducted after this date, project applicants (i.e. dischargers) are instructed to design and implement a Stormwater Pollution Prevention Plan (SWPPP) that includes sampling and analysis (i.e. monitoring) of stormwater in two instances:

- Where site stormwater discharges directly to a water body that is designated as impaired for sedimentation/siltation or turbidity by the SWRCB on its Section 303(d) List.
- Where other pollutants that are known or should be known by permittees to occur on construction sites and that can not be visually observed or detected in storm water discharges could result in or contribute to exceedance of water quality objectives in receiving waters.

The modified provisions documented in Resolution 2001-46 cover the implementation schedule for the new regulations, identification of pollutant sources and Best Management Practices (BMPs), as well as monitoring program and reporting requirements. (SWRCB web site, Sept. 2001)

b. Section 303(d) impaired waterbodies and total maximum daily loads (TMDLs)

In addition to the Phase II stormwater regulations, Marin County and its member municipalities will be required to comply with new federal water quality criteria for total maximum daily loads (TMDLs) designated for several high priority stormwater contaminants, including mercury and PCBs, and the pesticide diazinon. The TMDL regulations are designed to limit contaminant loading of stormwater influent to the San Francisco Bay Estuary, which can assimilate only certain quantities of contaminants before its beneficial uses become significantly impaired.

Relevant sections of the Marin County Code that address general hydrologic and water quality issues and related development standards include:

- Title 11: Harbors and Waterways- regulates both the construction and repair of dams not regulated by the State and the diversion or obstruction of watercourses. Of particular interest regarding hydrology and water quality are Section 11.08-010 Interfering with water flow; and 11.08.050-060 Permit required for construction/Application-Fees. Section 11.08-010 prohibits the discharge of fill, debris, waste, bank stabilization materials into creeks if the discharge obstructs or impedes flow in the channel. However, it also exempts channel or bank modifications that improve or realign the channel, as long as natural flows are not diverted, obstructed or prevented. Sections 11.08.050-060 require that any property owner contemplating instream improvements such as channel realignment and bank protection measures secure a creek permit from the County DPW prior to construction.

- Title 22: Development Code- encompasses both Zoning and Subdivision Ordinances. Section 22.94 Primary Floodway District and Section 22.95 Secondary Floodway District - establish Primary (F-1) and Secondary (F-2) Floodway Districts and regulates floodway encroachment (see Environmental Hazards Element Technical Report- Flooding for further discussion). It also establishes requirements for site preparation, design and use of projects to satisfy the goals and

objectives of the Countywide Plan, both within the City-Centered Corridor and the Coastal Recreational Corridor, which is subject to the permitting authority of the California Coastal Commission.

Sections 22.10.040 and 22.16.030 identify design requirements for projects zoned as Residential, Multiple Planned District (RMP), including those applied to site preparation, grading, roadway design, erosion control measures and site drainage. While the sub-section on Drainage discusses design measures to reduce the risk of erosion to adjacent properties, it does not mention the conversion of natural channels to storm drain systems.

Section 22.14.060, Bayfront Conservation (-BFC) Combining District, identifies the boundaries of environmentally sensitive areas along the shoreline of San Francisco Bay and restricts development therein. The -BFC enhances the County's policy of encouraging regulatory flood control by discouraging development in sensitive baylands. It also requires the mitigation of environmental impacts due to development, and prohibits diking or filling of wetland areas within the tidal zone.

Article V, Coastal Zones was approved by the Marin County Board of Supervisors on June 24, 2003, however, this recent County Code update has not yet been approved by the California Coastal Commission (CCC). Pending approval by the CCC, land located within the coastal zone will continue to be regulated by relevant provisions of Title 22 of the Marin County Code that were in effect prior to the current Code. The Coastal Development Code describes development requirements, standards and conditions for developments in the Coastal Recreational Corridor. Many of these projects are subject to conditions of the Local Coastal Program (LCP) and must secure coastal development permits from the CCC. In nearly every case, the standards described in this section are much stricter than those governing development elsewhere in the County, i.e. outside the Coastal Recreation Corridor. Water supply, septic system design, sediment and erosion control, and stream and wetland resource protection are discussed in detail in this section. Two specific provisions relate to developments within or adjacent to blue line streams as identified on USGS 7.5-minute quadrangle sheets: 1) post-project peak flow rates shall not exceed those of the pre-project condition, and 2) development setbacks from stream channels shall be 100 feet from the nearest top of bank, or 50 feet beyond the edge of established riparian vegetation, whichever is greater.

Chapter 22.52, Tidelands Permits, pertains to land and water areas with elevations the mean high tide (MHT). Construction, dumping, filling, excavating dredging and the placement of piers or other structures is prohibited in the defined tidelands. Applications for the installation of structures may be conditionally approved as long as they meet certain conditions, including not causing an increase in the likelihood of flooding on adjoining lands.

- Title 23 Natural Resources: Chapter 23.08 sets standards for earth grading operations. Chapter 23.09 Floodplain Management- establishes the Special Flood Hazard Areas (SFHAs) as defined by FEMA for the base 100-year flood event as the standard definition of the channel floodplain covered by the section. It also establishes permit requirements for proposed floodplain construction projects, prohibits floodway encroachments and sets standards for construction, utilities and subdivisions. Special provisions for coastal high hazard areas are defined in Section 23.09.039.

Chapter 23.18, Article 2, Discharge Regulations and Requirements, Sections 23.18.0060- 23.18.094 – prohibit the discharge of non-storm water discharges to a County storm drain and requires that all other discharges (with specified exemptions) be in compliance with a NPDES permit for the discharge. They grant the Director of Public Works the authority to establish temporary and/or permanent controls on the volume and rate of stormwater runoff from new developments and redevelopments; establish creek maintenance responsibilities and guidelines for creekside property owners; control unpermitted discharges, channel excavation and fill; set standards for parking lots and similar structures; and regulate unpermitted construction, modification or removal of existing structures within a watercourse.

- Title 24: Development Standards, Chapter 24.04 Improvements, VI. Drainage Facilities, VII. Subsidence, and VIII. Grading- set standards for the design and construction of channels, catch basins and conduits, and drainage setbacks; cites minimum elevations for garage floors and finished floors of structures for flood protection; and regulates the conduct of grading with no distinction between instream and off-stream environs.

  The Title 24, Chapter 24.04 Improvements, VIII Grading, Sections 24.04.620 – 24.04.740 sets standards for grading operations, including the protection of disturbed areas using erosion control measures, restrictions on the timing of grading operations, permit and bonding requirements for development projects, and the application of Best Management Practices (BMPs) for erosion control and water quality management.

2. Groundwater Quality

The principal set of water quality regulations associated with groundwater development in California is the federal Safe Drinking Water Act of 1974, amended in 1986 and 1996. This Act gave EPA the authority to delegate the primary responsibility for enforcement of drinking water regulations to the states. The states adopt, implement and enforce the standards established by the federal drinking water program. In conjunction with the federal legislation, California has promulgated Chapter 4 of the California Health and Safety Code, the California Safe Drinking Water Act. Actual standards for drinking water are cited in Title III of the federal Clean Water Act. (CWA) and are monitored by the State Department of Health Services (DHS). (USEPA web site: www.epa.gov)

Developers of individual and community groundwater wells must test and analyze well water samples for Title III constituents and submit the results to the State Department of Health Services (DHS), prior to bringing a well into service. Chemical, physical, bacteriological and radiological tests are required which measure the levels of color, odor, turbidity, metals, nutrients, coliform bacteria, and many organic and inorganic chemical constituents. The frequency of sampling and testing for this extensive list of elements ranges from weekly (coliform bacteria) to every four years for radiological parameters. (DHS web site: www.dhs.ca.gov.)

Other legislation that affects groundwater quality in the CWPA includes the federal Resource Conservation and Recovery Act of 1976, the Comprehensive Environmental Response and the Compensation and Liability Act of 1986 (formerly the Superfund Amendments and Reauthorization

Act). Both of these acts address the monitoring and enforcement authority of the federal government to mandate technical studies, field experiments, legal actions and other remedies to remediate hazardous waste and groundwater contamination.

The California legislature in its *Supplemental Report of the 1999 Budget Act* required the State Water Resources Control Board (SWRCB) to develop a comprehensive ambient groundwater monitoring plan. In response to this mandate, the SWRCB has instituted the Groundwater Ambient Monitoring and Assessment Program (GAMA). The purpose of the program is to assess the water quality and relative susceptibility of groundwater resources in the State. Its two components include the California Aquifer Susceptibility Assessment and the Voluntary Domestic Well Assessment. The program is affiliated with the SWRCB Division of Clean Water Programs, Land Disposal Section, Groundwater Special Studies Unit. (SWRCB web site: www.swrcb.ca.gov)

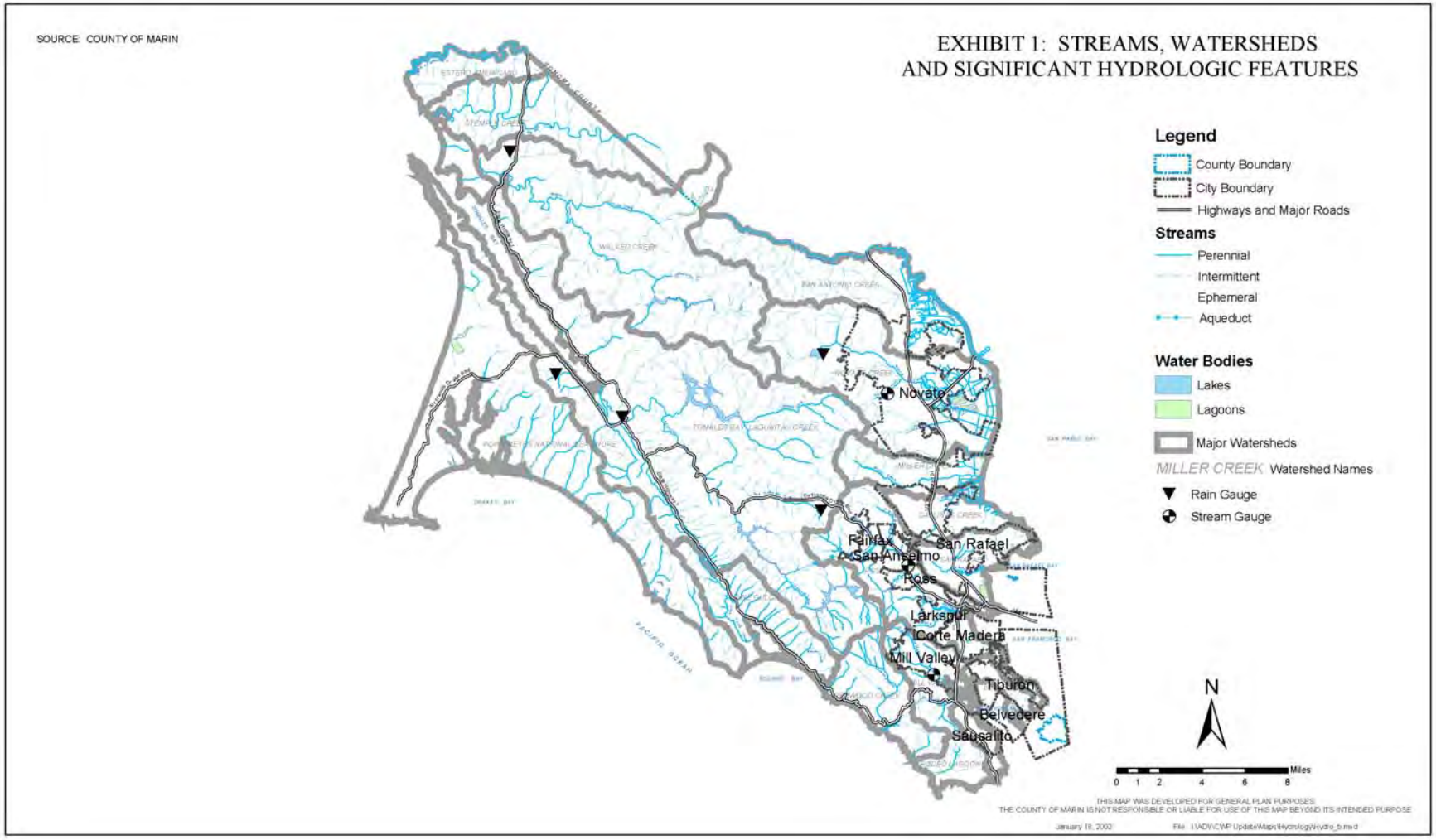
C. MAPPING SUMMARY

This technical report on Hydrology and Water Quality in the CWPA refers to maps and tables, each of which is given an exhibit or table number, as appropriate. Table 1 lists the beneficial uses of water bodies in the CWPA as established in the 1995 Basin Plan (RWQCB 1995), while Tables H-2 and H-3 refer to Marin Municipal Water District supply vs. demand projections for the Year 2025 and County Groundwater Basin Characteristics, respectively. Exhibit 1 is the map of CWPA watersheds and principal hydrologic features. It includes watershed boundaries, blue line streams, lakes, reservoirs and embayments, as well as the locations of rain gauging and stream gauging stations. Exhibit 2 is a map that depicts the geographical areas in the CWPA that are not served by any of the established community water districts. Residences and farmsteads in these areas must rely on spring systems or individual wells for a potable water supply. Exhibit 3 is a map of probable maximum well yields in Marin County. Exhibit 4 is a rainfall "isohyetal" map of the CWPA area, which depicts mean annual precipitation totals in the form of isohyetes, i.e. contours of equal rainfall amounts. Exhibit 5 is a map of the significant groundwater basins in the CWPA. Finally, Exhibit 6 maps the open space areas within the CWPA and delineates County streams that support sensitive aquatic habitats for the federally-listed steelhead and Coho salmon. Exhibits are inserted immediately following the page on which they are first mentioned.

D. SETTING

1. Water Supply

Marin County's drinking water supplies are derived primarily from surface water sources, including reservoirs and piped diversions from the Russian River Basin in Sonoma County. The Marin Municipal Water District (MMWD) and the North Marin Water District (NMWD) are the principal entities managing and delivering these supplies to residential and commercial consumers in the CWP area. MMWD serves southern and central Marin County, while NMWD serves the City of Novato and portions of the Inland Rural and Coastal Recreational corridors. Exhibit 1 depicts County streams and other


SOURCE: COUNTY OF MARIN
EXHIBIT 1: STREAMS, WATERSHEDS
AND SIGNIFICANT HYDROLOGIC FEATURES
Legend
County Boundary
City Boundary
Highways and Major Roads
Streams
Perennial
Intermittent
Ephemeral
Aqueduct
Water Bodies
Lakes
Lagoons
Major Watersheds
MILLER CREEK Watershed Names
Rain Gauge
Stream Gauge
Novato
Fairfax
San Anselmo
San Rafael
Ross
Larkspur
Corte Madera
Mill Valley
Tiburon
Belvedere
Sausalito
N
0 1 2 4 6 8 Miles
THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
THE COUNTY OF MARIN IS NOT RESPONSIBLE OR LIABLE FOR USE OF THIS MAP BEYOND ITS INTENDED PURPOSE
January 18, 2002
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hydrologic features, including major water supply reservoirs operated by MMWD and NMWD for their Marin County service areas.

Small community water districts along the Coastal Recreational corridor serve the rest of the remaining user base. These water districts include the Stinson Beach County Water District (SBCWD), the Bolinas Community Public Utility District (BCPUD), the Inverness Public Utility District (IPUD), and the Muir Beach Community Services District (MBCSD). The community of Dillon Beach is served by two small independent water companies, the California Water Service Company (formerly Coast Springs Water Company) and the Estero Mutual Water Company. Both the Muir Beach and Dillon Beach systems rely on groundwater pumping for their water supplies. (Written communication from Drew McIntyre, NMWD, August 2001.)

a. MMWD

The MMWD manages seven water supply reservoirs, five of which impound runoff from the Lagunitas Creek Watershed. Lake Lagunitas, Bon Tempe Reservoir, Alpine Lake, Kent Lake and Nicasio Reservoir combine to provide a maximum storage capacity of 68,560 acre-feet. Two additional reservoirs, Phoenix Lake and Soulajule Reservoir bring the system-wide capacity to 79,561 acre-feet. Phoenix Lake is located on a tributary to Corte Madera Creek, while Soulajule Reservoir is located on Arroyo Sausal, a tributary to Walker Creek, which itself is confluent with Tomales Bay. (Systems Operations Report: Lagunitas Creek, Marin County; D. Roxon MMWD, Feb. 1992)

In 1982, the District raised Peters Dam which increased the storage capacity of Kent Lake. As mitigation for this project, the State Water Resources Control Board (SWRCB) ordered the District to study the instream flow requirements for fish in lower Lagunitas Creek, below the dam. The results of the study were released in 1995. The SWRCB then issued Order WR95-17, which mandated the implementation of an instream flow augmentation program for Lagunitas Creek, as well as implementation of a sediment and riparian management plan and a streambed and habitat monitoring program. Instream flows are subject to augmentation via reservoir releases depending on gauged discharges in the lower reach of the Creek. In defined low water years, these releases must be increased to meet minimum instream flows downstream.

The sediment and riparian management plan was completed in 1997 (Prunuske Chatham 1997). It included recommendations for the construction of instream structures for habitat enhancement, stream and watershed erosion control projects, and riparian revegetation. The monitoring component of the Board Order included requirements for streambed monitoring (e.g. condition of spawning gravel beds, pool development, large woody debris concentration and fish and shrimp surveys), riparian habitat attributes and monitoring of sediment input and source areas. (Clearwater Hydrology conversation with Greg Andrew, fisheries biologist, MMWD, Sept. 2001)

The safe yield of the MMWD water system is roughly 30,000 acre-feet. This safe yield accounts for maintenance of a minimum continuous reservoir storage of 10,000 acre-feet, which serves to ensure normal pumped distribution of District supplies during severe droughts. Prior to the issuance of SWRCB Order 95-17, the safe yield included 25,700 acre-feet of reservoir storage and 4,300 acre-feet of diverted Russian River flows. Under a 1993 agreement negotiated between MMWD and the Sonoma County Water Agency (SCWA), which manages the Russian River water storage and distribution

system, MMWD could receive up to 14,300 acre-feet of Russian River Basin water annually. However, since the MMWD and NMWD share the same delivery pipeline and NMWD has a contractual priority, MMWD has yet to receive more than 8,000 acre-feet/year.

A capital improvement program intended for construction of a separate cross-basin diversion for the MMWD was approved by County voters in 1994. However, to date political considerations have stalled the initiation of the facilities expansion. While the current water diversion agreement with SCWA has offset the storage losses associated with instream flow releases to Lagunitas Creek, the MMWD supply will require implementation of the cross-basin diversion to meet projected growth demand in the CWP area. (D.Roxon, ibid; D. McIntyre, ibid, Clearwater Hydrology conversation with Dana Roxon, MMWD, Oct. 2001)

Assuming there are maximum (w/separate pipeline) and minimum (w/o pipeline) water supply scenarios for MMWD in the next two decades, the current projections for water supply vs. demand for Year 2025 are listed in Table 2: Water Demand (Year 2025)

Table 2
Marin Municipal Water District: Water Supply and Demand Projections for Year 2025

	Acre-Feet/Year
Water Demand Reduction due to expanded water reclamation	40,100 2,000
Water Supply: Marin Co. Reservoirs Sonoma Co. Aqueduct	 27,500 14,300 (w/sep. intertie) 8,000 (w/o sep. intertie)
Potential Deficit/Surplus	-2,600 (deficit w/o intertie) +3,700 (surplus w/intertie)

As the figures in the exhibit indicate, the construction of a separate pipeline intertie to the SCWA's Russian River distribution system will be required to meet MMWD's projected customer demand at Year 2025.

b. NMWD

NMWD maintains two independent water storage and distribution systems within its jurisdiction. The principal system serves the Novato area and derives its water supplies from two sources: Stafford Lake and cross-basin diversions from the Russian River Basin. The second, smaller system serves portions of West Marin, including the communities of Point Reyes Station, Olema, Inverness Park and Paradise Ranch Estates. This West Marin system utilizes groundwater that is pumped from two wells adjacent to Lagunitas Creek in Paradise Ranch Estates and a backup well at Gallagher Ranch. The backup well is brought on-line when low streamflow on Lagunitas Creek induces increased salt water intrusion into the principal pumping area. This backup well serves only a portion of the service area and is inadequate to

meet the total system water demand. Moreover, it is not yet connected to the rest of the West Marin distribution system.

Unlike the MMWD supply, the NMWD receives the bulk of its Novato area supply (80 percent) from Sonoma County. The safe annual yield for Stafford Lake supplies is 1,750 acre-feet. To meet the system demand, the NMWD has negotiated a Master Water Supply Agreement with the SCWA. Under the most recent (11th) amendment to the Master Agreement, the District is entitled to receive up to 19.9 million gallons per day (mgd) for the average peak month and 14,100 acre-feet annually from the Russian River Aqueduct. Temporary impairment of the SCWA system facilities has reduced the current peak-month take to 18.1 mgd. However, the full entitlement is expected by summer 2006. At the maximum entitlement, NMWD expects to be able to meet its system demands through the year 2025.

The wells serving the West Marin distribution system are founded in the alluvial aquifer that underlies the Lagunitas Valley. Significant aquifer recharge occurs through streambed infiltration along Lagunitas Creek. In average or wet years, the local watershed runoff and upstream reservoir releases provide more than sufficient recharge to meet the water use demands of the West Marin service area and to maintain instream flows for fish. NMWD estimates the extent of the annual groundwater withdrawals at less than one percent of the average annual streamflow. During droughts, however, NMWD is prohibited by SWRCB Order WR 95-17 from extracting groundwater from these wells during the low flow season which extends from July through October. NMWD has an "intertie" agreement with MMWD that allows it to request an exchange of system supplies. Under this 1993 agreement, MMWD releases stored water into Lagunitas Creek from Kent Lake in order to maintain acceptable streamflow in the pumped reach of the Creek. NMWD in turn conveys an equivalent volume of water to the MMWD system via the Russian River Aqueduct. Since the SWRCB Order mandates that MMWD increase its releases to Lagunitas Creek in dry years in order to provide sufficient water for fish, these flows are augmented to accommodate the downstream groundwater withdrawals. The difference is accounted for and traded via the Russian River intertie.

The existing Intertie Agreement between MMWD and NMWD runs through 2014 and provides for an annual exchange of 250 acre-feet. NMWD also has an agreement with Giacomini Ranch wherein the District can utilize a portion of the Ranch's appropriated water right to satisfy Lagunitas Creek instream flow requirements. (McIntyre, op cit.)

The NMWD has prepared the Long Range Plan For West Marin (NMWD 2001) which details the demand and supply projections for its two service areas over the short to long-term planning horizon. The Plan includes recommendations for replacement of aging, damaged or inadequate storage, pumping and distribution facilities in the West Marin system. Two development alternatives were presented for consideration by the District. Implementation of either of the Plan alternatives would achieve four design objectives:

5. In addition to supplying sufficient operational storage (25 percent of the maximum day demand for each service area), provide sufficient storage capacity (i.e. storage tanks) to accommodate the higher of: a) required emergency storage volume or b) fire flow storage. Supplying the total emergency storage and fire flow storage volumes would be financially infeasible for this small water system.

6. Provide two water storage tanks in each pressure zone that cannot obtain water from storage in a higher pressure zone. The second tank would supply some redundancy in the storage system, which would allow for tank maintenance without an interruption in supply.

7. Replace or upgrade existing storage tanks and pumping capacities to meet demands at ultimate buildout under current zoning, and to satisfy seismic safety requirements.

8. Provide a supply back-up to the existing well field at Paradise Ranch Estates (Lagunitas Valley) in case salt water intrusion contaminates that portion of the aquifer.

Most of the piping in the West Marin distribution system was replaced in the 1970s and 1980s. Thus, with one exception, replacement of distribution system piping was not part of the proposed alternatives presented in the Plan. For the recommended Plan alternative, Alternative 2, short-term improvements would include the following:

- Upgrading the Bear Valley pump station
- Replacing and/or upgrading Paradise Ranch Estates storage tanks
- Installing a new storage tank at Olema
- Selective tank seismic upgrades
- Replacing and upgrading two Inverness Park pumps and installing a pressure reducing valve
- Installing booster pumps at three PRE pump stations
- Installing a parallel 8-inch water main in Highway 1

Future, long-term improvements include continuing seismic upgrades, additional replacements and/or upgrades of existing storage tanks, installation of a connecting pipeline from the Gallagher well to the rest of the West Marin distribution system and development of a second Gallagher well. (Brelje & Race 2001)

As noted above, completion of the facilities improvements and expansions recommended in the Plan would provide NMWD with supplies sufficient to meet area demand at ultimate buildout under existing General Plan zoning. Furthermore, NMWD already owns adequate water right entitlements to develop the required supply. (Drew McIntyre, op cit., Dec. 2001)

c. Community Water Districts

The community water districts in Bolinas and Inverness derive their water supplies from surface streams, via direct diversion to storage, treatment and distribution facilities. The BCPUD diverts water from Arroyo Hondo for a safe yield of 40 acre-feet. The aging distribution system is estimated to lose between 15 and 20 percent of the system capacity to leakage. Capital improvements to correct system

deficiencies are still outstanding and new water hookups have been prohibited to protect existing supplies.

The IPUD diverts and stores streamflow during the wet winter season and maintains a storage and distribution capacity of roughly 95 acre-feet per year. Three filtration plants, one each in First, Second and Third Valleys, treat the water prior to distribution to local customers. The District expects to meet future water demands with its current facilities, except for eventual replacement of storage tanks, as required. The community of Inverness is nearly built-out, as only a few potentially developable lots remain. (Clearwater Hydrology conversation with Carin Gann, general manager, Inverness PUD, Dec. 2001)

The communities of Muir Beach and Dillon Beach rely on groundwater for their drinking water supplies. Limited populations in these communities are supplied by modest well production. The Muir Beach Community Services District (MBCSD) operates two groundwater wells, a newly installed (2005) well yields 60 gallons per minute (gpm), and the older well, now the back-up well, yields around 40 (gpm). (Clearwater Hydrology conversation with Harvey Pearlman, water manager, MBCSD, Oct. 2005) In addition, the MBCSD maintains storage tanks with a combined capacity of 250,000 gallons. Another storage tank is planned to be installed, bringing the total capacity to 300,000 gallons. Since perhaps only 10-15 buildable lots remain in its service area, these planned MBCSD facilities expansions are expected to meet the ultimate water demand for the community. (Clearwater Hydrology conversation with Donovan MacFarlane, operations manager, MBCSD, Dec. 2001)

Dillon Beach is served by two private water companies, the California Water Service Company (CWSC) and the Estero Mutual Water Company. The combined capacity of these two providers totals approximately 10,000 gallons per day. Estero Mutual also maintains a permitted stream diversion on a tributary to Estero de San Antonio. Diverted flows are stored in a small reservoir with a capacity of 49 acre-feet. (D. McIntyre, op cit.)

The CWSC operates seven groundwater wells in Dillon Beach with a maximum combined yield of roughly 35 gpm. During the drier summer months, the yield drops to 16-17 gpm. Two of the wells, referred to locally as tunnel well and side hill well, are not currently used as potable water sources. This is due to poorer quality water associated with the shallow and downgradient exposure of these horizontal wells, whose flows are conveyed in surface channels once they exit the bedrock. The CWSC currently has a moratorium on new service hookups and is in the process of assessing the feasibility of further developing one of its existing wells. The Company is seeking a more reliable single well supply (e.g. 60+ gpm) that will enable it to suspend the moratorium and pump water more economically. The CWSC also maintains two storage tanks with a combined capacity of 335,000 gallons. (Clearwater Hydrology conversation with Tom Fitzgerald, area manager, California Water Service Company, Dec. 2001)

d. Areas Outside of Current Municipal and Community Water District Service Areas

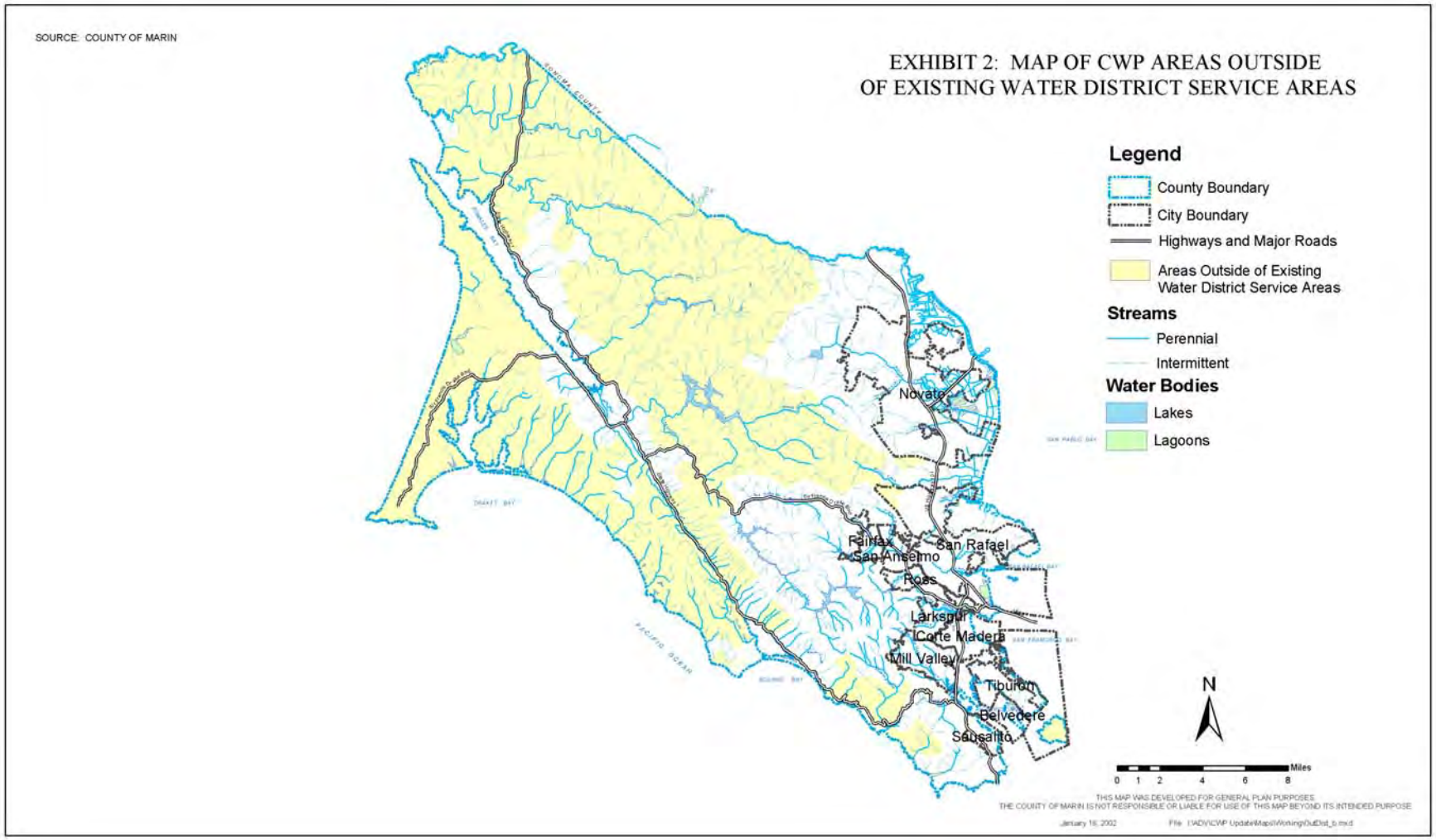
Exhibit 2 (CWP Areas Not Served by Existing Water Districts) outlines the geographic region within the CWP area that falls outside of any of the current municipal and community water service areas. Since no water company or service district distribution systems serve this region, current and future

residents must rely on either individual groundwater wells or small spring-based storage systems. Spring-based systems are often susceptible to severe capacity drops during extended periods of drought, but proven perennial springs can supply enough water for single residences.

0The bulk of the unserved areas are underlain by poorly permeable rock with limited storage capacity or thin deposits of alluvium or colluvium, which have insufficient saturated thickness to yield substantial quantities of water to wells. According to a macro-scale geologic interpretation of potential well yields in the San Francisco Bay Region (Webster (USGS) 1972), well yields in these areas range from 0.1 to 10 gallons per minute (gpm), with the majority of wells yielding less than 5 gpm. **Exhibit 3** is a partial reproduction of this mapping for the lands of the CWPA. With the exception of the Pt. Reyes peninsula, which is permanently dedicated to parkland and public open space, Bolinas Point, and Novato Valley, only small pockets of alluvial valleys are projected to yield in excess of 10 gpm (typically, 10-100 gpm). A few of these small areas of greater yield are located in the Lagunitas Valley, where NMWD maintains and operates its small well field for the West Marin service area. Here, the District pumps at rates of 250-300 gpm, well above the general projections of the USGS mapping. This indicates that individual wells can successfully be developed with significantly higher yields than the predicted range. In most cases, such high yielding wells tap deeper aquifers, at correspondingly higher costs. In fractured or sheared rock, which is fairly common in the Franciscan complex that underlies much of upland Marin County, both the spring-based and individual well water systems are subject to contamination from degrading or malfunctioning septic systems.

2. Regional Surface Water Hydrology

The Marin Countywide Plan Area (CWPA) encompasses roughly 480 square miles of baylands, alluvial valleys, and uplands which drain to the western margins of Central San Francisco Bay and San Pablo Bay, as well as the Pacific Ocean. The spine of the Coastal


SOURCE: COUNTY OF MARIN
EXHIBIT 2: MAP OF CWP AREAS OUTSIDE
OF EXISTING WATER DISTRICT SERVICE AREAS
Legend
County Boundary
City Boundary
Highways and Major Roads
Areas Outside of Existing
Water District Service Areas
Streams
Perennial
Intermittent
Water Bodies
Lakes
Lagoons
Novato
Fairfax
San Anselmo
San Rafael
Ross
Larkspur
Corte Madera
Mill Valley
Tiburon
Belvedere
Sausalito
N
Miles
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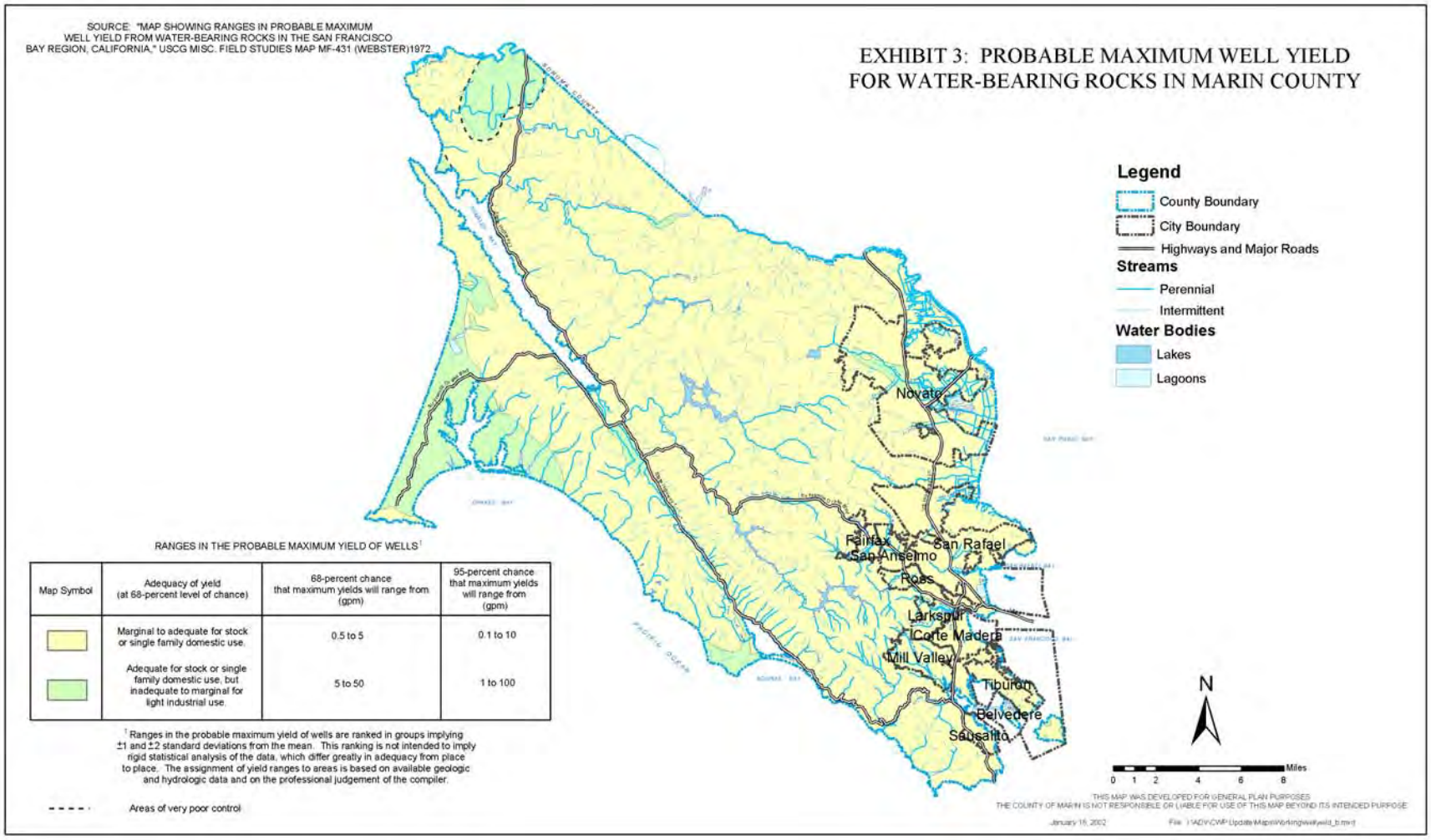
January 18, 2002



RANGES IN THE PROBABLE MAXIMUM YIELD OF WELLS[1]

Map Symbol	Adequacy of yield (at 68-percent level of chance)	68-percent chance that maximum yields will range from (gpm)	95-percent chance that maximum yields will range from (gpm)
	Marginal to adequate for stock or single family domestic use.	0.5 to 5	0.1 to 10
	Adequate for stock or single family domestic use, but inadequate to marginal for light industrial use.	5 to 50	1 to 100

[1] Ranges in the probable maximum yield of wells are ranked in groups implying ±1 and ±2 standard deviations from the mean. This ranking is not intended to imply rigid statistical analysis of the data, which differ greatly in adequacy from place to place. The assignment of yield ranges to areas is based on available geologic and hydrologic data and on the professional judgement of the compiler.

- - - - Areas of very poor control

Range geographically separates the watershed lands tributary to the Bays from lands on the west-facing slopes that drain to the Pacific Ocean. Elevations in these diverse landforms range from sea level at the Bay and Ocean margins to more than 2,500 feet along Mt. Tamalpais. Geologically, the low-lying lands in the CWPA belong to the bay plain and alluvial valley depositional provinces, while the higher elevation lands occupy the foothills and Marin uplands erosional provinces (Brown and Jackson, USGS, 1974).

The lowest elevation zones of the bay and alluvial valley depositional province are characterized by tidal marshes, diked and filled baylands, and broad areas of alluvial fan, floodplain and deltaic deposits. The bulk of these areas are underlain at varying depths by bay mud and tidal siltation rates can be high, particularly where subsided diked lands are opened to tidal action. Common land uses comprise salt marsh and grassland biotic communities, subdivisions founded on imported fill, and subsiding farmland surrounded by tidal levees or dikes. The communities of Kay Park and Santa Venetia are examples of settlements established in these bay plains.

At slightly higher elevations, the valley slopes increase and the thickness of the underlying alluvium increases. Watershed sediments are conveyed through streams in this zone to depositional zones in local floodplains and bay outlets. Urban development encroaches on much of this zone. Other land uses include grassland and riparian biotic communities, and pasture. Pasture lands along the inland corridor include the St. Vincent's/Silveira Ranch property and other unurbanized lands situated primarily to the east of Highway 101 and north of the City of San Rafael. Large tracts of pasture and agricultural lands, primarily dairy operations, are maintained through zoning mandates along the coastal recreational corridor. Major urban populations occupy the region's alluvial valleys along the City-Centered Corridor.

The foothills erosional province contacts the bay plain and alluvial valley depositional province and transitions to the Marin uplands erosional province, which encompasses the highest elevation zone in the CWPA. This province comprises portions of the Inland Rural Corridor that is described in the Countywide Plan. It is characterized by rolling hills extending to elevations of roughly 1,000 feet. Slope steepness typically reaches 20 percent, but slope lengths are significantly shorter than those associated with the uplands erosional province.

Dominant erosional processes in the foothills erosional province include gullying, streambank failure, and slump earthflows. Hillslope and streambank instability can be triggered by intensive grazing which compacts underlying soils and denudes stabilizing riparian vegetation. Such grazing is limited along the inland corridor lands, but is widespread among the coastal lands that are largely in agricultural and grazed open space uses. The foothills terrain is characterized by coastal scrub and riparian woodland, and is also utilized for low density suburban and rural development. Much of the mid-elevation lands occupied by the cities and towns of the region are part of this erosional province, as are the extensive open space and watershed lands extending southwest from Tomales Bay to Drakes Bay and Limantour Estero.

The Marin uplands erosional province comprises the mountainous regions of the County, including the slopes of Mt. Tamalpais and the highlands of Bolinas Ridge, the Marin Headlands, Pt. San Pedro Ridge and Big Rock Ridge. Bedrock outcrops are common on these lands, which are otherwise dominated by relatively thin soils. Runoff from these uplands provides the water supply for the bulk of the urban

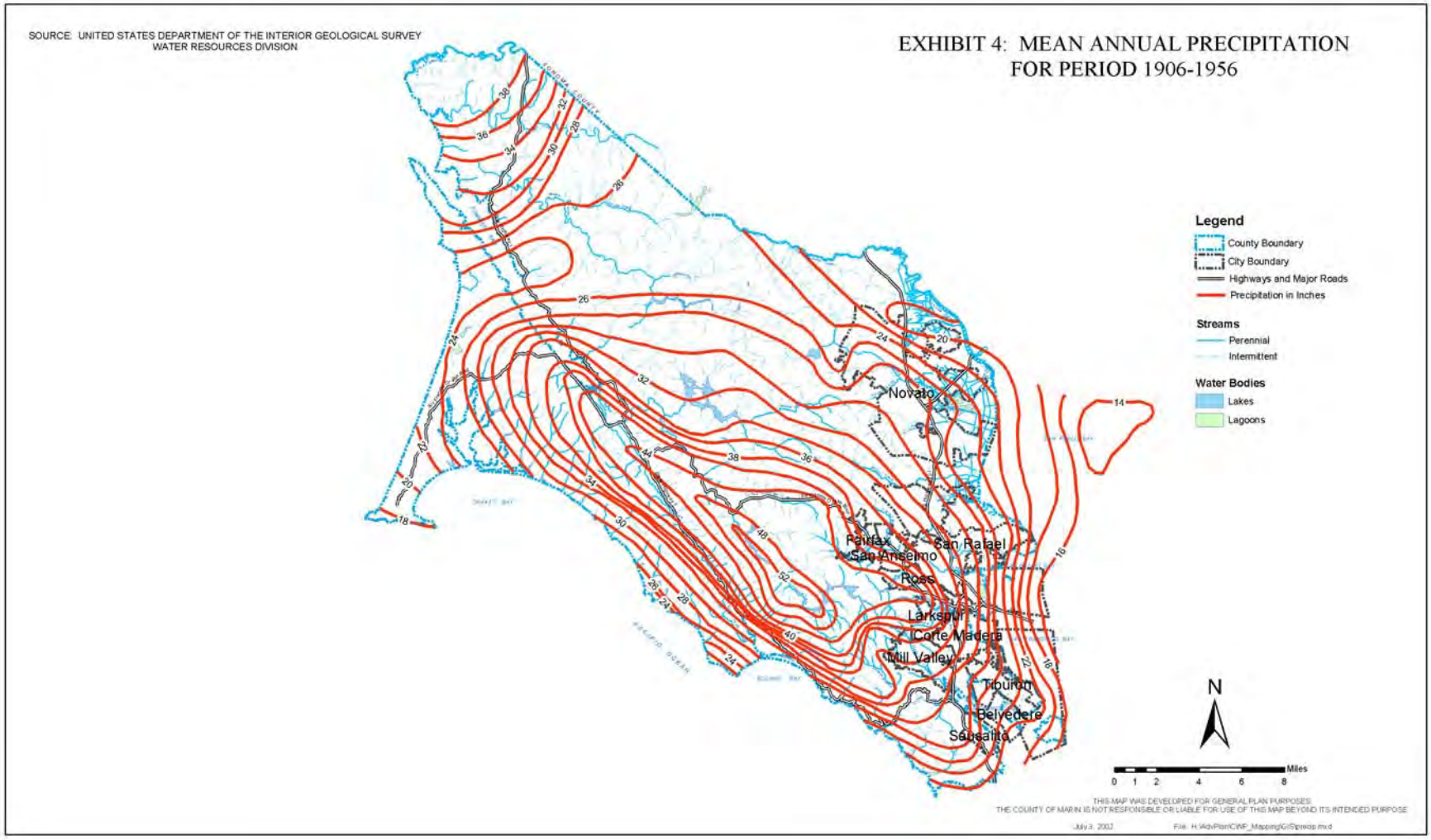
population. Accordingly, the principal uses of these high elevation lands within the CWPA are watershed lands and public and private open space.

Exhibit 1 depicts the streams, watersheds and significant hydrologic features within the GPA. The principal eastern watersheds draining to San Francisco Bay/San Pablo/Richardson Bay include: Arroyo Corte Madera del Presidio, Coyote Creek, Corte Madera Creek, San Rafael Creek, Las Gallinas Creek, Miller Creek, Novato Creek and San Antonio Creek. Principal Pacific Ocean Watersheds include Estero Americano, Stemple Creek, Walker Creek, Laguintas Creek, Olema Creek, Pine Gulch Creek and Redwood Creek. Tomales Bay, Bolinas Bay, Drakes Estero and Limantour Estero represent significant ecological habitats, as does the extensive tidal wetlands that form the Novato Creek Marsh. Several of the principal streams in the CWPA have been designated as critical habitat for anadramous fish, although the most important of these from a species survival perspective occur in the Pacific Ocean tributaries (Clearwater Hydrology conversation with Bill Cox, CDFG, Sept. 2001). The sections on "Surface Water Quality" and "Stream Restoration" discuss the ecological attributes of CWPA streams in more detail.

With the exception of the upper reach of Miller Creek, which is affected by livestock grazing yet otherwise remains undisturbed, streams in the City Centered Corridor have been significantly modified by dams (Novato Creek- Stafford Dam), flood control projects, storm drain installations and other urban encroachments. In the few relatively unmodified stream reaches and in the bulk of the streams in the Inland Rural and Coastal Recreational Corridors, otherwise natural channels have typically been detrimentally affected by historical logging and livestock grazing. Significant opportunities exist for restoring the geomorphic stability and hydrologic functions of these historically degraded channels. These opportunities and guidance regarding the hydrologic design for stream restoration are discussed further in the section on Stream and Wetland Restoration Opportunities.

Mean annual rainfall in the CWPA ranges from 18 inches at Pt. San Pedro to 50 inches or more along the ridgeline of Mt Tamalpais. **Exhibit 4** is a mean annual rainfall map of the CWPA, based on USGS rainfall data for the period 1906-1956 (Rantz 1971). This is the best available long-term compilation of regional rainfall data for the CWPA. Orographic influences associated with Mt. Tamalpais are responsible for the elevated rainfall totals in this central southern portion of the CWPA. Most of the area rainfall occurs during the wet winter season which typically extends from November through March. Significant runoff events occur in response to prolonged rainfall of two to three days' duration, punctuated by short periods of intense nested rainfall.

Damage-inducing flooding has occurred infrequently in the Countywide Plan area, primarily in the lower lying alluvial valleys and Bay plains of the City-Centered Corridor.


SOURCE: UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
EXHIBIT 4: MEAN ANNUAL PRECIPITATION
FOR PERIOD 1906-1956
Legend
County Boundary
City Boundary
Highways and Major Roads
Precipitation in Inches
Streams
Perennial
Intermittent
Water Bodies
Lakes
Lagoons
Novato
Fairfax
San Anselmo
San Rafael
Ross
Larkspur
Corte Madera
Mill Valley
Tiburon
Belvedere
Sausalito
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Miles
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From 1950 to 1970, major floods occurred in 1952, 1955, 1958, 1967 and 1970. Over the past 30 years, significant flooding has occurred in portions of Corte Madera, Larkspur, Greenbrae, Ross, San Anselmo, San Rafael and Novato in January 1982, January and December 1983, February 1986, January 1997 and February 1998. Severe floods in the CWPA can also occasionally cause channel instability in area streams.

Two forms of flooding occur in the Countywide Plan area: 1) tidal flooding and 2) watershed flooding. Coincident tidal and watershed flooding can also occur. Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. Watershed flooding occurs in response to severe runoff-inducing rainfall over the tributary watershed of one of the region's stream channels. Major watershed floods are typically generated by rainstorms of 3-4 days duration that include nested periods of high intensity rainfall. Such rainstorms occur primarily during the wet winter season which normally extends from November through March. When watershed flooding occurs in conjunction with high bay tides, the extent and/or depth of overbank flooding or levee overtopping can increase due to an upward adjustment in the flood water surface profile. For an expanded discussion of historical flooding events in the County, see Section D1 of the Technical Background Report on Flooding.

3. Regional Groundwater Hydrology

In general, regional groundwater conditions in the CWPA have not been well documented. According to the U.S. Geological Survey (USGS) and the California Department of Water Resources (DWR), no regional studies of groundwater availability or quality have been conducted in Marin County. The *1995 Basin Plan* cites four significant groundwater basins: Ross Valley, Novato Valley, Petaluma Valley and the Sebastapol-Merced Formation, which includes the town of Dillon Beach, at the northern edge of Tomales Bay. The Petaluma Valley Basin includes a small portion of northern Marin County, but is primarily situated in Sonoma County. Lagunitas Valley is not listed in the Basin Plan discussion. However, based on yield data from the North Marin Water District (NMWD) wells in Lagunitas Valley, the safe yield is likely in excess of the quantity cited for the Ross Valley Basin. **Exhibit 5** shows the location and extent of the principal groundwater basins in the CWPA, including Lagunitas Valley. Table 3 lists some defining characteristics of the principal groundwater basins in Marin County, including areal extent, average aquifer depths, total basin storage capacity and perennial safe yield. This information was gathered by preparers of the *Basin Plan* from local water agencies and specific studies/reports for specific geographical areas in the County. Tabulated information for Lagunitas Valley was added, yet it represents at best a lower bound to the potential range of safe yield for the valley aquifers. Note that in some drought years the West Marin system wells cannot be pumped at normal rates due to salt water intrusion. This contingency affects the safe yield considered for groundwater withdrawal.

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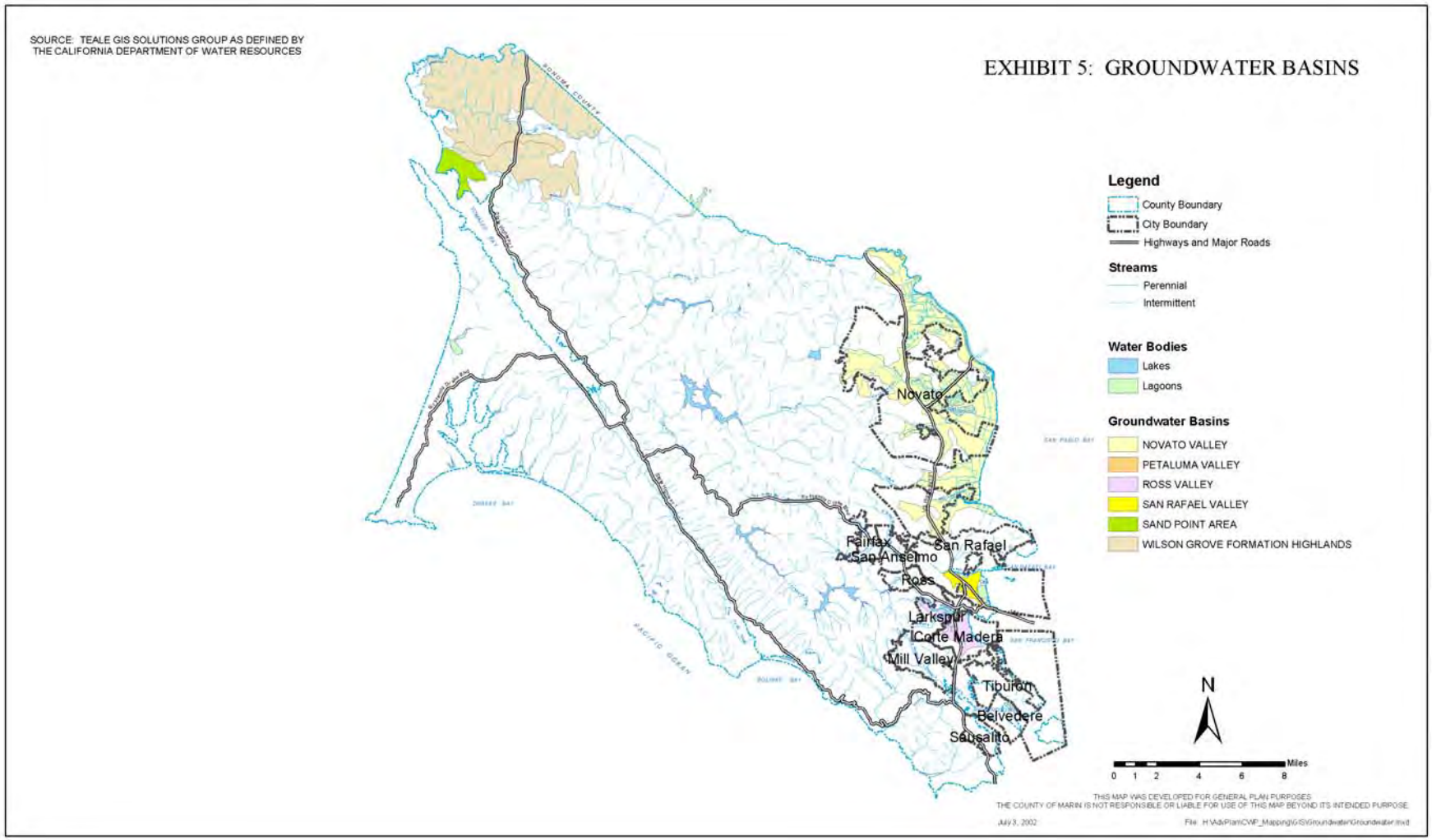
SOURCE: TEALE GIS SOLUTIONS GROUP AS DEFINED BY THE CALIFORNIA DEPARTMENT OF WATER RESOURCES
EXHIBIT 5: GROUNDWATER BASINS
Legend
County Boundary
City Boundary
Highways and Major Roads
Streams
Perennial
Intermittent
Water Bodies
Lakes
Lagoons
Groundwater Basins
NOVATO VALLEY
PETALUMA VALLEY
ROSS VALLEY
SAN RAFAEL VALLEY
SAND POINT AREA
WILSON GROVE FORMATION HIGHLANDS
Novato
Fairfax
San Anselmo
San Rafael
Ross
Larkspur
Corte Madera
Mill Valley
Tiburon
Belvedere
Sausalito
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July 3, 2002

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Table 3
Groundwater Basin Characteristics for Marin County

Groundwater Basin	Areal extent (sq. mi.)	Depth Zone (ft.)	Storage Capacity (ac. – ft.)	Perennial Safe Yield (ac. ft.)
Novato Valley	17.5	55-90	NA	NA
Sand Point Area	2.0	20-300	NA	NA
San Rafael	NA	NA	NA	NA
Ross Valley	18	10-60	1380	350
Petaluma Valley	41	0-900	21. mil	NA
Laguintas Valley	NA	NA	NA	300 +/-

According to the Director of the Department of Public Works for the Town of Ross, groundwater is utilized only for landscape irrigation, both public and private. (Clearwater Hydrology conversation with Robert Elias, Director of Public Works, Town of San Anselmo and former Director of Public Works, Town of Ross, Sept. 2001)
The City of Novato does not depend on well water for its public water supply, as it is adequately served by stored water at Stafford Lake and its piped allocation from the Sonoma County Water Agency (SCWA). Thus, well water is used by a few private landowners and no current information on groundwater quality is available. In fact, the City has had a policy of capping private wells, wherever possible to avoid aquifer contamination. (Clearwater Hydrology conversation with Robert Weil, P.E., City of Novato/Coastland Civil Engineering, Sept. 2001)
Potable water wells are maintained and operated by the NMWD as part of its West Marin supply system, which serves the Pt. Reyes Station and Inverness Park communities. As indicated above in the section on Water Supply, during average and wet years, these wells are adequate to serve the needs of the West Marin service area. However, during droughts the reduction in groundwater recharge can result in sea water intrusion into the zone of groundwater pumping. The lack of recharge can also reduce instream flows for fish, which are protected under State Water Resources Control Board Order WR95-17. Under these conditions, the NMWD secures additional releases from Kent Lake under its intertie agreement with MMWD. These releases produce enough instream flow for both fish and the NMWD's groundwater pumping requirements.
The communities of Dillon Beach, Stinson Beach and Muir Beach each depend either wholly or partly on groundwater for their community water supplies. The current Dillon Beach wells have limited yields under 30 gallons per minute and a total well field capacity of only 35 gpm. (Clearwater Hydrology conversation with Tom Fitzgerald, Area Manager, California Water Service Company, Guerneville, CA., Sept. /Dec. 2001) The Muir Beach Community Services District (MBCSD) operates a single 40 gpm well in the alluvial valley adjacent to Redwood Creek (Donovan MacFarlane, Muir Beach Community Services District, Sept. 2001). For more information on the other water supply facilities maintained by these communities, see the section on Water Supply.

a. Groundwater Recharge

Groundwater recharge to the CWPA's principal aquifers occurs when infiltrated rainfall ultimately reaches the water table within the alluvium that comprises the aquifers. In these recharge areas, there is a downward component to the groundwater flow and the water table usually lies at greater depth. In discharge areas, the groundwater flow has a significant upward flow component and the water table is shallow (e.g. spring outlets and stream channels. Typically, areas of significant groundwater recharge include the portions of alluvial valleys that have not been subject to intensive urban or suburban

development, and the fractured bedrock that accepts infiltrated rainfall on the surrounding hillslopes. Within the alluvial materials in these stream valleys, the hydraulic conductivity of sediments may vary by orders of magnitude, due to the spatial and temporal variations in the nature of the deposited sediments. For example, coarse sediments (e.g. sands and gravels) laid down by fluvial processes can be interspersed with finer sediments (e.g. silts and clays) that are deposited over adjoining floodplains. Since the alignment and profile of natural channels change over time, alternating lenses of these riverine and floodplain deposits can occur along portions of the valley floor that are no longer occupied by streams or their current floodplains. In general, significant zones of groundwater recharge within the CWPA are coincident with the areas delineated as significant groundwater basins, i.e. the alluvial valleys of Ross, Novato and Lagunitas.

Critical groundwater recharge areas exist wherever small communities in the Coastal Recreational Corridor rely on groundwater for their potable water supply (e.g. Inverness, Point Reyes, Dillon Beach, Muir Beach, and Stinson Beach). As noted above under Section 3. Regional Groundwater Hydrology, the NMWD relies on groundwater for its West Marin distribution system. In addition, coastal and inland streams that support critical species such as steelhead and Coho salmon are fed by shallow groundwater aquifers. Thus, the valley alluvium that occupies the largely undeveloped floodplains of Olema Creek, Laguintas Creek, and other small streams identified as critical streams for these listed species represents an important source of groundwater recharge in the CWPA.

4. Surface Water Quality

The quality of stormwater runoff in the CWPA affects the biotic health of both inland waterways and the downstream receiving waters of San Rafael and San Pablo Bays. It also influences the extent and quality of water-oriented recreational uses. While the chemical characteristics of natural waters vary with local geology and climatic influences (e.g. rainfall and temperature), the impact of human activities typically occurs more dramatically over a shorter time period. Residential and commercial development, the most common urban land uses in the CWPA, result in increased pollutant loading of stormwater discharged to local waterways. Contaminated runoff is generated and concentrated over impervious surfaces in these urbanizing portions of the watersheds and enters storm drains, eventually reaching creeks and/or San Rafael and San Pablo Bays. This type of dispersed contaminant loading is referred to as non-point source pollution. Constituents in urban stormwater in the Bay Area include fine sediments, heavy metals, trace organics (e.g. pesticides, PCBs), nutrients, and oil and grease.

Rural land uses, in particular cattle grazing and feedlots and horse stables, can also introduce significant contaminants to surface runoff which eventually discharges to streams. In the Inland Rural and City Centered Corridors, these areas are limited within the CWPA to the undeveloped portions of the Miller Creek Watershed, i.e. the Wetzel and former Grady Ranches and St. Vincent's/Silveira Ranch, and portions of other watersheds to the north, through the City of Novato. Lands in the Coastal Recreational Corridor which drain to the Pacific Ocean, by contrast, are largely zoned for agricultural, ranchstead and open space uses. Significant portions of non-forested land in these areas have been grazed since European colonization. Even some of the newer developments in the western portions of the Inland Rural Corridor (e.g. French Ranch) incorporate some horse stabling and riding facilities.

The 2003 California 303(d) List and TMDL Project Schedule (RWQCB, USEPA 2005) contains descriptions of each regulated pollutant, sources, priorities and the expected date of TMDL

implementation for significant streams and water bodies in the San Francisco Bay Region. The San Francisco Bay mercury TMDL was adopted in 2004. Other TMDL projects are scheduled for completion by 2008. All urban streams in the urban City-Centered Corridor of the CWPA, including Arroyo Corte Madera del Presidio Creek, Corte Madera Creek, Miller Creek, and Novato Creek are listed as impaired for the pesticide Diazinon. This appears to be based on the ubiquitous nature of the chemical in urban environs, rather than specific water quality sampling. TMDLs for Diazinon are expected toward the end of 2005.

For the Central San Francisco Bay and San Pablo Bay, commonly listed pollutants include the pesticides Chlordane, DDT, Diazinon and Dieldrin; dioxin compounds; exotic species; furan compounds; mercury and; PCBs (dioxin-like and non-dioxin like) and selenium. In addition, San Pablo Bay is listed as impaired for the metal nickel. San Pablo Bay circulation and water quality are influenced strongly by the volume of freshwater runoff exiting the Delta and the tributary channels that discharge watershed runoff from the City-Centered Corridor of Marin County and the southern regions of Sonoma and Napa Counties. Wet season runoff is typically accompanied by higher sediment loads, particularly fine-grained particles that act as an adsorpting surface for contaminants. The highest levels of arsenic, mercury and nickel were documented in the San Pablo Bay as noted in the most recent monitoring data (2003) on the San Francisco Bay published by the Regional Monitoring Program (RMP) of the San Francisco Bay Estuary Institute (SFEI 2005). In fact, the DOC concentration measured at the Petaluma River sampling station in February 2001 was the 2nd highest DOC concentration measured in the history of the RMP, which originated in 1993. Related sediment sampling and testing undertaken in an earlier RMP study (SFEI 1997) noted that sediment samples from wetland channels in China Camp Marsh and Petaluma Marsh were generally more contaminated than samples from the adjacent San Pablo Bay station. This is an indication of the sediment trapping efficiency of marshes, and the lack of efficient circulation in many wetland areas.

Richardson Bay is impaired similarly to San Pablo Bay, except that its list of impairing pollutants excludes Diazinon,, nickel and selenium, and includes high coliform counts. Until 1983, a number of municipal sewerage agencies discharged treated wastewater to some of the shallower portions of Richardson Bay. In addition, houseboats and live-aboard boats, primarily in the Sausalito harbor area, were responsible for illegal wastewater discharges in and around the harbors. Both the shallow portions of the Bay and the harbor/marina areas are subject to seasonally poor hydraulic circulation. This produced coliform counts that were higher than acceptable for both water-contact recreation and shellfish harvesting (Bay Conservation and Development Commission 1983).

In response to regulatory agency mandates, the Sewerage Agency of Southern Marin constructed a combined sewer outfall that conveyed wastewater from treatment plants operated by the City of Mill Valley and the Richardson Bay Sanitary District to a discharge point in Raccoon Strait. Due to its position adjacent to the Tiburon Peninsula and the efficient scouring of tidal currents, Raccoon Strait maintains a depth of 90 feet and a dilution rate of 1,400:1. (Clearwater Hydrology conversation with David Coe, General Manager, Sewerage Agency of Southern Marin, Dec. 2001) Thus, the wastewater treatment plant discharges no longer contribute to the elevated coliform counts registered in the Bay. Likewise, the City of Sausalito has enacted a stringent zoning ordinance regarding houseboats and live-aboards. Article 5, Section 10.505 and 10.506 regulate houseboats and single-family "ark" dwellings. The regulations mandate that all houseboats be provided with a City-approved sewer connection. Still, data compiled by the Regional Water Quality Control Board (RWQCB) through 2003 indicates that

some sampling stations continue to show elevated levels of coliform (RWQCB, raw data email from Farhad Ghodrati 2005).

Of the listed TMDL pollutants, highest priorities have been assigned to mercury (Adopted 2004), dioxin-like PCBs, dioxin and furan compounds, and exotic species.

Impairing pollutants in the listed unurbanized streams and bays of the western Coastal Recreational Corridor include:

- Tomales Bay: Mercury (due to mining in the watershed), nutrients, pathogens, and sedimentation/siltation
- Lagunitas Creek: Nutrients, pathogens, and sedimentation/siltation
- Walker Creek: Mercury, nutrients, sedimentation/siltation

To gage the performance of the TMDL criteria, it is likely that the Countywide Program and its sister City programs will be required to implement a more extensive schedule of stormwater sampling, testing and reporting. To date, the MCFCWCD, in association with BASMAA and the RWQCB, has participated in sampling programs for PCBs, mercury and organochlorine pesticides. In addition, the County is currently working on a mercury identification and source reduction study plan with the North Bay Watershed Association (NBWA). In its role as the local permitting authority for development projects within the CWPA, the County DPW also has responsibility for review and approval of SWPPPs which are prepared by developers and other project proponents in association with NPDES General Permit provisions for stormwater. (Clearwater Hydrology conversation with Elizabeth Lewis, MCFCWCD Creek Naturalist and MCSTOPPP Coordinator, Sept.- Dec. 2001)

a. Standardized urban stormwater mitigation plans (SUSMPs)

The SUSMP defines new requirements for the integration of the "start at the source" approach to stormwater control and treatment in development and redevelopment projects. Front-end site design for the minimization of stormwater runoff and contaminant migration are the foundation of the "start at the source" approach. SUSMPs have recently been adopted in the Los Angeles and San Diego areas of Southern California, and similar standards (whether or not they are referred to as SUSMPs) are currently being incorporated into the upcoming reissue of the NPDES stormwater permit for Santa Clara County. While the public comment on proposed requirements for Bay Area SUSPs is underway, the deliberations will likely result in higher standards of performance for municipal stormwater pollution prevention programs

b. County Water Quality Programs

1. Marin County Stormwater Pollution Prevention Program (MCSTOPPP)

While most of the communities in Marin County currently have populations of less than the NPDES threshold, Marin County is still required by the 1995 Basin Plan to develop and implement a baseline

control program to prevent the increase of pollutants in stormwater discharges. To comply with these requirements, Marin County municipalities joined together in the early 1990s to develop a countywide program. The Marin County Stormwater Pollution Prevention Program, referred to as MCSTOPPP, encompasses both the Countywide Program and Local Programs. It provides regional oversight and support for the Local Programs that are now in-force in all municipalities in Marin County. Staff with the Countywide Program meet with Regional Board staff annually to discuss program performance and goals, as well as evolving stormwater regulations. Countywide Program staff also coordinate with other Countywide Programs in the Bay Area, as well as other regional and state agencies, to keep current with new developments in stormwater treatment technologies. MCSTOPPP's current program plan and implementation schedule are detailed in *Action Plan 2005: Protecting and Enhancing Marin County's Watersheds*.[3] The Draft *Action Plan 2010* is currently in the review phase.

MCSTOPPP has developed and implements the Aquatic Macroinvertebrate Sampling Program, primarily in streams along the City-Centered Corridor. The purpose of the program is to assess both the habitat and water quality of urban streams. Information gathered by the program monitoring supplements monitoring of chemical constituents in stream waters, which is more costly. Beginning in the fall of 1999, MCSTOPPP coordinators and community volunteers applied the California Stream Bioassessment Procedure which was developed by the US Environmental Protection Agency (EPA) and the California Department of Fish and Game (CDFG), and conducted habitat surveys on Arroyo Corte Madera del Presidio, Corte Madera Creek, Miller Creek and Novato Creek since 1999. The program is ongoing. (MCSTOPPP web site: www.mcstoppp.org)

Phase II NPDES stormwater permitting regulations were implemented in 2003. Under this phase of the regulations, all Marin municipalities were required to obtain NPDES permit coverage. According to *Action Plan 2005*, the Regional Board intends to adopt a NPDES general permit for the Countywide Program and specific instructions on how the Local Programs can obtain coverage under the general permit. The Phase II regulations mandated that MCSTOPPP implement a minimum of six pollution control measures in order to meet program objectives. These control measures are:

1. Public education and outreach on stormwater impacts
2. Public involvement/participation
3. Illicit discharge detection and elimination
4. Construction site storm runoff control
5. Post-construction stormwater management in new development and redevelopment
6. Pollution prevention/good housekeeping for municipal operations

In conjunction with each of the above control measures, MCSTOPPP was required to submit a list of Best Management Practices (BMPs) and measurable goals for the implementation of each BMP. BMPs are erosion and pollutant control measures that minimize the discharge of contaminated stormwater from non-point source areas. Draft *Action Plan 2010* describes activities throughout the document

which represent MCSTOPPP's BMPs. Appendix A, Performance Standards, details measurable goals. (Page 28 of PDF)

2. County of Marin urban runoff pollution prevention ordinance

Chapter 23.18 of the Marin County Code specifies guidelines for minimizing and controlling illicit discharges (non-stormwater) to area storm drains or watercourses, and for reducing pollutants in storm water discharges to the maximum extent practicable. Its intent is to protect and enhance water quality in area water bodies and wetlands in a manner pursuant to and consistent with the federal Clean Water Act. The Ordinance describes exempted activities (e.g. agricultural operations, NPDES permitted discharges), watercourse protections and BMPs for new developments and redevelopments.

Section 23.18.093 of the Ordinance outlines provisions related to site erosion and sedimentation controls, establishes the authority of the Director of Public Works to mandate controls on the rate and volume of runoff produced from a development or redevelopment site, and further establishes the authority of the Director of Public Works to mandate permanent controls designed for the removal of sediment and other pollutants. Such runoff controls could potentially be applied to enact prohibitions on the common "undergrounding" of surface drainageways, as storm drain systems are one of the principal factors in increasing peak flow rates. Taken cumulatively, increased peak flows in even minor (i.e. non-blue line) channels or swales can result in flashier runoff response in blue-line streams during the more frequent (e.g. <2-year recurrence interval) rainstorms normally not considered in flood risk calculations. In addition, properly maintained surface water drainageways act as biofilters for heavy metals and other contaminants, particularly those adsorbed onto fine sediments.

The current language of Section 23.18.093 does not specify under what conditions the development-related construction of storm drain systems should be allowed. With the imminent implementation of TMDLs for County streams, bays, and wetland receiving waters, ecologically sensitive BMPs will increasingly be required at the site design level of a development project. These site design BMPs to minimize surface runoff and off-site contaminant migration are described in the *Start At the Source Manual* (BASMAA 1999) and its companion guidebook, *Start at the Source Tools Handbook* (BASMAA 2000).

c. Water Quality Data for the CWPA

Actual water quality data collection for CWPA streams and its Pacific Ocean embayments has historically been limited to project-specific purposes, typically in conjunction with regulatory activities by federal and state agencies (e.g. RWQCB, USGS, Corps of Engineers, US Fish and Wildlife Service (USFWS) or California Dept. of Fish and Game (CDFG)). Water quality in the water supply reservoirs of the MMWD and NMMWD are regularly sampled and tested for dissolved oxygen (DO), temperature and turbidity. In addition, the RWQCB, USGS, California Dept. of Water Resources (CDWR) and the non-profit San Francisco Estuary Institute (SFEI) maintain water quality monitoring programs for Central San Francisco Bay, San Pablo Bay, and Richardson and San Rafael Bays.

The most recent CWPA surface water quality monitoring for which published results are available was undertaken on behalf of the Joint Stormwater Agency in October and November 2000 (Kinnetic Laboratories Inc. 2001). The sponsoring agency includes MCSTOPPP, as well as other municipal clean

water or pollution prevention programs from Santa Clara, Contra Costa and San Mateo counties and the cities of Vallejo and Fairfield-Suisun. Four stormwater monitoring stations were sampled within the lands of the CWPA, one each in the urban areas of Mill Valley (Arroyo Corte Madera del Presidio Creek), San Rafael (San Rafael Creek), Novato (Novato Creek), and one on Miller Creek, just west of Highway 101. In each case, the sampling sites were in open channels at the outlets to storm drains. Sampled sediments were analyzed for PCBs, Total and Methyl Mercury (Hg), Total Organic Carbon and percent silt/clay. No clear statistical relationship could be determined for different urban land uses and levels of contaminants. However, sampled open space areas (unurbanized) exhibited contaminant concentrations ranging from one (total mercury and methyl mercury) to two (PCBs) orders of magnitude lower than urban sites. The sampling site on Arroyo Corte Madera del Presidio exhibited the highest contaminant concentrations of any of the four Marin County sites. It should be noted, however, that measured background levels of methyl mercury are typically one-half of the level of the those measured in mixed urban environs. Moreover, the methylation process is considered more effective where fine sediments (e.g. clays and silts) are combined with elevated levels of organic matter, conditions which were present in the wetland environment of the Arroyo Corte Madera del Presidio sampling station.

Additional stormwater quality data (Hg and PCBs) were collected during a year-long effort by the staff of MCSTOPPP and the San Francisco Estuary Institute (SFEI) in 1999. While this local data has contributed to the regional assessment of contaminant loading, no conclusions regarding water quality trends are possible with such a small sample size.

In the late summer of 2001, the San Francisco Chronicle reported that RWQCB and MCFCWCD staff had sampled sediment in storm drains conveying stormwater to the Pacheco Pond Wildlife Area in Novato. The sediment was found to contain high concentrations of the pesticides DDT and Chlordane.

In addition to the County-specific efforts described above, municipalities conduct periodic monitoring of stormwater within their jurisdictions. Water quality data obtained from this monitoring is shared with MCSTOPPP coordinators on a regular basis. Similarly, accumulated data from the municipalities and those generated from MCSTOPPP's own efforts are shared with the RWQCB under the requirements of the County's NPDES permit.

1. Tomales Bay water quality

As noted above, the RWQCB has listed Tomales Bay as an impaired Section 303(d) water body for mercury, nutrients, pathogens and sedimentation/siltation. Two of its principal tributaries, Walker and Lagunitas Creeks, are also listed for nutrients and sedimentation/siltation. Walker Creek is impaired for mercury, the result of surface mining activities in its watershed. Lagunitas Creek, while not impaired for mercury, is also impaired for pathogens due most likely to aging, malfunctioning septic systems in its watershed.

Numerous federal and state agencies, water and utility districts, watershed groups, aquaculture operators and university researchers are currently involved in water quality monitoring in Tomales Bay and its principal tributaries, Lagunitas, Walker and Olema Creeks. Two watershed groups, the Tomales Bay Watershed Council (TBWC) and the Tomales Bay Septic Task Force Advisory Committee (SEPTAC), are taking lead roles in compiling existing data from these disparate sources. TBWC has

retained a water quality consultant to prepare a watershed management plan for Tomales Bay. The plan will summarize all existing water quality data for the bay and its tributaries, assess requirements for future data collection and analysis, and outline an action plan for realization of identified water quality objectives. (Tomales Bay Watershed Management Plan- Draft Outline, supplied by Neysa King, TBWC, August 2001).

2. Regional Board Watershed Management Initiative and the North Bay Watershed Association

The regulatory activities of the SWQCB and the RWQCBs are guided by a five-year *Strategic Plan* which was updated in 2001. The 1995 *Strategic Plan* marked the beginning of the Watershed Management Initiative (WMI) which was developed by the State and Regional Boards to promote a better understanding of watershed-scale influences on regional water quality. [4] The Regional Board identified critical watersheds and water quality issues for each of the Bay Area counties under its jurisdiction. For the City Centered Corridor in Eastern Marin County, *Action Plan 2005* indicates several significant Regional Board concerns regarding water quality issues, including three proposed development projects in diked wetlands (the Bahia development has since been defeated in a local initiative), the proposed upstream expansion of the Corps of Engineers project on Corte Madera Creek, and the erosion control project underway on Novato Creek. One of the wetland development projects, Bahia, was recently defeated in a local initiative.

Also in the City Centered Corridor and extending to the Inland Rural Corridor, but excluded from the *Action Plan 2005* list of concerns, is Miller Creek. Recent unpublished results from a field investigation of the watershed hydrology and fluvial geomorphology of Miller Creek sponsored by the RWQCB and SFEI have identified an intact native trout population in the creek. The watershed inventory included field identification and mapping of geomorphic and hydraulic channel conditions along the entire main stem creek. The documented channel conditions included bank and bed stability, sediment sources and estimated sediment yield, habitat attributes (e.g. pool frequency and depth, riparian canopy and channel shading), and biotic health. The researchers also identified potential channel stabilization and restoration opportunities.

In the Coastal Recreational Corridor, the RWQCB cites hill and gully erosion and impacts to stream corridors, runoff from confined animal (dairy) waste, and coliform contamination of shellfish growing areas of Tomales Bay (*Action Plan 2005*).

Another emerging regional entity involved in water quality and water resource issues is the North Bay Watershed Association (NBWA). Founded in 2000, the NBWA is composed of regulated local and regional public agencies that manage and implement projects affecting water resources in Marin and Sonoma Counties. The group includes sanitation agencies, the Counties of Marin and Sonoma, the Cities of San Rafael and Petaluma, MCSTOPPP, and area water districts. Its stated purpose is:

"to help regulated local and regional public agencies work cooperatively on water resources issues that impact areas beyond traditional boundaries in order to promote stewardship of the North Bay Watershed." [5]

The NBWA plans to form a watershed council that would include representatives from the NBWA, state and federal regulatory agencies, agriculture and landowners, business and environmental leaders, as well as at-large representatives from the communities and local watershed groups. It would work in an advisory role to include all facets of the community with interests in water resources in the development and implementation of NBWA projects and activities related to grant funding. The NBWA has developed technical committees in the areas of water quality, habitat and flood protection and integrated water resources. The committees will serve to inform the development of future NBWA projects and initiatives.

5. Groundwater Quality

Regional groundwater quality data for the lands of the CWPA is non-existent. According to the USGS and the CDWR, no regional studies of groundwater availability or quality have been conducted in Marin County. The *1995 Basin Plan* cites three significant groundwater basins: Ross Valley, Novato Valley and the Sebastapol-Merced Formation, which includes the town of Dillon Beach, at the northern edge of Tomales Bay. According to the Director of the Department of Public Works for the Town of Ross, groundwater is utilized only for landscape irrigation, both public and private. Thus, there is no water quality monitoring of the Town's well water. Aside from the County Department of Environmental Health Services' (DEHS) initial sampling of well water for new well installations, no water quality information is available for wells in the Ross Valley. (Clearwater Hydrology conversation with Robert Elias, Director of Public Works, Town of San Anselmo and former Director of Public Works, Town of Ross, Sept. 2001)

The City of Novato does not depend on well water for its public water supply, as it is adequately served by stored water at Stafford Lake and its piped allocation from the Sonoma County Water Agency (SCWA). Thus, well water is used by a few private landowners and no current information on groundwater quality is available. In fact, the City has had a policy of capping private wells, wherever possible to avoid aquifer contamination. (Clearwater Hydrology conversation with Robert Weil, P.E., City of Novato/Coastland Civil Engineering, Sept. 2001)

Potable water wells are maintained and operated by the NMWD as part of its West Marin supply system, which serves the Pt. Reyes Station and Inverness Park communities. NMWD maintains an ongoing groundwater monitoring program at well sites along this reach of Lagunitas Valley. Constituents are monitored on a quarterly basis and include among others: specific conductivity, TDS, hardness, alkalinity, metals, salts, nitrates and nitrites, pH, turbidity and temperature. Given the length of the monitoring and its consistency, these data represent one reliable source of groundwater quality information in the Tomales Bay Watershed.

The Towns of Dillon Beach, Stinson Beach and Muir Beach each depend either wholly or partly on groundwater for their community water supplies. However, apart from Title III water testing conducted for municipal supplies under permit agreements with the State Division of Environmental Health Services, no supplemental groundwater quality monitoring is conducted by these water districts. (Clearwater Hydrology conversation with Tom Fitzgerald, Area Manager, Coast Water Service, Guernville, CA., Sept. 2001; Donovan Mac Farlane, Muir Beach Community Services District, Sept. 2001)

Groundwater monitoring is also conducted in association with the performance of septic systems on larger commercial properties in the Inland Rural and Coastal Recreational Corridors (e.g. Olema Ranch Campground). Water quality data for these locations are available in the form of Self-Monitoring Reports that are required by the RWQCB for projects with permitted Waste Discharge Requirements. Self-Monitoring reports are available for inspection at the offices of the RWQCB in Oakland.

E. STREAM AND WETLAND RESTORATION OPPORTUNITIES

1. Overview

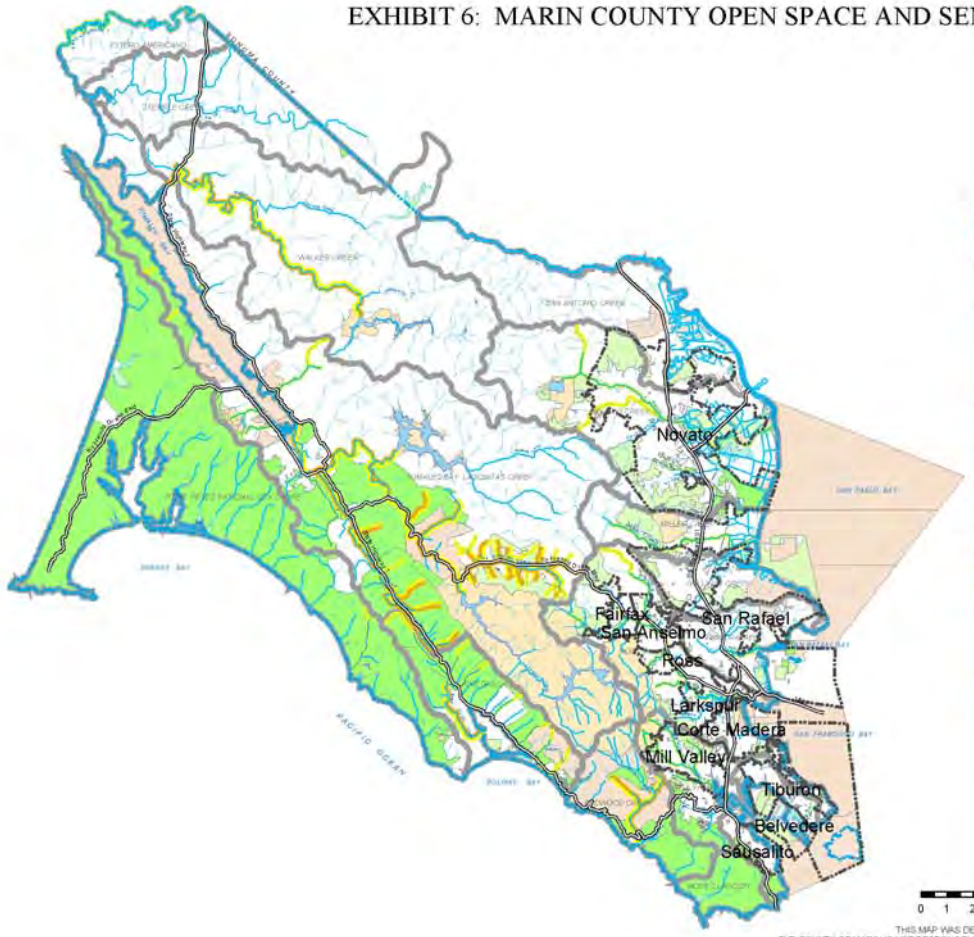
Marin County contains large tracts of public/private open space, protected park and watershed lands and agricultural lands that have experienced ecological stress due to poorly managed land uses such as livestock grazing, timber harvesting, road construction, and urbanization. The affected lands offer substantial opportunities for a more enlightened application of watershed management, including changes in land use practices and intensities, erosion control, and stream and wetland restoration. Limited opportunities for stream and wetland restoration also exist in some of the County's urban and suburban areas. The recent federal listing of coho salmon and steelhead as threatened species has increased regulatory protections for identified critical spawning streams. Also, increasingly stringent stream management objectives for Marin County set forth in its 401 Water Quality Certification (SFRWQCB 1996- locate exact reference, indirect ref. in Collins 1998) mandate the development and implementation of alternatives to traditional engineering design and maintenance of streams for flood control. In the City Centered Corridor, the designated critical streams for salmonids include Miller Creek, Corte Madera Creek, Arroyo Corte Madera del Presidio, and Novato Creek. In the Coastal Recreational Corridor, most of the significant streams carry the designation as critical habitat: Lagunitas Creek, San Geronimo Creek, Walker Creek, Olema Creek and Redwood Creek.

Exhibit 6 depicts the significant perennial and intermittent streams in Marin County. The figure also highlights those streams that have been designated as critical habitat for anadramous fish, as well as the County and federal entities responsible for stewardship of the bulk of these watershed lands. Besides private farmsteads, large tracts of open space lands are administered by the Golden Gate National Recreation Area (GGNRA), the Marin Municipal Water District (MMWD), the Marin County Open Space District (MCOSD), Pt. Reyes National Seashore, Audubon Canyon Ranch and various private water districts. The Marin County Resource Conservation District (MCRCD) assists in stewardship of local agricultural lands, primarily in the Inland Rural and Coastal Recreational Corridors. Its mission is primarily educational, as an agricultural extension service of the U.S. Department of Agriculture. However, the MCRCD also receives grant funding for planning and implementation of watershed erosion control projects, and assists local farmers and ranchers with their own erosion control efforts.

The County DPW has permit authority over residential, commercial and industrial development in its jurisdiction. In addition, the Environmental Quality Element of the 1994 Marin Countywide Plan, Policy EQ 2.2 and 2.3 mandates minimum 50 feet to 100-feet development setbacks from the top of bank for all the County's perennial and intermittent streams. Plan policies also define accepted land uses within these delineated Stream Conservation Areas (SCAs), as well as conditions regarding stream and vegetation management. Still, the County Development Code allows developers and their civil engineers to implement significant modifications to smaller creek channels, including their wholesale replacement by storm drain systems.

SOURCE: COUNTY OF MARIN

EXHIBIT 6: MARIN COUNTY OPEN SPACE AND SENSITIVE FISH HABITATS



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Typically, the smaller channels that fall outside of the SCA regulations are undefined swales or unstable gullies with minimal tributary watersheds that convey only ephemeral flow (i.e. during and immediately following a rainstorm). These ephemeral channels are the headwater tributaries of intermittent streams, and modification of their hydrologic function can affect the sediment and water discharges that influence the hydraulic and geomorphic stability of the more significant downstream channels. Moreover, the Marin County Development Code has no requirements for on-site mitigation of development-induced peak flow rates. Thus, this latitude granted the development community has subtle repercussions on the stability of downstream receiving streams.

Storm drain systems intensify the flashiness of stormwater runoff by accelerating its delivery to downstream channels. Combined with the replacement of permeable floodplain areas by impervious surfaces, storm drain system installation increases peak flow rates. This is particularly true for the more frequent flows. While such increases may not affect downstream flooding during severe, infrequent storm events (e.g. 100-year flood), they can alter the portion of the flow regime that influences channel formation.

Once flows up to the bankfull discharge, equal to roughly the 1.5-2-year discharge, are altered significantly, channel stability can decline if the sediment supply remains relatively constant. Increased peak flows are reflected in the channel's increased capacity to transport sediment. If the incoming sediment supply is not increased, the channel will begin to erode its bed and/or banks to satisfy the capacity for transport. Initially, this diminution of stability may manifest as small scale instabilities (e.g. bank slumping, excessive undercutting of the toe of bank). However, when severe winter flow seasons do occur, the already compromised banks can fail as major slumps trigger like failures downstream due to flow diversions, tree collapse and debris dam blowouts. Often the severe channel instability that develops during and after major floods is wholly attributed to those floods, rather than the progressive instability that preceded them.

2. Countywide Stream Restoration Opportunities

Up until the mid-1990's, watershed erosion control efforts constituted the primary impetus for stream restoration in Marin County. However, in 1997, the Central California Coast steelhead ESU (Evolutionarily Significant Unit) was listed as a threatened species under the federal Endangered Species Act (ESA). Later coho salmon were also given this designation. To guide public and private efforts at minimizing illegal "take" of these listed species, the National Marine Fisheries Service published the Section 4(d) Rule in June 2000. The 4(d) Rule went into effect in September 2000. It identifies both activities that are likely to harm listed salmon and steelhead and thirteen specific "limits" that describe exempted activities, i.e. activities that are already permitted under other sections of the ESA. Specifically, "Limit 8- Habitat Restoration Limits on the Take Prohibitions" exempts activities that are undertaken as "part of a watershed conservation plan", or "whose primary purpose is to restore natural aquatic or riparian habitat processes or conditions; it is an activity that would not be undertaken but for its restoration purpose". Therefore, stream restoration or bank stabilization projects that are designed and constructed in accordance with the principles of fluvial geomorphology and which incorporate features that truly enhance aquatic habitat should meet the criteria specified in Limit 8.

Among County departments, the MCFCWCD and MCOSD have assumed major roles in promoting a more ecologically sensitive approach to watershed and stream management and in assisting landowners

and stream restoration. The MCFCWCD oversees the County's implementation of the SFRWQCB's Water Quality Control Plan for the San Francisco Bay Region (i.e. 1995 Basin Plan), which requires the County and its member municipalities to enact programs that control the discharge of stormwater and other contaminants to the Bay and other receiving waters. This occurs through the aegis of the Marin County Stormwater Pollution Prevention Program (MCSTOPPP), which is a sub-section in MCFCWCD. It also is responsible for conducting watershed/stream assessments and implementing new stream management policies. MCFCWCD staff who are directly involved in these initiatives have received exceptionally high marks from interested state and federal resource and regulatory agencies (e.g. CH pers. communication with Bill Cox, CDFG, Sept. 2001).

MCOSD has been instrumental in preparing and enacting watershed management plans for the Cascade Canyon and White Hill Open Space Preserves, as well as other lands within its jurisdiction. Concern over the potential for catastrophic fires, as well as the impacts of trail and watershed erosion on critical salmonid stream habitat have led the District to implement more ecologically sensitive road and trail maintenance procedures These efforts have yielded significant improvements in roadway drainage which have likely reduced sediment yields to streamcourses (B. Cox, ibid).

Several other federal and regional agencies are actively involved in watershed studies and stream restoration projects within their jurisdictions. As outlined above, these include the GGNRA, Pt. Reyes National Seashore, MCRCD and MMWD. Also, local watershed councils and associations have formed around specific water bodies. These include the Tomales Bay Watershed Council, FishNet 4C, Friends of Corte Madera Creek, and the Septic Task Force Advisory Committee (SEPTAC), which consists of citizen representatives and County staff concerned about water quality impairment in the streams and bays in the Inland Rural and Coastal Recreational Corridors of Western Marin. Most recently (summer 2001), this list has expanded to include Blue Circle, a master coordinating group consisting of representatives of different citizen watershed organizations. Its intent is to facilitate communication and to provide a regional forum for sharing strategies and technologies for watershed management and habitat enhancement.

a. Golden Gate National Recreation Area (GGNRA)

The GGNRA administers watershed and habitat restoration projects on federal coastal lands extending south from Bolinas Lagoon to the Golden Gate. North of Bolinas Lagoon, GGNRA lands are administered by the Pt. Reyes National Seashore. Both GGNRA and PRNS are part of the National Park Service (NPS), regionally headquartered in the Presidio in San Francisco. Current GGNRA projects related to stream and watershed restoration include Redwood Creek and Eskoot Creek. The lower reaches of both of these creeks have historically been subject to floodplain modifications for agriculture and flood control purposes. In addition, logging and skid road construction have resulted in unstable watershed terrain, including landslide activity. GGNRA obtained SB271 grant funds to conduct a field investigation of sediment source areas in the Redwood Creek Watershed. NPS recently acquired funding to purchase the 35-acre Banducci Property on Redwood Creek between Muir Woods and Muir Beach. A restoration project was constructed in 2003 on the property to limit bank erosion and provide habitat for listed steelhead and coho salmon. Future restoration is planned at the site along with restoration projects of the aggraded channel and lost wetland area at Big Lagoon. Some funding has been secured and other sources of funding are being sought for project implementation. GGNRA has also been involved with the Corps of Engineers' Bolinas Lagoon Project. Historical logging, road

construction and livestock grazing in the Lagoon Watershed have produced excessive rates of sedimentation in the Lagoon. The declining tidal prism could eventually close the Lagoon's tidal inlet absent efforts to control watershed erosion. GGNRA and its consultants have proposed Lagoon dredging to increase the tidal prism and improve water quality conditions. (Clearwater Hydrology conversation with Darren Fong, GGNRA, Sept. 2001)

b. Pt. Reyes National Seashore (PRNS)

The National Park Service administers Pt. Reyes National Seashore (PRNS) which encompasses 75,000 acres of rolling hills, coastal bluffs and shoreline environs extending south from Tomales Bay, as well as nearly 25,000 acres of adjoining GGNRA lands. Streams within its boundaries include Olema Creek, Pine Gulch Creek and Redwood Creek. Both the Olema Creek and Pine Gulch Creek Watersheds have been degraded by cattle grazing, particularly unregulated access to riparian corridors. This has resulted in widespread gully development, downstream sedimentation and direct and indirect loss of riparian vegetation through trampling of banks and lateral channel migration, respectively. A Limiting Factors Analysis, funded by Prop 13 is currently being completed for both Lagunitas and Olema Creeks. A coastal watershed assessment report is due out in June 2006, and a General Management Plan and Water Resources Stewardship Plan for PRNS are also to be finalized sometime in 2006 (Clearwater Hydrology correspondence with Brandon Ketchum, September 2005)

c. Marin Municipal Water District (MMWD)

As described in the water supply portion of this report, MMWD operates an extensive network of dams and reservoirs which supply water to most of the inland corridor of Main County. By virtue of these activities, MMWD has significantly affected the flow regimes on many of the major streams draining the Coast Range and has diverted the water to the population centers along the City Centered Corridor. The principal streams affected by reservoir construction are Lagunitas Creek (downstream of Kent Lake) and Walker Creek (downstream of Soulajule Reservoir).

In the wake of the prolonged drought in the late 1970s, MMWD petitioned the State Water Resources Control Board (SWRCB) for permission to raise Peters Dam and increase the impoundment on Kent Lake. The SWRCB issued Order WR 95-17 which allowed the District to raise the dam and mandated mitigation for impacts to downstream aquatic resources. Baseline streamflow and sediment data was collected on Lagunitas Creek from 1983-95. This data was used to determine the impact of flow regulation on the flushing of watershed sediments and instream habitat degradation. It was also applied to a determination of normal vs. low water years, a distinction used to evaluate the need for augmentation of reservoir releases. In addition, instream and riparian habitat characteristics were assessed and some local erosion projects were undertaken, including gully and bank stabilization projects.

A comprehensive sediment and riparian management plan for Lagunitas Creek was completed in 1997. The plan includes recommendations for watershed erosion control (e.g. gully stabilization, fire/dirt road removal and maintenance procedures and landslide remediation), instream structures for habitat enhancement, spawning gravel importation, and riparian revegetation. Also, in accordance with the SWRCB Order, the management plan outlined monitoring requirements for streambed morphology and texture, fish and freshwater shrimp species and riparian vegetation, as well as completed bank

stabilization and erosion control projects. Specific projects are currently underway in conformance with the management plan recommendations. Marin County representatives, including Supervisor Kinsey, participate on the Lagunitas Creek Technical Advisory Committee, which oversees the implementation of the management plan. (Clearwater Hydrology conversation with Greg Andrew, Fisheries Biologist, MMWD, Sept. 2001)

In addition to the stream gauging and habitat monitoring on Lagunitas Creek, MMWD maintains stream gages on San Geronimo Creek, one of the Lagunitas Creek tributaries, and Walker Creek. A sediment study, which assessed suspended sediment concentrations and bedload, was completed for San Geronimo Creek in 2000. Extensive gully stabilization and stream restoration efforts have been implemented on Walker Creek, primarily under the auspices of the MCRCD.

d. Marin County Resource Conservation District (MCRCD)

The MCRCD is an independent resource management agency that maintains loose historical links to the Natural Resource Conservation Service (NRCS) of the U.S. Department of Agriculture. It collaborates with landowners in the planning and implementation of soil conservation, erosion control and stream and riparian restoration projects in the Tomales Bay, Drakes Bay, Stemple Creek, Stafford Lake and San Antonio Creek Watersheds. Supervised by a volunteer Board of Supervisors, the District is self-funding and its small staff obtains grant funding for its projects, which have included significant gully stabilization and stream and riparian restoration efforts on Stemple Creek and Walker Creek. The District commissioned the Stemple Creek Watershed Plan in 1994 and has implemented restoration projects recommended in that plan over the past six years. Additional projects in this watershed are continuing under the auspices of the Sonoma County Resource Conservation District, which shares jurisdiction of watershed lands with MCRCD.

Recently, the County has allocated grant monies to the MCRCD to enable it to retain two full-time staff. This has greatly improved the District's own grant acquisition process, which funds its erosion control and stream restoration efforts. Most grant funding obtained by the District requires some form of in-kind matching funds or landowner participation. In addition, some grant funding includes a retention provision, which has created significant problems for the District in its efforts at reimbursing retained contractors and landowners for erosion control and restoration services. (Clearwater Hydrology conversation with Nancy Scolari, MCRCD staff and Salley Gale, Vice President MCRCD Board of Supervisors)

e. Friends of Corte Madera Creek (FCMC)

FCMC is a watershed stakeholder group concerned with flood control and stream habitat along Corte Madera Creek and its upstream tributaries. FCMC has been an active participant in the ongoing discussions regarding the upstream completion of the Corps of Engineers Corte Madera Creek Flood Control Project. It has also be involved in the assessment of watershed erosion, sedimentation and fish habitat in the Cascade Canyon and White Hill Management Areas, which is currently being conducted by the MCOSD. In partnership with the MCFCWCD the group commissioned a geomorphic assessment of the Corte Madera Creek Watershed (Stetson Engineers 2000), as well as a study of fishery resources in the Watershed (AA Rich & Associates 2000), both of which are available to the public. The MCFCWCD sponsored the grant which funded the geomorphic assessment.

f. Tomales Bay Watershed Council (TBWC)

The TBWC was created in January 2000 with the initial goal of improving and protecting water quality in Tomales Bay. Tomales Bay supports the local economy through recreational tourism and aquaculture, primarily shellfish harvesting operations. It is also the receiving water for significant West Marin streams, including Laguintas Creek, San Geronimo Creek, Olema Creek, Chileno Creek and Walker Creek. Aside from the southern watersheds which encompass much of the Pt. Reyes National Seashore lands, the principal land use in the Tomales Bay Watershed is dairy farming. With the recent listing of Central Coast salmon and steelhead as threatened and the associated publication of Rule 4(d), the original goal was expanded to include the enhancement and protection of stream and riparian habitat in the Bay's tributary watersheds.

The Council consists of roughly 25 stakeholders, with regulatory and resource agency representatives (e.g. Pt. Reyes/National Park Service, RWQCB, CDFG) accounting for one-quarter to one-third of the total. The Tomales Bay Agricultural Group and the MCRCD are represented, as are staff of the County Department of Environmental Health Services (DEHS), the Director of the County Community Development Agency, and County Supervisor Steve Kinsey. Aquaculture operators are also represented. Among the environmental groups involved are the Tomales Bay Association, the Tomales Bay Advisory Committee, the Septic Task Force Advisory Committee (SEPTAC) and the Salmon Protection and Watershed Network (SPAWN).

Contaminated runoff from dairy farms and aging residential septic systems have degraded Tomales Bay water quality. This has resulted in its listing as an impaired water body for heavy mercury, nutrients, pathogens and sedimentation/siltation by the RWQCB. For further discussion of this link to the Council's work, see the section on Water Quality. Historical logging and continuing cattle grazing in the surrounding watershed lands have spawned significant gully development and/or channel instabilities. This has increased the delivery of sediment to the Bay's tributaries, degrading instream habitat for fish. For this reason, Laguintas and Walker Creeks have been designated by the RWQCB as impaired for sedimentation/siltation. As noted above, MMWD has been actively monitoring sediment loading and instream habitat characteristics in Lagunitas and San Geronimo Creeks since the 1980s.

TBWC has retained a water quality consultant to prepare a Watershed Stewardship Plan for the Tomales Bay Watershed. A Draft Plan was completed in March 2003. The Plan describes four actions to achieve its outlined goals. These actions include water quality monitoring in the Bay and surrounding watershed, reducing nonpoint source pollution, protecting and restoring habitat and public outreach and education about Tomales Bay and its watershed. g. North Bay Watershed Association (NBWA)

The member agencies that constitute the NBWA are described in the prior section on Water Quality. In addition to its coordinating role in bi-County water resource planning, the NBWA promotes and assists in obtaining grant funding for stream and wetland restoration projects in the Main-Sonoma area. At this stage in the organizations young history, actual restoration projects are under consideration, but none have been implemented.

3. Specific Stream Restoration Opportunities on County Jurisdictional Lands

Within its immediate jurisdiction, the MCFCWCD plans to facilitate stream restoration efforts on both Miller Creek and a small perennial creek located in the San Rafael Meadows neighborhood. A recent unpublished investigation of the fluvial geomorphology and biotic condition of Miller Creek was undertaken by the MCFCWCD, in association with the San Francisco Bay Estuary Institute's Watershed Inventory Project. The investigation concluded that Miller Creek maintains a native trout population and provides some of the best habitat for anadramous fish in the County. Sampling of channel bed sediments also indicated that the fine sediment loading was greater than expected for a watershed in this geologic terrain. Thus, upstream bank and channel erosion along Miller Creek is likely an inhibiting factor in the maintenance and enhancement of salmonid habitat in the watershed. (Unpublished data from L. Collins investigation, furnished by Liz Lewis, MCFCWCD, Feb. 2001).

County staff are currently advising small landowners in the application of biotechnical bank stabilization methods. MCFCWCD is also taking a lead role in the preparation of grant proposals for ecologically sensitive stabilization/restoration projects on Miller Creek under the Department of Water Resources' Urban Creeks Restoration Program. (Liz Lewis, pers. comm., Feb. 2001). Initial steps have been taken to facilitate and locate funding for one such project on the Wetzel Ranch property. While the right-of-way constraints on the Wetzel Ranch property are significant, ecologically sensitive bank stabilization could be implemented through that reach.

Immediately upstream of the Wetzel Ranch boundary, the bed of Miller Creek rises abruptly at the system's most severe barrier to fish passage. The channel headcut, which reaches a height of roughly 15 feet, has been haphazardly stabilized by former landowners using riprap and concrete debris. Upstream of the headcut on the property now owned by Lucasfilm Ltd. (formerly the Grady Ranch), the meandering channel is severely degraded, and is characterized by an excessive width-depth ratio, vertical to near vertical banks and a high degree of entrenchment. A preliminary restoration plan for this upper reach of Miller Creek was prepared in association with the Lucasfilm Ltd. Master Plan (Nichols Berman 1996). The restoration plan includes the conversion of the fish barrier to a passable step-pool cascade. If these contiguous restoration projects were implemented, the length of the Miller Creek channel open to migratory fish would dramatically increase and downstream loading of fine sediments would decrease.

Both the City of San Rafael and the County of Marin participated in the preparation of a study of land use and environmental enhancement opportunities on the St. Vincent's/Silveira Ranch property east of Highway 101. Study recommendations regarding flood control and stream and riparian corridor enhancement included: 1) re-alignment of Miller Creek east of the NWPRR tracks to approximate its historic alignment to San Pablo Bay; and 2) restoration of Miller Creek, particularly in the reach immediately west of the NWPRR tracks where the banks are unstable and habitat degraded.

a. Stream Restoration- Design and Implementation

Over the past 15 years, the design and construction practices associated with the hydrologic restoration of streams and their associated biotic habitats have steadily evolved and are now recognized as credible alternatives to standard engineering channel design and stabilization measures (e.g. concrete lining, concrete retaining walls, rock riprap and gabion revetments). Prior to this period, the accepted channel

design criteria applied by flood control engineers focused on efficient conveyance of the stormwater runoff generated by the maximum design storm (e.g. 100-year flood) for the contributing watershed. Typically, this entailed a structurally reinforced, regular trapezoidal channel cross-section which was not very effective at transporting the channel sediment load at low to moderate discharges. While this design configuration allowed for development in previously functional floodplains, it also resulted in significant maintenance costs and the destruction of significant riparian habitat. Accumulated sediment and vegetation in these flood control channels had to be removed periodically to maintain the lower hydraulic roughness values associated with the design flood protection levels. This maintenance precluded the establishment of natural biotic and aquatic habitats either in or alongside the channels.

As noted above, federal and state resource and environmental agencies have begun to apply stricter environmental constraints on flood control and stabilization projects, including their requirements for in-channel maintenance of vegetation. Regulatory requirements have, in turn, precipitated more proposals and projects incorporating some form of stream or riparian habitat restoration. Unfortunately, much of what passes for stream restoration does not integrate basic principles of fluvial geomorphology with commonly understood hydraulic engineering design. In the urban and suburban attempts at restoration, project site constraints such as limited right-of-way, multiple parcel ownership and geomorphically entrenched (i.e. incised) channel conditions make real stream restoration more difficult, if not infeasible. However, in such settings biotechnical bank stabilization techniques (also referred to as "soil bioengineering") can provide some enhancement of riparian habitat, even if more structural stabilization elements (e.g. rock or gabion revetments) dominate the design.

To the extent possible, the primary goal of a stream restoration project, be it a natural channel restoration utilizing geomorphic design principles or a more limited bank stabilization project, should be to create a stable channel. A stable channel is defined as a channel that is in a state of quasi-equilibrium with the prevailing water and sediment regime. In extreme cases of undersupply or oversupply of incoming watershed sediment, (e.g. upstream reservoir- undersupply; or massively unstable hillslopes or higher terraces- oversupply), the water and sediment regime are in such flux that the stable channel is a continuously morphing target. However, for relatively stable watershed conditions, a stable channel form is a practical and attainable goal. If stable conditions exist in a particular restoration/stabilization reach, it is unlikely that project construction (with appropriate professional supervision) will have a detrimental effect on adjacent channel reaches.

Where sufficient right-of-way is available to accommodate a natural stream restoration, design elements should include the following:

- A hydraulic design that considers both the water and sediment discharge characteristics of the stream, as well as its morphological character. For example, the form and cross-section of a low-gradient, meandering channel would differ from that of a higher gradient (>2 percent) channel with little or no sinuosity.

- A channel plan form (e.g. alignment, sinuosity) that matches that which is characteristic of natural streams with similar slopes, channel and bank sediments, and flow regime in the region.

- A composite channel cross-section that incorporates low flow and bankfull channels. The low flow channel conveys flow for longer periods into the dry season, while the bankfull channel conveys

flows at the 1.5- to 2- year recurrence interval without excessive scour or deposition. The exception to this design format would be in a gully repair with a minor winter base flow.

- Biotechnical bank stabilization methods to promote the quick establishment of riparian trees and other native vegetation. Certain types of biotechnical measures (e.g. native material revetments) can also provide a really limited and beneficial scouring of the channel bed. The establishment of riparian trees increases stream shading (especially south and west facing bank planting), lowers water temperatures and improves aquatic habitat. Targeted structural measures can be instituted where erosive pressures are high and right-of-way restrictions limit the extent of flood terrace or floodplain construction. Care should be taken, however, to match the extent of such stabilization with the local hydraulic conditions. Excessive stabilization can reduce the potential for habitat restoration, while inadequate stabilization can result in severe erosion where the structural protection transitions to the native bank.

- Channel bed stabilization and/or habitat enhancement features which stabilize the bed and adjacent banks (particularly in higher gradient streams), dissipate excessive erosive energies in floodflows, and promote local variations in the streambed topography (e.g. scour pools).

- Where channel re-alignment is required due to right-of-way or other constraints, the sediments that comprise the channel bed and low terraces (if included) should be of similar size and gradation as nearby channels with similar geology and slopes. Some natural sorting of bed material will occur during the first flow season following construction. However, in most high gradient streams, natural bed armoring typically forms over time in response to the locally higher bed shear stresses that accompany these channels. Thus, failure to install natural armoring material with appropriate levels of embeddedness can result in early channel incision and undesirable channel adjustments.

F. MARIN COUNTYWIDE PLAN REVIEW

Countywide Plan policies and programs which directly or indirectly address hydrology and water quality issues fall into three categories:

- Flood control and flood hazard protection

- Impacts of construction on hydrologic and biological processes

- Stream and Creekside Conservation Areas (SCAs)

Table 4 outlines each of the pertinent policies and programs cited in the 1994 CWP that pertain directly to watershed runoff and peak flow generation, stream stability, stream habitat quality, hydrologic attributes of stream conservation areas (SCAs), stormwater runoff quality and development effects on erosion, sedimentation and instream habitat and water quality. It identifies whether the policies and programs are sufficient in their present form, should be eliminated due to redundancy or lack of relevance, or require some refinement. Policies and programs related to flood control and flood hazard protection are evaluated in a similar manner in the companion Environmental Hazards Element Technical Report on Flooding. Due to its importance in promoting ecologically-sensitive management

along CWPA stream corridors and enhancing water quality, a general discussion of SCAs and their significance in flooding and flood control efforts is included below.

Stream Conservation Areas (SCAs) are defined under CWP Policy EQ-2.3 as follows:

Policy EQ-2.3 Definition of Stream Conservation Areas. A Stream Conservation Area (SCA) should be designated along all natural watercourses shown as a solid or dashed blue line on the most recent appropriate USGS quad sheet, or along all watercourses supporting riparian vegetation for a length of 100 feet or more. The zones consist of the watercourse itself between the tops of the banks and a strip of land extending laterally outward from the top of both banks, to a width of 100 feet on each side in the Coastal Recreation and Inland Rural Corridors and to a width of 50 feet on each side in the City-Centered Corridor on smaller infill lots. Where large tracts of land in the City-Centered Corridor are proposed for development, the 100-foot buffer should be applied, where consistent with legal requirements, and other planning and environmental goals. In the Coastal Recreation and Inland Rural Corridors, the zone should be extended if necessary to include an area 50 feet landward from the edge of riparian vegetation.

Stream Conservation Areas (SCAs) protect the following valuable hydrologic functions pertinent to groundwater recharge, stream stability, erosion control and water quality, and instream and riparian habitat:

> Infiltration and groundwater recharge- In many valley environs in the CWP, the principal zone of rainfall infiltration and groundwater recharge is the alluvium (e.g. sands and gravels) that occupy the valley floor. The restrictions on development within the SCAs, in particular the introduction of new impervious surfaces, maximize the extent of rainfall infiltration and groundwater recharge on the valley floor. This infiltrated and recharge process extends the time over which the rainfall discharges to local stream channels as seepage and groundwater discharge. The natural diversion of this water from the process of storm runoff generation reduces the peak flow rates associated with channel discharges for a given storm event. Maintenance of natural rates of runoff over portions of the watershed eases flooding pressures on hydraulic structures and natural channel reaches located further downstream. CWP Policies EQ-2.15: Stream Alterations and EQ-2.28: Protection of Watersheds, Aquifer Recharge Areas and Natural Drainage Systems directly address the maintenance of infiltration and groundwater recharge attributes in SCAs. Policies EQ-2.9: Minimal Disturbance of Vegetation and EQ-2.11: Modification of Natural Channels indirectly pertain to these attributes via the protection of riparian vegetation and the minimization of impervious surfaces.
>
> Stream channel stability—SCAs provide protection of riparian vegetation along stream corridors. Riparian vegetation, particularly riparian trees, has a direct impact on the stability of streambanks. When riparian vegetation is removed, the shear and tensile strength provided to streambank soils by the root masses of trees and other riparian plants is lost. The streambanks then become more vulnerable to various forms of erosion and failure, e.g. slumping following high flow events, trampling by cattle access. This is not to infer that all corridors with riparian vegetation are stable. If upstream compaction of soils and gully formation occur due to livestock grazing, urbanization, or other detrimental watershed practices, the balance between stream

discharge and sediment load can be lost and instabilities can ensue. However, even in such cases, the impact of bank erosion and stream instability is minimized by the aforementioned effects of riparian vegetation along the stream corridor. When streambanks become unstable, entire reaches of a stream channel, at and downstream of the initial instability, can undergo a process of progressive destabilization due to debris obstructions, heightened sediment deposition (e.g. in bar deposits and debris jams) and instream flow deflections. This can reduce the effective flood conveyance in a stream and increase local flood elevations.

One current CWP policy directly addresses channel stability concerns: Policy EQ-2.9: Minimal Disturbance of Vegetation. Several other policies indirectly infer some link to this SCA attribute, including Policies EQ- 2.4: Land Uses in Stream Conservation Areas, EQ-2.5: Prohibited Land Uses in Stream Conservation Areas, EQ-2.8: Retention of Riparian Vegetation, EQ-2.10: Tree and Shrub Plantings and EQ 2.22 Altering Stream Flow, Bed and Banks.

Erosion, sedimentation and water quality- In addition to the erosion of streambanks associated with loss of riparian vegetation along stream corridors, the vegetated corridor acts as a filter for sediments moving in overland flow (either in broad swales, small channels or overland) toward the principal stream channels. Water pollutants such as heavy metals can adsorb onto sediment particles, which are transported in runoff to streams. However, when sufficient vegetated buffers and vegetated swales (i.e. bioswales) are provided to convey runoff toward streams, the vegetation filters the contaminated sediments from the runoff. Concentrations of herbicide and pesticide residues, as well as oil and grease residues, can also be reduced to some extent by vegetated buffers. Since turf and other native grasses often are more efficient filter mediums than relatively sparsely vegetated areas underneath riparian tree canopies, the 50-feet buffer landward of the actual riparian boundary which is cited in the existing SCA ordinance is crucial to the performance of the SCA in its water quality protection function.

Existing CWP policies that directly refer to erosion, sedimentation and water quality in SCAs include Policies EQ-2.8: Retention of Riparian Vegetation, EQ-2.14: Monitoring Stream Conservation Areas, EQ-2.15: Stream Alterations, EQ-2.23 Seasonal Development Factors, EQ-2.29: Upstream Development Impacts, and EQ-2.31: Water Quality. Policies that only indirectly pertain to erosion, sedimentation and water quality in SCAs include Policies EQ- 2.4: Land Uses in Stream Conservation Areas, EQ-2.5: Prohibited Land Uses in Stream Conservation Areas, , EQ-2.9: Minimal Disturbance of Vegetation, EQ-2.11: Modification of Natural Channels, EQ-2.17: Stream Management Plans, EQ-2.18: Soil Disturbance, EQ-2.20: Retention of Sediment, and EQ-2.21: Roads, Road Spills and Roadfill Slopes.

Instream and riparian habitat- As noted in the above discussion on the erosion, sedimentation and water quality effects of SCAs, the combined riparian plus landward vegetative buffer specified in the SCA ordinance is crucial in maintaining the SCA's water quality function. This water quality maintenance function as it relates to stormwater runoff has an important influence on the quality of instream waters and the health of the aquatic habitat. Improved stormwater quality, particularly in combination with a reduced dependency on storm drain installations to convey developed area runoff, has a direct impact on the viability of receiving waters to support fish and the invertebrates they feed on.

Existing CWP policies that directly address instream and riparian habitat include Policies EQ-2.4: Land Uses in Stream Conservation Areas, EQ-2.8: Retention of Riparian Vegetation, EQ-2.9: Minimal Disturbance of Vegetation, EQ-2.11: Modification of Natural Channels, EQ-2.14: Monitoring Stream Conservation Areas, EQ-2.15: Stream Alterations, EQ 2.22 Altering Stream Flow, Bed and Banks, EQ-2.24: Enhancement of Stream Conservation Areas, and EQ-2.31: Water Quality. Policies EQ-2.5: Prohibited Uses in Stream Conservation Areas, EQ-2.10: Tree and Shrub Plantings, EQ-2.17: Stream Management Plans, EQ-2.23 Seasonal Development Factors, EQ-2.26: Restoration of Damaged Portions of Stream Conservation Areas, EQ-2.28: Protection of Watersheds, Aquifer Recharge Areas and Natural Drainage Systems, and EQ-2.29: Upstream Development Impacts relate indirectly to instream and riparian habitat.

As MCSTOPPP's Aquatic Macroinvertebrate Sampling Program has discovered in its initial sampling and surveying efforts, invertebrate species diversity and sensitive species populations increase with increasing distance upstream into the watershed. (Clearwater Hydrology conversation with Elizabeth Lewis, op cit.) Given the settlement patterns in the County, this strongly suggests a link between degraded stormwater quality and a reduction in instream habitat quality.

G. KEY ISSUES, TRENDS AND OPPORTUNITIES

The NPDES permit program implemented Phase II stormwater regulations in 2003. TMDL criteria for selected stormwater contaminants, including mercury (2004), PCBs, diazinon, and other pollutants will be implemented during 2005–2008. A more substantial stormwater monitoring program would include sampling and laboratory testing for TMDL constituents and perhaps a wider array of regulated contaminants.

For new development and redevelopment along the urbanized eastern corridor, particularly in areas still drained by quasi-natural streams, the issue of peak flow and water quality mitigation needs to be addressed in a more comprehensive manner by the Department of Public Works, including the MCFCWCD, and the Community Development Agency. At present, the Development Standards outlined in Title 24 of the County Code are administered by the Department of Public Works. These standards consist of specific design specifications and directives that are evaluated at the Precise Plan level of a development project.

The Development Code (Title 22), which comprises both the County Zoning and Subdivision ordinances, guides the initial layout and design approach taken by developers at the Master Plan and Tentative Map stages of a project. The current County Development Code does not include strong enough guidance to the development community to influence a move toward integration of start-at-the-source design features. In combination with similarly strengthened specifications for new construction in the Title 24 Development Standards, the County would be able to influence development projects toward a more ecologically sensitive approach. Such changes could reduce the time and expense of environmental review, as many of the protests of the interested communities and regulatory agencies are associated with undergrounding of drainageways (i.e. replacement with storm drain systems), peak flow increases and water quality and sensitive habitat impacts- all of which could be minimized if the

development community utilized more ecologically-sensitive design features at the earliest stages of the planning and environmental review process.

In August 2001, staff with both the Land Use and Water Resources Division of the County DPW and the MCFCWCD prepared a memorandum that identified several sections of Title 22 which could be modified to conform more closely with project design guidelines outlined in *Start at the Source: Design Guidance Manual for Stormwater Quality Protection* (Bay Area Stormwater Managers Agencies Association (BASMAA) 1999) and *Start at the Source Tools Handbook* (BASMAA/EOA, Inc. 2000). Only one of the recommended sections pertained directly to flooding: Section 22.080 Parking Requirements. For this section, the recommended language comprised two bullet items:

- Reduce impervious area through shared parking
- Encourage the use of pervious surfaces (i.e. Turfblock, porous asphalt, gravel) wherever feasible, especially for overflow parking.

The County has three strong regulatory pillars to utilize in promoting modifications to the Development Code: Phase II NPDES stormwater permit requirements (2003); TMDLs for high priority contaminants, including mercury (2004), PCBs and Diazinon (due in 2005-2008); and Rule 4(d) for steelhead (2000). On-site stormwater design is a significant link in the chain of hydrologic influences on water quality and aquatic habitat.

Finally, the County will have the opportunity to support stream and wetland restoration projects within the CWPA, both on lands under its active jurisdiction and on County lands administered by the federal government and by NMWD and MMWD. Stream restoration opportunities exist on the small perennial drainage in the San Rafael Meadows subdivision and on Miller Creek, both upstream and downstream of Highway 101. Some wetland restoration potential also exists in association with the St. Vincent's/Silveira Park lands east of Highway 101. In addition, significant opportunities exist for the County to continue in its already strong cooperative efforts to facilitate watershed management activities by local watershed groups, coalitions and resource organizations. These include the MCRCD, FishNet 4C, the Tomales Bay Watershed Council (TBWC), SEPTAC and the Friends of Corte Madera Creek. If properly implemented, watershed management plans can enhance water quality and aquatic habitat in both streams and the downstream receiving waters of Marin's plentiful bays and lagoons.

Specific recommendations for water quality and restoration projects and activities within the CWPA include:

- Promote MCSTOPPP's development of BMP lists and stormwater sampling, testing and reporting obligations required to meet the Phase II NPDES stormwater protection goals and TMDL water quality criteria.
- Support the incorporation of Standardized Urban Stormwater Mitigation Plans (SUSMPs) or their equivalent into the County's soon-to-be issued NPDES stormwater permit.

- Modify Title 23: Natural Resources and Title 24: Development Standards of the County Code in the following areas:

- Strengthen code language in Section 23.18.093 items (b) and (c) regarding BMPs for new developments and redevelopments. Enforce the implementation of site design measures that minimize increases in runoff volume and peak flows. Refer project applicants to the BASMAA publications: *Start at the Source: Design Guidance Manual for Stormwater Quality Protection* (BASMAA 1999) and *Start at the Source Tools Handbook* (BASMAA/EOA, Inc. 2000); and strictly enforce the implementation of this approach via DPW's review and permitting authority. Prohibit the elimination of surface drainageways and their substitution by storm drain systems, wherever surface drainageways can be retained without exacerbating local flooding conditions. For headwaters swales or gullies that drain small watershed areas, minor drainageway re-alignment and/or restoration should be preferred over storm drain installations.

- Consolidate and clarify all SCA-related policies and programs which are at present overlap and lack specificity. Add protections for all channels delineated on the Marin County Soil Survey. The Soil Survey includes well-defined channels that do not show up as blue line streams on the USGS quadrangle sheets. Channel setbacks should be modified to provide setbacks from the top of bank as determined by a 2:1 extrapolation from the toe of bank, rather than from the top of bank per se. In degraded reaches of creeks, future bank retreat will be accommodated by this adjustment in the SCA provisions. Minimum buffers landward of areas of significant riparian vegetation, currently specified at 50 feet in width, should be retained.

- Continue the County's strong representation in the watershed management and planning activities of the Tomales Bay Watershed Council (TBWC), the Septic Task Force Advisory Committee (SEPTAC), and the North Bay Watershed Association.

- Explore the possibility of obtaining the services of the USGS to conduct a regional groundwater study of the Tomales Bay Watershed, including the Walker, Lagunitas, Stemple and Olema Creek Watersheds. The State Water Resources Control Board (SWRCB) has recently passed Resolution No. 2001-026 authorizing the Executive Director to enter into an agreement with the USGS or Lawrence Livermore National Laboratories, or other public agency to conduct ambient groundwater monitoring. The total allocation is not to exceed $2,245,000. (SWRCB web site, Sept. 2001)

- Continue to assist the MCRCD with grant assistance in order to facilitate their collaborative erosion control and stream restoration activities with local North Marin landowners and farm/ranch operators. Grant assistance has allowed the District to maintain two full-time staff, which is critical for its pursuit of additional project funding and landowner cooperation.

- Upgrade the County's trail and rural road maintenance practices to reduce local erosion, water quality and habitat impacts. Implement proper trail and roadway drainage practices; retrofit old culvert outlets with ecologically appropriate energy dissipation measures; and stabilize and revegetate gullies that have formed in response to culvert installation. Where fish passage has been eliminated due to culvert-induced scour, rebuild transition structures appropriate for fish passage.

(Trail improvements and erosion reduction activities of this sort are currently being implemented by the MCOSD as part of the Cascade Canyon and White Hill Management Plan.) The MCRCD Board Vice-President has cited culvert-induced gully erosion as a critical factor in continuing watershed erosion and downstream sedimentation in Western Marin (Clearwater Hydrology conversation with Salley Gale, MCRCD Board V.P., Sept. 2001).

- In association with the MCFCWCD's ongoing channel maintenance and stormwater quality initiatives, promote the implementation of the above-mentioned trail and road maintenance practices among municipalities in the CWPA. While the County's recent efforts at amending road and trail practices have produced some encouraging results thus far, the same effort has been largely absent at the city level. (Clearwater Hydrology conversation with Bill Cox, biologist, CDFG, Sept. 2001)

- Some potential may exist for tidal wetland or seasonal wetland restoration at the lower end of Miller Creek, in conjunction with the ultimate development of the St. Vincent's/Silveira Ranch property. The County should advocate for a strong wetland restoration component along the tidal reach of Miller Creek.

- Continue with MCFCWCD staff efforts toward obtaining grant funding for restoration of portions of Miller Creek through the Marinwood residential subdivision and potentially on the Wetzel Ranch property.

- Lucasfilm Ltd. has proposed to restore the upper reaches of Miller Creek on the former Grady Ranch. This reach of the creek is critical to expanding anadramous fish habitat, as it would include the removal of an in-stream barrier to migration. The County should promote implementation of this restoration program, if and when it is proposed.

- Investigate assisting the Marinwood Community Services District in obtaining grant funding for modifications to the original Miller Creek restoration along the Lucas Valley Estates Subdivision reach. Specifically, the modifications would be to retrofit and/or amend the existing channel stabilization measures to improve channel geomorphological function and instream habitat for fish (e.g. add pool habitat through the reach). Initially, the targeted sub-reach would extend from 250 ft. below the lower subdivision bridge crossing to 250 ft. above the crossing. Other sub-reaches could also be modified based on an available funding and an evaluation of fish habitat objectives and the recent geomorphic survey of Miller Creek by Laurel Collins (unpublished).

Table 4
EVALUATION OF EXISTING COUNTYWIDE PLAN
HYDROLOGY POLICIES AND PROGRAMS

Environmental Quality Element

RESOURCE CONSERVATION AREAS

1. Stream and Creekside Conservation Areas	
Policy EQ-2.1 Value of Riparian Systems. Riparian systems, streams and their riparian and woodland habitat are irreplaceable and should be officially recognized and protected as essential environmental resources, because of their values for erosion control, water quality, fish and wildlife, aesthetics, recreation, and the health of human communities.	Needs Refinement. Add mention of groundwater recharge and channel stability to values list.
Policy EQ-2.2 Streams Defined as Blue Lines on USGS Quad Maps. All perennial and intermittent streams, which are defined as natural watercourses shown as solid or dashed blue lines on the most recent appropriate USGS quad sheet, should be subject to these stream and creekside protection policies. A perennial stream is further defined as: a watercourse that flows throughout the year (except for infrequent or extended periods of drought), although surface water flow may be temporarily discontinuous in some reaches of the channel such as between pools. An intermittent stream is further defined as: *a watercourse that flows during the wet season, continues to flow after the period of precipitation, and ceases surface flow during at least part of the dry season.* An ephemeral stream should be subject to these policies if it supports riparian vegetation for a length of 100 feet or more. An ephemeral stream which does not support vegetation for 100 feet or more may also be subject to the SCA policies if it is demonstrated that the stream has value for flood control, water quality, or habitat which supports rare, endangered, or migratory species. An ephemeral stream is defined as: *a watercourse which carries only surface runoff and flows during and immediately after periods of precipitation.*	Needs Refinement (Potentially). Consult with Bill Cox of CDFG and others involved with sensitive species habitat preservation- ephemeral streams w/o 100 ft. long riparian corridor which has a defined channel (incised) may warrant SCA status.

Policy EQ-2.3 Definition of Stream Conservation Areas. A Stream Conservation Area (SCA) should be designated along all natural watercourses shown as a solid or dashed blue line on the most recent appropriate USGS quad sheet, or along all watercourses supporting riparian vegetation for a length of 100 feet or more. The zones consist of the watercourse itself between the tops of the banks and a strip of land extending laterally outward from the top of both banks, to a width of 100 feet on each side in the Coastal Recreation and Inland Rural Corridors and to a width of 50 feet on each side in the City-Centered Corridor on smaller infill lots. Where large tracts of land in the City-Centered Corridor are proposed for development, the 100-foot buffer should be applied, where consistent with legal requirements, and other planning and environmental goals. In the Coastal Recreation and Inland Rural Corridors, the zone should be extended if necessary to include an area 50 feet landward from the edge of riparian vegetation.	Needs Refinement
Program EQ-2.3a Protection of Stream Conservation Area. The County shall implement the policies for Stream Conservation Areas through its established permit review processes and/or through adoption of specific new ordinances. When a development permit is applied for, staff will determine whether the proposed development falls within the zone, generally 100 feet from the banks of streams (50 feet from the banks of streams in the City-Centered Corridor). If the project is in this zone, staff will determine whether the proposed use is permitted by right under the Stream Conservation policies, as well as by the underlying zoning. If the proposed use is not a permitted use in Policy EQ-2.4 and it is not a prohibited use in Policy EQ-2.5 of Stream Conservation policies, but it is allowed under the zoning, the applicant may apply for a development permit. In order for such a permit to be issued for an existing parcel, it should be determined that the parcel either: Falls entirely within the Stream Conservation Area; or Development on any other portion of the parcel (outside the SCZ) would have greater impacts on water quality. If the proposal involves the creation of a new parcel, any needed modifications should be made to assure that no development occurs within the Conservation Area to the extent possible. Applicants shall be required to submit adequate information to determine whether the Stream Conservation Area policies are being met. All development permit applications shall be reviewed for conformity with these policies, and in accordance with the California Environmental Quality Act. Proposals which do not conform to Stream Conservation policies, and which cannot be modified or mitigated so that they do conform, shall be denied. Information on 100-year floodplains should be made available for public and staff reference and shall be incorporated into all planning reviews	Needs Refinement. Specifically define the physical dimensions of the zone (e.g. refer to existing CWP figure EQ-3) and adjust the streamward edge of the SCA to show 50 or 100 ft. landward of the 2:1 projection of the nearest toe of bank. This is more conservative than taking it from the existing top of bank, if the bank happens to be nearly vertical. Also, include a landward buffer of grassland or other undevelopable land of 50 ft. outside of the landward edge of riparian vegetation.

Program EQ-2.3bEstablish a Fund to Fence Sensitive Stream Areas. The County should explore the feasibility of creating a fund, established in conjunction with the Resource Conservation District and the Soil Conservation Service, and other relevant agencies, to pay the cost of fencing sensitive streamside areas (on private property) which could be impacted by cattle grazing.	Needs Refinement. Appears to be in conflict with Policy EQ-2.4 which allows grazing in SCAs. Expand the discussion to clarify under what circumstances fencing should be sought. Otherwise insert a statement of preference for ungrazed SCAs or partial livestock access at stabilized stream access points (i.e. planned gaps in exclosure fencing).
Policy EQ-2.4 Land uses in Stream Conservation Areas (SCAs). The following uses are permitted in the SCA by development permits, provided these uses are allowed by the underlying zoning: • all currently existing structures and uses including reconstruction and repairs • necessary water supply projects • flood control projects • projects to improve fish and wildlife habitat • grazing of livestock and other agricultural uses • maintenance of water channels for erosion control and other purposes • road and utility line crossings • water monitoring installations • trails	Needs Refinement. Requires better defined exemptions, circumstances under which grazing and flood control projects are allowed; specify types of erosion control that are preferred (consult with MCFCWCD). Also, blanket permission for grazing of livestock and other agricultural uses can lead to severe channel destabilization and impairment of instream water quality. Thus, there should be mention of appropriate grazing which would be managed according to the health of the riparian corridor and/or the stream channel itself. Grazing densities and scheduling should be approved only where it is part of a riparian/range management program approved by the County. Otherwise, some stream systems that are currently unstable and largely devoid of a healthy riparian corridor could continue to act as sediment sources that are detrimental to aquatic habitat, including fish and shellfish (e.g. Tomales Bay).
Policy EQ-2.5 Prohibited Land Uses in Stream Conservation Areas. The following new uses are prohibited in the SCA: • roads and utility lines, except at crossings • confinement of livestock • dumping or disposal of refuse • use of motorized recreational vehicles • any structural improvement (excluding repairs) other than those identified in Policy EQ-2.4, including residences, barns, and storage buildings, unless allowed by a development permit in Policy EQ-2.6.	Needs Refinement. Add horse stables and riding rings which could compromise stream quality in the event of overbank flooding and normally due to entrained sediment in overland runoff.

Policy EQ-2.6 Other Allowable Land Uses in the Stream Conservation Areas. Other uses may be allowed in the SCA by development permit, provided these uses conform to all other policies for SCAs and are: • allowed by the underlying zoning • on existing parcels that fall entirely within the zone • on existing parcels where it can be conclusively demonstrated that development on any other part of the parcel would have a more adverse effect on water quality or other environmental impacts.	Still Applicable.
Policy EQ-2.7 Consideration of Costs. All concerned agencies should take aesthetic, scenic, environmental, and recreational benefits into full consideration when computing costs of alternatives for modifications of streams (applicants will be required to obtain a Streambed Alteration Agreement from the State Department of Fish and Game).	Still Applicable.
Policy EQ-2.8 Retention of the Natural Vegetation. The retention of the natural vegetation in an SCA should be encouraged in order to realize benefits such as soil erosion prevention, stream, shade, etc. When vegetation must be removed and soil disturbed within the SCA, or when vegetation has been destroyed or eliminated, the area should be re-seeded or replanted with native plants of the habitat as soon as possible. Broom and other aggressive exotic plants should be removed and replaced with native plants.	Needs Refinement. Benefits: erosion control and reductions in downstream sedimentation, enhances channel stability, preserves water quality and aquatic and wildlife habitat (e.g. stream shading and invertebrate populations) for fish and other species.
Policy EQ-2.9 Minimal Disturbance of Vegetation. Disturbance of vegetation within the SCA should be minimized or avoided whenever possible. Minimizing or avoiding disturbance of streamside vegetation is particularly important for trees and shrubs which provide shade, stability for the streambank, and wildlife habitat. Vegetation may partially block streams creating a ponding effect which may be beneficial fish habitat. Tree growth may be cleared from the stream channel when it unduly restricts flood flows, to protect health, safety, and welfare.	Needs Refinement. Tree growth or debris should be cleared from the channel if it unduly restricts floodflows or jeopardizes streambank stability due to the deflection of currents at high flows, to protect
Policy EQ-2.10 Tree and Shrub Plantings. Trees and shrubs to be planted along watercourses should include a variety of species that would naturally grow in or near the creek. In general, the planting of exotic trees should be avoided. When removal of riparian vegetation is unavoidable, and mitigation is required, replacement should be at a 2:1 ratio, whenever feasible. Enhancement and restoration of culverted streams is encouraged, whenever feasible.	Needs Refinement. Last sentence seems to belong elsewhere, perhaps EQ-2.11
Policy EQ-2.11 Modification of Natural Channels. Modification of natural channels within SCAs for flood control, etc., should be done in a manner that retains and protects the vegetation forming ground cover and shade. Special attention should be given to the protection of riparian vegetation.	Needs Refinement. Add strong preference for exclusion of storm drains and culverts within SCAs.

Policy EQ-2.14 Monitoring Stream Conservation Areas. A system of monitoring SCAs should be established to assure the protection of vegetation, soils, water quality, and wildlife habitat along streams.	Needs Refinement. Clarify how this is being accomplished. To date, no formal monitoring of SCAs is conducted by MCFCWCD. Consult with MCFCWCD to determine whether such a system is feasible given the number of streams involved and County resources. Mention could be made of the Aquatic Macroinvertebrate Sampling Program and goals or objectives of same (this program uses volunteer labor under supervision/coordination of County staff.
Policy EQ-2.15 Stream Alterations. Before any stream alterations are permitted, the minimum water flows necessary to protect fish habitats, water quality, riparian vegetation, groundwater recharge areas, and downstream users should be determined in conjunction with the State Department of Fish and Game and the Division of Water Rights of the State Water Resources Control Board.	Needs Refinement. The language of this policy seems to fit diversions rather than alterations. The text would be fine if the subject was Stream Diversions. A separate policy could be crafted to deal with Stream Alteration, including CDFG, RWQCB, US ACOE consultation.
Policy EQ-2.17 Stream Management Programs. Projects and stream management programs which improve the opportunity for fishing and enhance the abundance of sport fish should be encouraged and supported.	Still Applicable.
Policy EQ-2.18 Soil Disturbance. Soil disturbance should be discouraged within the SCA. Where absolutely necessary it should be limited to the smallest surface area and volume of soil possible and for the shortest practical length of time.	Needs Refinement. Add mention of requirement for revegetation following disturbance, with use of native plant species. Also refer to Policy EQ-2.10 for mitigation ratios. Alternatively, combine EQ-2.10 and EQ-2.18.
Policy EQ-2.19 Surface Runoff. Surface runoff rates in excess of pre-development levels should not be allowed where a new problem will be created or where the runoff will exacerbate an existing problem.	Needs Refinement. (Expand and combine with BMP policy)

Policy EQ-2.20 Retention of Sediment. On-site facilities for the retention of sediments or contribution toward regional sediment control measures produced by development should be provided during construction and, if necessary, upon project completion. Continued maintenance of these facilities should be required.	Needs Refinement. Too vague. Update wording to stress installation and monitoring/maintenance of BMPs for contractor activities, for erosion and sediment control and for post-construction conditions, including monitoring and maintenance of these measures. Clarify under what circumstances actual sediment retention basins or contributions to regional sediment retention facilities would be applicable.
Policy EQ-2.21 Roads, Road Spoils, and Roadfill Slopes. New roads and roadfill slopes should be located outside the SCA, except at stream crossings. No spoil from road construction should be deposited within the SCA. At road crossings in the SCAs, special effort should be taken to stabilize soil surfaces.	Needs Refinement. Add strong preference for clear span bridge crossings that preserve the hydraulic geometry of the channel at low to moderate flows. Also add mention of culvert designs that allow for maintenance of fish passage and preservation of the existing streambed gradient.
Policy EQ-2.22 Altering Stream Flow, Bed, or Banks. Filling, grading excavating, obstructing flow, or altering the bed or banks of the stream channel and riparian system shall be discouraged. Such activity will only be allowed after completion of environmental review, identification of appropriate mitigation measures, and issuance of a permit by the Department of Public Works.	Needs Refinement. Add mention requirement to obtain a Stream Alteration Agreement from CDFG, a Waiver of Water Quality Certification from the RWQCB and potentially, a Nationwide Permit from the US ACOE.
Policy EQ-2.23 Seasonal Development Factors. Development work adjacent to and affecting SCAs should be done during the dry season only, except for emergency repairs. Disturbed surfaces should be stabilized and replanted, and areas where woody vegetation has been removed should be replanted with suitable species before the beginning of the rainy season.	Needs Refinement. Planting for revegetation and erosion control is normally conducted at the onset of the winter rainy season (mid-late October) in the case of seeding and in mid-winter (dormant season) in the case of instream willow plantings. Summer or early fall plantings of woody species should account for moisture availability and temporary or permanent irrigation, or hand watering should be conducted if necessary.

Policy EQ-2.24 Enhancement of Stream Conservation Areas. Uses and development within SCAs should enhance the appearance of the streamside environment and protect native vegetation. Through careful site analysis and development, views should be preserved and the integrity of the streamside environment should be protected. The County should work in close cooperation with the flood control districts, water districts, and wildlife agencies in the design and choice of materials for construction and alterations within the SCAs.	Still Applicable. (Combine w/ EQ 2.4)
Policy EQ-2.26 Restoration of Damaged Portions of Stream Conservation Areas. Damaged portions of SCAs should, wherever possible, be restored to their natural state. When it is not possible to return the SCA to a natural state, the portions of the channels that have been significantly altered for flood control should be improved for urban open space uses such as landscaped areas and paths. These improvements should enhance habitat values.	Needs Refinement. Clarify that even where flood control channel improvements are conducted, channel design should be accomplished using integrated principles of hydraulic engineering and fluvial geomorphology.
Policy EQ-2.27 Water Resource Management. Water resources should be managed in a systematic manner that is sensitive to natural capacities, ecological impacts, and equitable consideration of the many water-related needs of the County.	Eliminate. This policy seems to vague and unfocused to be of any import.
Policy EQ-2.28 Protection of Watersheds, Aquifer Recharge areas, and Natural Drainage Systems. High priority should be given to the protection of watersheds, aquifer-recharge areas, and natural drainage systems in any consideration of land use.	Needs Refinement. Add mention of preference for maintenance of existing natural drainageways over storm drain installations and culverts.
Policy EQ-2.29 Upstream Development Impacts. The effect of upstream development on downstream land uses should be examined during project review. The following issues should be considered: • Increase in surface runoff • potential for erosion • corresponding increase in downstream sedimentation • decrease in water quality	Needs Refinement. Add mention of stream channel stability.
Policy EQ-2.30 Water Impoundment Areas. Water impoundment areas should have marginal protection areas and should be protected and maintained for their water supply, as well as environmental and recreational values.	Needs Refinement. Adjust language "marginal" as it's used here could be taken to mean scant, rather than its intended meaning- as a conservation buffer.
Policy EQ-2.31 Water Quality. Water quality should be maintained or enhanced in order to promote the continued environmental health of natural waterway habitats. A Surface Runoff Pollution Control Program should be developed for the County.	Needs Refinement. Update this to reflect the current status of MCFCWCD/MCSTOPP programs and directives.
Policy EQ-2.32 Educational Uses. The use of streams and surrounding lands for education purposes should be encouraged.	Still Applicable.

Policy EQ-2.33 Streams in Development Plans. Streams which are part of lands to be developed are a resource for their aesthetic and wildlife values. Vegetated buffer areas of native plants should be included in plans in order to protect the habitat for wildlife, to preserve and focus views, and to assure public safety. Vegetated buffer areas, rather than fencing, should be utilized except where safety issues or specific environmental concerns need to be addressed.	Needs Refinement. Clarify whether this discussion pertains to just SCA blue-line streams or all streams w/ defined channels. Substitute SCA language for general "buffer" references. Also, this policy may just be redundant.
Policy EQ-2.34 Land Divisions in Stream Conservation Areas. Land divisions should be reviewed for size of parcels and property line locations relative to creeks to allow management of the creek by one property owner, to the greatest extent possible.	
Policy EQ-2.36 Floodplain Management Ordinance. The ordinance for floodplain management in compliance with regulations for the Federal Flood Control Insurance Program should continue to be implemented.	Transfer to Env. Hazards section or combine with other policies cited therein. Also, change wording of existing sentence under this heading to "The ordinance for floodplain management in compliance with regulations for the National Flood Insurance Program should continue to be implemented."
Policy EQ-2.38 Flood Control Measures. Flood control measures should retain natural features and conditions as much as possible. Compatible uses (agriculture, wildlife habitat, recreation, etc.) of flood ponding areas and seasonal floodways should be promoted.	Still Applicable.
Policy EQ-2.39 Flood Ponding Areas. Publicly controlled flood ponding areas should be retained. Ponding covenants or easements held by the Flood Control District on property should not be transferred to other properties to allow development within floodways.	Transfer to Env. Hazards section or combine with other policies therein.
Policy EQ-2.40 Alteration to Floodways, Floodplains and Ponding Areas. Filling or other physical alteration in floodways, floodplains, or ponding areas should be limited to the minimum necessary as determined in development permits issued by the County.	Transfer to Env. Hazards section or combine with other policies therein.

3. Bayfront Conservation Areas

Policy EQ-2.46 Freshwater Habitats. Freshwater habitats in the bayfront areas associated with freshwater streams and small former marshes should be preserved and/or expanded so that the circulation, distribution, and flow of the fresh water supply is facilitated.	Still Applicable.
Policy EQ-2.47 Use of Flood Barriers for Seasonal Habitat. Natural or managed flood basins should be utilized to provide seasonal habitat for waterfowl and shorebirds.	Still Applicable

Policy EQ-2.48 Transfer of Development Rights. The County shall allow the transfer of the development potential of diked historic marshlands which are restored to tidal status or enhanced as wetlands habitat to upland sites, provided that development on the upland site complies with development standards for the protection of adjacent habitat areas.	Still Applicable.
Policy EQ-2.49 Planned District Development Review with Environmental Assessment. The County shall review all proposed development within the Bayfront Conservation Zone in accordance with the planned district review procedure in order to ensure maximum possible habitat restoration and protection. An Environmental Assessment of existing environmental conditions (biologic, geologic, hazard, and aesthetic) shall be required prior to submittal of development plans.	Still applicable.
Program EQ-2.49a Environmental Assessment of Bayfront Lands. Environmental assessment (biologic, geologic, hazard, and aesthetic) of existing conditions on proposed development sites will be completed prior to preparation of master plans and development plans. These assessments will include recommendations for siting and design that will avoid adverse environmental impacts. When it is not possible to avoid impact, recommendations shall include provisions for minimizing environmental impact. The assessment should serve as a portion of the Environmental Impact Report on the project and recommendations should be incorporated into the project itself. Refer to Program 2.43a for detailed criteria to be used in formulating recommendations for siting and design.	Still Applicable.
Policy EQ-2.50 Coordination with Trustee Agencies within Bayfront Conservation Areas. The County shall facilitate consultation and coordination with the trustee agencies (Department of Fish and Game, U.S. Fish and Wildlife Service, the Corps of Engineers, EPA, Regional Water Quality Control Board, and BCDC) during environmental review and during review of other proposals for lands within the Bayfront Conservation Zone.	Still Applicable.
Program EQ-2.50a Early Consultation with Other Agencies. Any development project within the Bayfront Conservation Zone is subject to the review, and possibly the permit process, of federal and state agencies with jurisdiction over wetlands. It is critical that the applicant consult with these agencies at the very outset of a development project. The County will make every effort to coordinate its review process with the review process of other agencies, consulting with them on the environmental assessment and the master plan. The applicant will be informed at the first contact with the Community Development Agency which other agencies are likely to claim jurisdiction and what the policies and standards of those agencies are regarding development activities in the Bayfront Conservation Zone. The National Wetland Inventory Maps (NWI) will aid County staff in providing this information to applicants.	Still Applicable.

Policy EQ-2.51 Minimal Impacts Within Bayfront Conservation Zone. The County shall ensure that development in the County occurs in a manner which minimizes the impact of earth disturbance, erosion, and water pollution within the Bayfront Conservation Zone.	Needs Refinement. Add mention of impacts to freshwater and tidal wetlands.
Policy EQ-2.52 Disruption to Runoff and Stream Flow. Disruption or impediment to runoff and stream flow in the watersheds of Marin County marshes should not be permitted if an environmental assessment indicates that the quality of the water entering the marshes and bay would be diminished.	Still Applicable.
Policy EQ-2.53 Siting of Industrial Facilities. The development and siting of industrial (and any other) facilities adjacent to bayfront areas should be planned to eliminate significant adverse environmental impacts on the water quality of the bay and marshes.	Needs Refinement. Seems redundant (e.g. see Program EQ-2.49a)
Policy EQ-2.54 Tides and Currents. The development of jetties, piers, outfalls, etc., should not be allowed to alter the movement patterns of the bay's tides and currents, such that significant adverse impacts would result.	Needs Refinement. Clarify the nature of the potentially adverse impacts: e.g. increased sedimentation rates, shoreline or beach erosion.
Policy EQ-2.55 Bay Fill. The County shall discourage any bay fill that diverts and retards currents, increases the deposition of sediments, or causes erosion and pollution.	Needs Refinement. Add regulatory considerations for any bay fill, i.e. BCDC, Dept. of Army, and RWQCB permits.
Policy EQ-2.56 Waste Discharge. The County shall not permit waste discharge which would contaminate water resources or adversely affect any inter-tidal environment. Municipal discharges should move toward partial consolidation and relocation of discharge points.	Still Applicable.
Policy EQ-2.57 Basin Plan. The County Department of Public Works shall continue to cooperate with the EPA and the Regional Water Quality Control Board in implementation of the San Francisco Bay Basin Plan. This includes the preparation of a Baseline Control Program. This program will help to prevent future water quality problems and limit increases in pollutant discharge.	Needs Refinement. Update citing current water quality programs such as NPDES stormwater permitting, SWPPP review, monitoring of TMDLs et al.
Policy EQ-2.64 Land Uses in Floodplains. Areas defined as floodplain should serve the dual purpose of habitat and flood protection. Areas should be evaluated periodically to determine whether increases in the volume and rate of runoff from urbanization or natural forces warrant further flood mitigation measures.	Needs Refinement. Refer to flood policies in Hazards section and/or clarify difference between uses allowed in floodway (F-1) or floodway fringe (F-2). Also, change first sentence to read: "Areas defined as floodplain should serve the three-fold purpose of habitat, groundwater recharge and flood protection. Maximizing the extent of groundwater recharge, where applicable, increases stream base flow and improves instream habitat and water quality."

Policy EQ-2.65 100-year Floodplain. The County's regulatory procedures should reflect 100-year floodplain areas as determined by the Federal Emergency Management Agency (FEMA).	Still Applicable.
Policy EQ-2.66 Use of Shoreline Areas. Public use of the shoreline areas is desirable and should be encouraged consistent with ecological and safety considerations.	Still Applicable.

THE BUILT ENVIRONMENT

1. General Policies	
Policy EQ-3.1 Project Review Procedures. The County shall continue to implement and review specific procedures for reviewing public and private actions that significantly affect the quality of the environment throughout the county, in accordance with the characteristics of each proposed action and each potential location (see Table EQ-7).	Eliminate. (What is this policy saying?)
Policy EQ-3.2 Air, Water, and Noise Pollution. Air, water, and noise pollution shall be prevented or minimized.	Eliminate. Too general, replace with more substantive policy or eliminate.
Policy EQ-3.4 Changes to Hydrological and Biological Processes. No operation shall cause irreversible damage or more than minimum reversible change to natural hydrological and biological processes. .	Still Applicable. OK, although the language is very broad and unfocused
Policy EQ-3.7 Avoidance of Hazards from Earthquake, Erosion, Landslide, Floods, and Fires. Construction and operations shall be located and designed to avoid or minimize the hazards from earthquake, erosion, landslides, floods, fire, and accidents consistent with policies and programs in the Environmental Hazards Element.	Still Applicable.
<u>Land Uses</u>	
Policy EQ-3.21 Creekside Development. Along creeks, development must retain the natural vegetation, prevent water pollution, and minimize flood hazards from runoff (see Figure EQ-13).	Eliminate. Redundant after SCA policies above.

[1] *Water Quality Control Plan- San Francisco Bay Basin (Region 2).* California Regional Water Quality Control Board, San Francisco Bay Region. June 1995.

[2] *California Storm Water Best Management Practice Handbooks.* Stormwater Quality Task Force. March 1993.

[3] *Stormwater Management FY 2000/01- 2004/05 Action Plan: Protecting and Enhancing Marin County's Watersheds.* Marin County Stormwater Pollution Prevention Program. Prepared by EOA, Inc.,January 2001.

[4] Marin County Stormwater Pollution Prevention Program. Ibid.

[5] *The North Bay Watershed Association (NBWA).* Pamphlet prepared by the NBWA. February 2001.

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APPENDIX 1-M

KEY TRENDS, ISSUES, AND STRATEGIES REPORT, JANUARY 2003

Key Trends, Issues, and Strategies Report

Marin Countywide Plan Update

January 2003

Marin County
Community Development Agency

Alex Hinds, Director

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Key Trends, Issues, and Strategies Report

January 2003

Attention:

This background report has been assembled with input from a variety of sources including volunteer committees, staff, and members of the public. The purpose of the document is to be a reference tool to identify issues and potential strategies for consideration and discussion during the preparation of the Marin County General Plan Update. The information and suggestions contained in this report have not been debated by nor adopted by the County of Marin nor any of its decision-making bodies.

Public Participation

The public is invited to participate in the process of updating the Plan in a number of ways. You can attend workshops and public meetings, send email and letters, and review and comment on this report and others on the Internet. For additional information, log on to the Countywide Plan update website at www.future-marin.org, or contact our staff as indicated below.

Copies of this report may be obtained by contacting:

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Printed on recycled paper

Marin Countywide Plan Update 2004

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Introduction

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I. Introduction

The *Key Trends, Issues, and Strategies Report* is one of the principal background reports that will be used as a reference to update the Marin Countywide Plan. The report summarizes public and technical input from two years of community meetings and working group sessions. The report identifies trends, issues, and strategies affecting the future of Marin County in the three broad categories that will provide an organizing framework for the Plan: natural systems; the built environment; and the economy, equity, and culture. The report is to serve as a resource document, or "tool kit," to help shape the update of the Countywide Plan. The update to the Marin Countywide Plan is expected to be completed by 2004.

The natural systems section addresses environmental quality, environmental hazards, open space and trails, parks and recreation, and food and agriculture. The section on the built environment deals with transportation, housing, community design, community facilities, emergency preparedness, and community development. The section on the economy, equity, and culture focuses on a variety of socioeconomic issues, including the economy, social equity, public health, and the arts and cultural resources. Energy issues are addressed throughout the report.

The trends, issues, and strategies identified in the report have been assembled from a variety of sources. The process of gathering information began with public comments collected during 11 public workshops. There were also 15 meetings of four working groups. Additional public input was collected during the "Help Design the Future of Marin County" event held in February 2002.

Vision

Marin County intends to work toward the long term vision of becoming a sustainable county before the end of the 21st century. By drawing upon the best from the past and the present, we can plan communities designed to serve the needs of those who live and work within them, as well as sustain the natural systems that support life for future generations. While this vision will require a time frame and changes well beyond the scope of this Countywide Plan, establishing a program of indicators and targets will enable us to measure our progress toward more sustainable communities. Ongoing monitoring will also provide a forum to consider new or revised techniques as necessary to achieve our goals and objectives.

During the 21st century . . .

> Marin will become a place with dramatically reduced dependence upon fossil fuels, hazardous chemicals, and manufactured substances that accumulate in nature and harm life-sustaining systems. This vision includes the protection, restoration, and enhancement of watersheds, agriculture, air quality, and open space that will continue to enrich the lives of all species. Hazardous materials will not be released into the environment, and the concept of "waste" will be eliminated, as waste products will be converted into resources. We will not breathe harmful fumes from vehicle exhaust, and healthy, locally produced food without toxic residues will be available to the community.
>
> Marin residents will have the opportunity to live close to public transportation or to where they work, shop, or recreate. Our freeways will not be gridlocked, as our communities will be designed with many transportation choices. Homes will be heated, cooled and powered using intelligent design and renewable energy. Housing will be more affordable to the wide range of our workforce and our families. Housing choices will include mixed-use villages in our downtowns, above parking lots, within commercial areas, and near transit.
>
> Marin businesses and food growers will be supported through local purchasing. In turn, local agriculture and business will nourish and enrich their surrounding communities. We will enjoy a rich cultural diversity. There will be affordable choices for child and elder care in the workplace

and in the community. High quality education will be available to people of all ages, cultures and income levels equally. Support systems and housing will be in place to help those in need. Marin in the 21st century will be a place where community needs are met in fair, creative, and effective ways, where people know their neighbors, and where families can live, work and play in a safe, healthy, and just environment.

Guiding Principles

In May 1999, the Marin County Board of Supervisors adopted a recommendation from the Marin Economic Commission to address sustainability in the Marin Countywide Plan update. Subsequently, the Marin County Board of Supervisors determined that sustainability would be the overarching theme of the update. In late 2000, a working group consisting of 14 members of the public was convened to prepare a set of general principles to guide revisions to the Countywide Plan. This group met eight times over six months to review models from around the United States and the world, and proposed the guiding principles listed on the following pages.

I

MARIN COUNTYWIDE PLAN UPDATE
Interim Guiding Principles

Preamble

Meeting the needs of the present without compromising the future is the overarching theme of the Marin Countywide Plan. Marin County government is committed to lead by example, support public participation, and work in community partnerships to improve quality of life, using key indicators to measure progress. To design a sustainable future, we will adhere to the following:

Guiding Principles

1. Link equity, economy, and the environment locally, regionally, and globally.

We will improve the vitality of our community, economy, and environment. We will seek innovations that provide multiple benefits to Marin County.

Examples of community indicators: Social, economic, and environmental indicators listed below; GPI (Genuine Progress Indicator: comprehensive, aggregate measure of general well-being and sustainability including economic, social, and ecological costs).

2. Use finite and renewable resources efficiently and effectively.

We will reduce consumption, and will reuse and recycle resources. We will reduce waste by optimizing the full life cycle of products and processes.

Examples of community indicators: Per capita waste produced and recycled; per capita use of energy, natural gas, and water; ecological footprint (measures per capita consumption of natural resources).

3. Reduce the release of hazardous materials.

We will make continual progress toward eliminating the release of substances that cause damage to living systems. We will strive to prevent environmentally caused diseases.

Examples of community indicators: Water and air quality; measurements of toxic levels; childhood cancer rates.

4. Steward our natural and agricultural assets.

We will continue to protect open space and wilderness, and enhance habitats and biodiversity. We will protect and support agricultural lands and activities, and provide markets for fresh, locally grown food.

Examples of community indicators: Acres of wilderness; acres of protected land; levels of fish populations; track special-status plants and animals; quantity of topsoil; active farmland by crop; productivity of acreage and crop value of agricultural land; acres of organic farmland.

5. Provide efficient and effective transportation.

We will expand our public transportation systems to better connect jobs, housing, schools, and shopping and recreational facilities. We will provide affordable and convenient transportation alternatives that reduce our dependence on single occupancy vehicles, conserve resources, improve air quality, and reduce traffic congestion.

Examples of community indicators:Vehicle-miles traveled; bus and ferry ridership and fares; person-miles traveled; community walkability; miles and use of bike paths.

6. Supply housing that is affordable to the full range of our workforce and community.

We will provide and maintain well-designed, energy-efficient, diverse housing close to job centers, shopping, and transportation links. We will pursue innovative opportunities to finance workforce housing, promote in-fill development, and reuse and redevelop underutilized sites.

Examples of community indicators: Jobs-housing balance; housing affordability; number of new housing units within walking distance of jobs or transit.

7. Foster businesses that provide a balance of economic, environmental, and social benefits.

We will retain, expand, and attract a diversity of businesses that meet the needs of our residents and strengthen our economic base. We will partner with local employers to address transportation and housing needs.

Examples of community indicators: Taxable sales; retention and attraction of targeted businesses; job growth; unemployment rate; number of businesses with environmental management systems; hospitality revenues.

8. Educate and prepare our workforce and residents.

We will make high quality education, workforce preparation, and lifelong learning opportunities available to all sectors of our community. We will help all children succeed in schools, participate in civic affairs, acquire and retain well-paying jobs, and achieve economic independence.

Examples of community indicators: Education level of Marin residents; per-pupil expenditures; percentage of eligible voters who voted; high school dropout rate; percentage of high school graduates going to college or post-secondary training.

9. Cultivate ethnic, cultural, and socioeconomic diversity.

We will honor our past, celebrate our cultural diversity, and respect human dignity. We will build vibrant communities and enact programs to maintain, share, and appreciate our cultural differences and similarities.

Examples of community indicators: Racial diversity; diversity of community and corporate leadership; number of hate crimes; number and use of cultural resources such as museums and theaters.

10. Support public health, safety, and social justice.

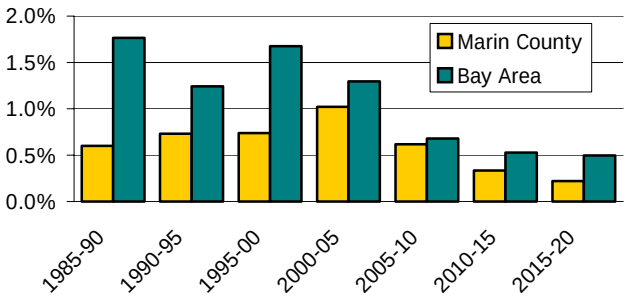
We will live in healthy, safe communities and provide equal access to amenities and services. We will particularly protect and nurture our children, our elders, and the more vulnerable members of our community.

Examples of community indicators: Income statistics; health statistics; percentage of uninsured (medical) population; longevity after retirement; volunteerism; crime rate; percentage of philanthropic contributions.

Marin Within the Region

Marin County accounts for only a small percentage of population growth in the Bay Area. The Bay Area's warm climate, beautiful setting, abundance of recreational activities, top universities, Fortune 500 businesses, and career opportunities attract people from around the world. While the Association of Bay Area Governments (ABAG) estimates that the population of the nine Bay Area counties is expected to grow by 1 million over the next 20 years, less than 3 percent of that growth will occur in Marin (Figure I-1). Between 2000 and 2020, Marin's population is projected to grow from 247,289 to 275,500, an increase of 11.4 percent. Marin's population-growth rate is lower than that of all the counties in the Bay Area except San Francisco.

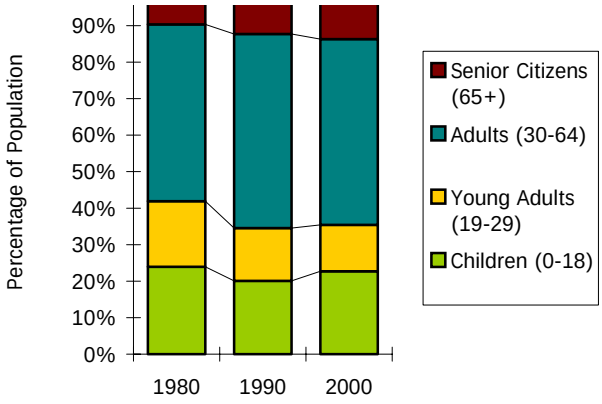
Figure I-1
Annual Population Growth, 1985-2020,
Averaged for Each Five-Year Interval



Source: 2001 Association of Bay Area Governments

One factor limiting growth in Marin is longstanding land use regulations focusing development within existing communities along the City-Centered Corridor. Of the county's 520 square miles of land area, only 11 percent is developed. The majority of the land is either in agricultural production, designated as open space or watershed areas, or in park lands, resulting in nearly half of the county's land area being in some form of protected open lands. Only 5 percent of additional land in Marin is potentially developable.

Figure I-2
Age Distribution



Source: United States Census Bureau

Marin residents are aging and living longer. According to ABAG, another factor limiting Marin's demographic growth is the county's aging population. The population of Marin continues to age, as both the median age and the percentage of people over the age of 65 continue to increase. The population of Marin has aged significantly since 1980, when the median age was 33.6 years. By 1990, the median age increased to 38.0 years, and it increased again to 41.3 years in 2000. The percentage of senior citizens has increased significantly, from 9.7 percent of the population in 1980 to 13.7 percent by 2000 (Figure I-2).

ABAG estimates that the proportion of the region's population of people 65 years old and over will double in the next 20 years, while the proportions of the population less than 20 years old and of children less than 5 years old will decrease. The proportion of the Bay Area population age 65 and older increased from 9.7 percent in 1980 to 13.7 percent in 2000, about the same increase as Marin's. The portion of Marin's population 85 years and older has grown by 62 percent since 1990.

The percentage of children in Marin is decreasing as the population ages. The number of children decreased from 24 percent of the population in 1980 to 20.1 percent in 1990 and then increased to 22.7 percent in 2000. Although young adults were 18.0 percent of the population in 1980, they were only 12.7

percent by 2000. The adult (age 30–64) share of the population was 48.4 percent in 1980, peaking at 53.2 percent in 1990 and then decreasing to 50.9 percent in 2000.

Although the region's population is aging, life expectancy in the Bay Area continues to outpace life expectancy compared with the rest of California as well as the nation as a whole. Residents of the Bay Area have a life expectancy six months longer than that of people in other parts of California, and two years longer than in the United States as a whole.

Marin residents are living longer for a variety of reasons. One factor is the high level of income and education of residents. Residents are more knowledgeable about health care and preventive health measures and can afford to pay for health insurance. Improved nutrition and diet, exercise, less smoking, and access to modern medications are other factors that have produced a healthier, older population.

Long term job growth is anticipated in the Bay Area and in Marin, although there may be a shortage of Marin workers to fill jobs. Despite the recent downturns in the Bay Area economy, the long term forecast shows significant change. According to ABAG, the region already has an unusually high concentration of computer electronics, telecommunications, and computer software jobs. In addition, the Bay Area is also one of the leading regions for biomedical research and development. It is expected that the number of jobs in the region will increase by 1.1 million by 2020.

Job growth in Marin mirrors the trend in job growth for the Bay Area. Between 1990 and 2000, Marin added more than 15,500 jobs. ABAG projects that the county will add about 33 percent more jobs, which translates into 40,310 more jobs, over the next 25 years. Similarly, high technology and finance have been the fastest growing employment sectors in the county, although the service sector still continues to dominate Marin's economy.

Marin's aging population impacts the available workforce and the local economy. The retired senior population generally has less disposable income than people in the workforce, and the decrease in the share of the population age 30 to 64 means fewer Marin residents to fill local jobs.

The unemployment rate in the San Francisco Bay Area is the highest it has been in six years. This has also had an impact on consumer confidence. Between November 2000 and the end of 2001, the region's consumer confidence had decreased from the mid-130s to almost 80. The unemployment rate in Marin continues to remain low in comparison with the Bay Area, California, and U.S. averages. Because Marin has fewer people employed in volatile industries, such as construction and manufacturing, the county is not as affected as other areas when there is a downturn in the regional, state, or national economy.

The Bay Area's workforce is changing as well. The traffic congestion in the region and advances in technology may transform the office job of the future. Improved technology may bring about an increase in telecommuting: more people working from home, attending meetings via satellite, communicating with colleagues via email, and submitting assignments via dial-up modem, DSL, or cable modem.

Knowledge-based industry will contribute to the future of Marin's economy. ABAG projections indicate that approximately 18 percent of the Bay Area's workforce will be in knowledge-based industry, which drives innovation, economic growth, and job generation in the region. Marin is expected to absorb 19 percent of the total growth. The jobs typical of knowledge-based industry are in fields including computers, electronics, telecommunications, multimedia, movie and television production, biotechnology, environmental technology, and travel and tourism.

There will continue to be a high demand for housing in the region and in Marin. The Bay Area is well known for its tight housing market due to the high demand for housing. Only half a million dwelling units are expected to be added to the Bay Area's housing supply within the next 20 years. The projected population growth will only increase the demand for housing in the region. In Marin, this increased demand, coupled with limited supply, contributes to high housing prices.

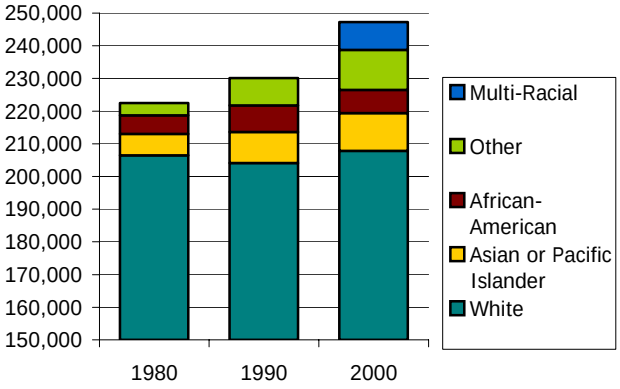
I

Marin is less ethnically diverse than the rest of the Bay Area. The ethnic makeup of the Bay Area is expected to significantly change within the next 20 years. ABAG projects that the proportion of the Bay Area population that is white will fall from 61 percent to 47 percent between 1995 and 2020. During the same period the Hispanic population is expected to grow from 16 percent to 24 percent, and the population of Asians and Pacific Islanders from 16 percent to 20 percent. The African American population is expected to remain around 9 percent.

Marin County is not as ethnically diverse as the rest of the region. In Marin, whites comprise 84 percent of the total population, followed by persons of Hispanic origin (11.1 percent), Asians or Pacific Islanders (4.7 percent), African Americans (2.9 percent), and other races (4.9 percent) (Figures I-3 & 4). The racial composition of the Bay Area, however, is 58.1 percent white, 19.5 percent Asian and Pacific Islander, 7.5 percent African American, 9.8 percent other races, and 4.9 percent multiracial.

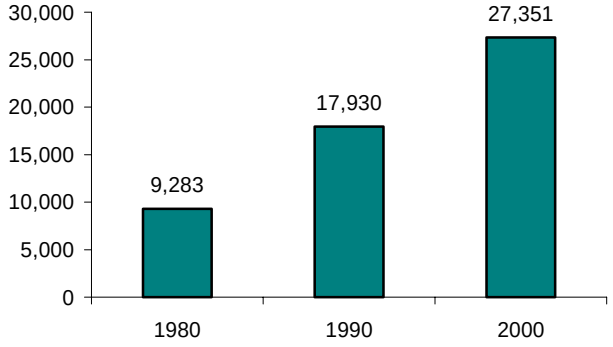
Change is gradually occurring in the ethnic makeup of Marin's population. While the population is becoming more diverse, Marin County is diversifying at a much slower rate than the rest of the Bay Area or California. A combination of factors may be influencing this, including housing costs and disparity in education levels, which in turn affects employment potential.

Figure I-3
Population Growth and Racial Distribution, Marin County, 1980–2000



Source: United States Census Bureau

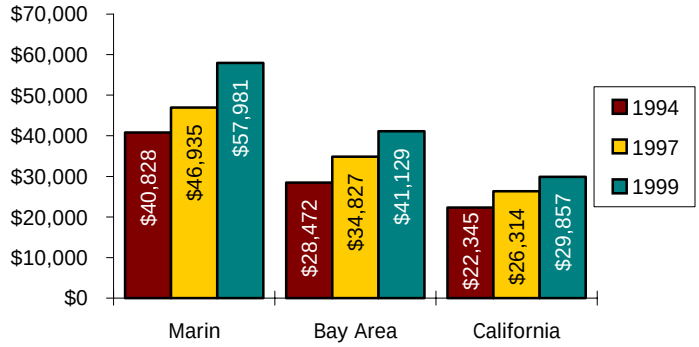
Figure I-4
Persons of Hispanic Origin, 1980–2000



Source: United States Census Bureau

Marin has the highest per capita income in California. In 1999 the per capita income in Marin was $57,981, compared with $41,129 for the Bay Area and $29,857 for the state (Figure I-5). Household income in Marin is also higher than in the Bay Area: $100,000 in 2000 compared with less than $80,000 for the Bay Area. Household income includes income from all income earners in the household. The growth in household income may indicate an increase in households where more than one person is employed. This may be a result of Marin's high cost of living, which requires a greater household income in order to afford to live in the area.

Figure I-5
Per Capita Personal Income



Source: Bureau of Economic Analysis

Development in the region is spreading outward from central cities. The relationship between central cities and suburbs has changed over the last few decades. The relationship between San

Francisco and Marin is no exception. Fifty years ago, cities were the location for major employers, museums, theaters, and homes for many people. Today those resources and the economic activities that surround them have dispersed and they will continue to disperse.

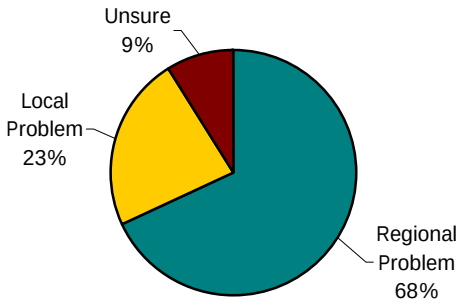
The region, rather than the city, is now the basic geographic unit in which goods and services are produced. Workers are hired from a regional labor pool. Transportation and infrastructure systems are regional.

According to ABAG, 60 percent of the land available for residential development between 1995 and 2020 is earmarked for single-family homes. Housing more affordable in price tends to be built far from jobs and public transit on the periphery of the region, where land costs are relatively low. ABAG indicates that a significant portion of the land anticipated for development is on the periphery of the region because land there is less expensive. Most of this land is earmarked for single-family residential development at very low densities. Residential and commercial/industrial development is being pushed geographically outward.

Traffic congestion in the Bay Area is increasing. Most daily automobile trips made by Bay Area residents are less than five miles and are trips to the grocery store, gym, day-care center, or a child's school or sports practice. Between 1980 and 1990, a 45 percent decrease in the cost of gasoline per mile encouraged more people to drive. Despite significant public investment in public transportation, the number of people driving alone to work grew by 35 percent during the same period. Modern subdivision design has not encouraged walking or cycling, and driving a car is often the only safe way to travel from home to various activity centers.

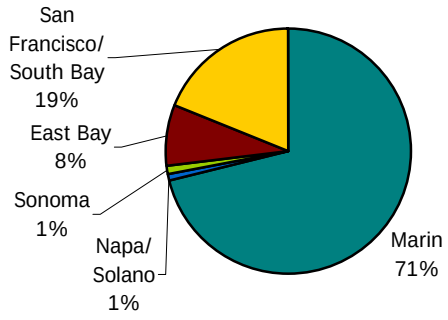
The majority of people interviewed in a Marin County survey believe that traffic congestion is more a regional than a local problem to resolve (Figure I-6). However, the data shows that 71 percent of all vehicle trips starting in Marin also end in Marin. The next most frequent destination is San Francisco and the South Bay, with 19 percent of trips (Figure I-7).

Figure I-6
Traffic Congestion: A Local or Regional Problem?



Source: 2000 Marin County Congestion Management Agency

Figure I-7
Destination of Vehicles Originating in Marin County, 1999

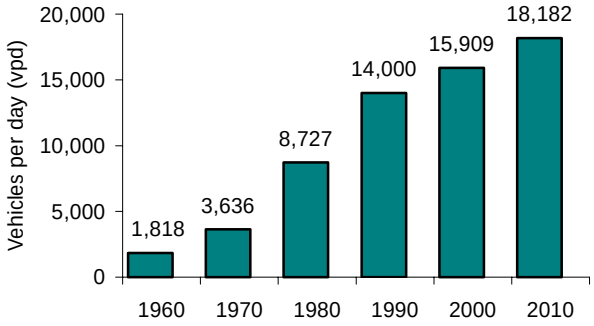


Source: 2000 Nelson \Nygaard/Marin County Congestion Management Agency

There is a perception that much of the traffic congestion on Highway 101 is from Sonoma County commuters traveling through Marin. Traffic data indicates that there has been a 281 percent increase in the number of one-way vehicle trips from Sonoma to Marin over the last 50 years (Figure I-8). Slightly fewer than half the vehicle trips originating in Sonoma County are going to Marin County destinations (Figure I-9). In fact, the proportion of trips destined to Marin and San Francisco from Sonoma is expected to decrease as Sonoma County further develops its own job base. However, trips to Marin from Sonoma, Napa and other counties will continue to grow as Marin is still a major destination with a significant lack of affordable housing (Nelson\ Nygaard).

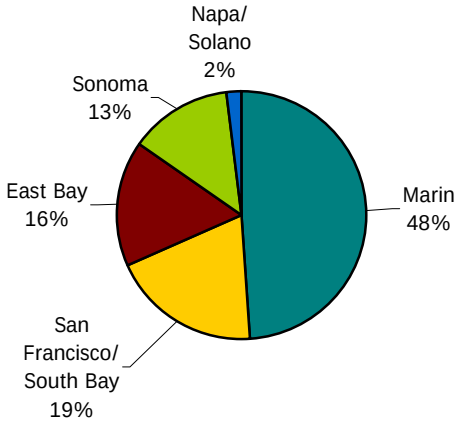
In the Bay Area there is a relationship between income and the number of vehicles owned. The higher the income per Bay Area household, the more vehicles owned in that household (Figure I-10). In the Bay Area, the average number of vehicles per household grew from 1.67 to 1.76 from 1980 to 1990, and was expected to have averaged 1.91 in 2000. Similar to the rest of the Bay Area, the number of vehicles registered in Marin County has increased steadily between 1981 and 1999 (Figure I-11).

Figure I-8
Total Daily One-Way Vehicle Trips from Sonoma to Marin



Source: Nelson\Nygaard/Marin Congestion Agency

Figure I-9
Destination of Vehicles Originating in Sonoma County, 1999



Source: 2000 Nelson\Nygaard/Marin County CMA

Figure I-10
Bay Area Vehicles per Household by Income and Unit Type (1990)

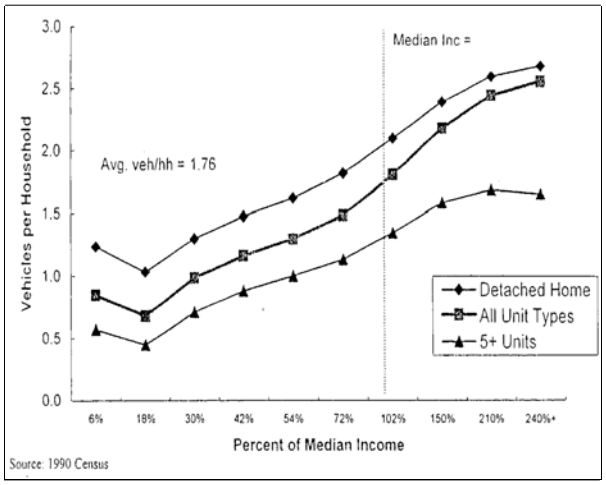
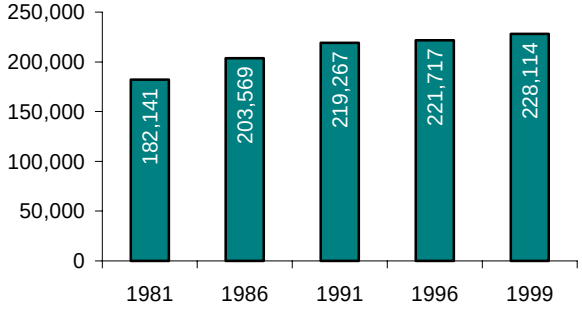


Figure I-11
Number of Vehicles Registered in Marin County



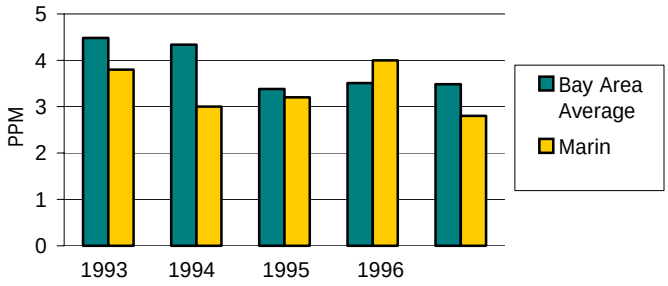
Source: 2001 Marin County Congestion Management Agency

California's growing population will intensify the demand for water. According to the California Water Plan, by 2020 the state will face a water shortfall of 2.9 million acre-feet in average years. The forecast for the San Francisco Bay Area is far less dire. However, the projections assume a substantial increase in conservation efforts, with the greatest savings anticipated through landscaping and irrigation in new and existing developments, and aggressive conservation efforts by commercial and institutional establishments.

According to Marin Municipal Water District (MMWD) figures, Marin's demand for water has grown from about 23,000 acre-feet in 1992 to slightly more than 30,000 acre-feet in 2001. Demand is projected to increase to nearly 33,000 acre-feet by 2020 in the area served by MMWD. A combination of conservation, recycling, and development of a new water supply may meet demand.

Although motor vehicles contribute to air pollution, air quality in the Bay Area is getting better. According to the Bay Area Air Quality Management District, motor vehicles produce nearly half the emissions that combine to produce ozone, the principal component of smog. Automobile emissions also include a significant amount of carbon dioxide, which contributes to global warming and cannot be removed from the atmosphere easily or inexpensively.

Figure I-12
Air Quality in Marin and Bay Area, Carbon Monoxide



Source: California Air Resources Board

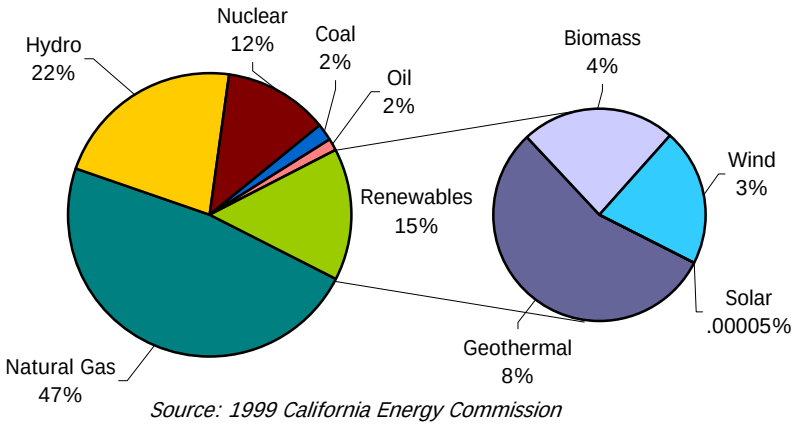
Air quality in the Bay Area is improving. Since 1998, the Environmental Protection Agency reclassified the area as a carbon monoxide "maintenance" area. Prior to 1998, the Bay Area was a "moderate non-attainment" area for carbon monoxide due to localized violations of the national carbon monoxide standards in downtown San Jose and Vallejo (Illingworth & Rodkin) (Figure I-12). Although air quality is improving in the region, the Bay Area has continued to violate National Ambient Air Quality Standards for ozone since 1998. Standards are violated when an area exceeds ozone standards three times a year for three consecutive years (Illingworth & Rodkin).

In Marin County, air quality is generally good because there are no major air pollution sources and prevailing winds are mostly off the ocean. However, since the winds blow eastward, sources of air pollution in Marin can contribute to air quality problems in other parts of the Bay Area and beyond.

I

Natural gas is California's primary energy source, although there is a slight trend toward diversification. The recent electricity supply and cost problems helped to increase awareness of energy use among California residents. Though the majority of California's energy consumption involves natural gas, there has been a gradual migration toward diversifying the mix of energy resources in the state (Figure I-13). In comparison, the majority of Marin's electricity and natural gas is imported by the privately owned utility Pacific Gas & Electric (PG&E). Gasoline is still the primary fuel used for transportation (99.9 percent) (Energy Information Administration).

Figure I-13
PG&E Energy Sources



Source: 1999 California Energy Commission

Over the past 10 years, the relative composition of California's energy generation sources has remained steady. The greatest percentages of electricity generated are from natural gas, hydroelectric power, and nuclear energy, respectively. Overall, use of petroleum has had the largest decrease, followed by nuclear, coal, and renewables. The use of natural gas has changed significantly, with a growing percentage in the use of natural gas for co-generation facilities, which produce electricity by using both oil and natural gas. The use of natural gas for combustion power plants has decreased (Figure I-14).

Figure I-14
California's Generation Sources

Generation Source	1990 (MW)	1999 (MW)	% Change (1990–1999)
Natural gas	25,123	19,303	-10.1
Hydroelectric	13,317	14,086	+1.9
Co-generation	1,151	8,486	+13.9
Nuclear	4,746	4,310	-0.7
Coal	474	376	-0.2
Oil	3,345	1,024	-4.3
Renewables	5,945	5,573	-0.5

MW = Megawatt

Source: 2000 California Energy Commission

Marin has no large- or small-scale generating capacity of its own. The primary sources of energy purchased by PG&E are natural gas, hydroelectric power, and nuclear energy. Use of renewable energy commands a smaller percentage of the state's energy mix, at 15 percent combined.

Interest in renewable energy is growing in the Bay Area and Marin County and residents are increasingly pursuing alternatives. For example, in November 2001 the voters of San Francisco passed Bond Measures B and H, which will seek bond money to install 40 to 50 megawatts of photovoltaic panels in the city.

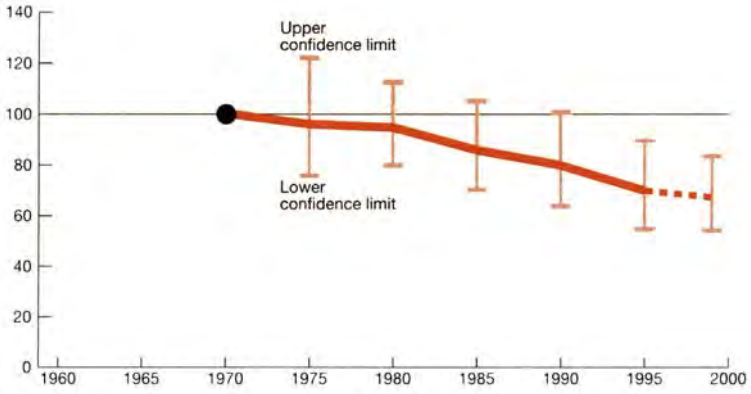
The Bay Area is well known for its earthquake activity, with several active faults running through the region. Six strike-slip faults and one thrust fault in the San Francisco Bay Area are known to be slipping between 2 and 24 mm/year. These faults in general release most of the seismic energy in the Bay Area and include the San Andreas, Hayward-Rodgers Creek, Calaveras, San Gregorio, Concord-Green Valley, Greenville, and Mount Diablo faults (Snyder and Smith Associates). The Working Group on California Probabilities (WG99) found that there is a 70 percent probability of at least one earthquake of magnitude 6.7 or greater before 2030 within the San Francisco Bay region. This earthquake is likely to occur on one of the seven major fault systems in the Bay Area. It was determined that the Hayward-Rodgers Creek, San Andreas, and Calaveras fault systems have the highest probabilities of generating an M>6.7 earthquake before 2030 (Snyder and Smith Associates).

Marin Within the Global Context

Human beings now use natural resources faster than they regenerate them. While the productive capacity of the earth's natural ecosystems has declined about 33 percent over the last 30 years (Figure I-15), the human impact on the earth's natural systems has increased by about 50 percent over that same period (Figure I-16).

The ecological footprint measures the use of natural resources against the planet's actual biocapacity. It can be calculated for individuals, regions, countries, or the entire earth and is expressed as the number of acres of the earth's total surface area it takes to support one person. Given the current global population, there are about 5 acres for each individual on Earth. The average American accounts for 24.0 acres while the Marin footprint is 27.4 acres per capita, 15 percent higher than the average American. Other western democracies such as Canada, France, and Italy have footprints of 21.8, 13.0, and 9.5 acres, respectively (Figure I-17).

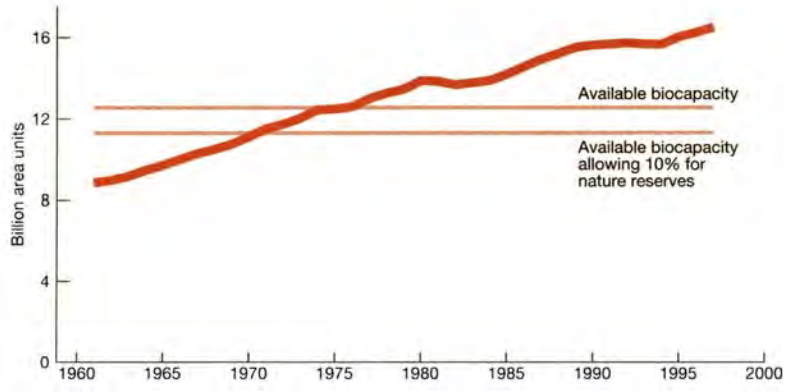
Figure I-15
Living Planet Index



**The Living Planet Index is a measure of the natural wealth of the Earth's forests, freshwater ecosystems, oceans, and coasts.*

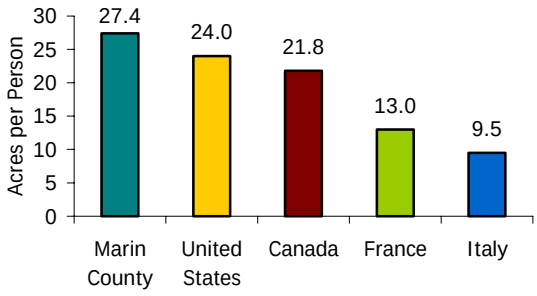
Source: 2000 World Wide Fund for Nature

Figure I-16
World Ecological Footprint



Source: 2000 World Wide Fund for Nature

Figure I-17
Ecological Footprint Comparison



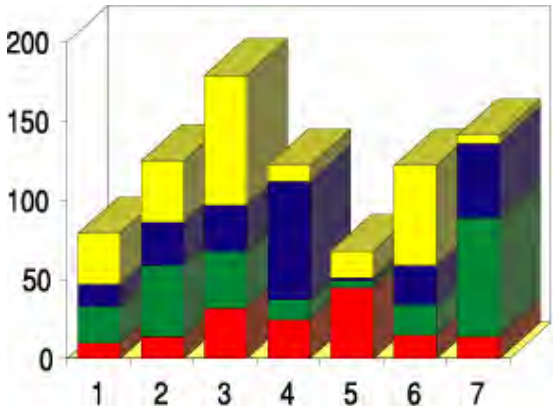
Source: 2000 Sustainable Sonoma County with Redefining Progress

What Are Trends?

Trends indicate the general direction, movement, or prevailing tendency of a course of events.

The following are some examples of possible trends:

- Fewer but larger dairies
- More cars per household
- Larger, more expensive housing



How Will Trends Be Used?

While trends do not automatically indicate our destiny, trend analysis helps us to evaluate factual information, project the direction in which we may be heading, and identify key issues to be considered in planning our future.

Community Development Agency staff conducted research on identified trends and provided background information for each of the trends listed in the report. The trends are based on facts and statistics from governmental agencies, nonprofit organizations, consulting firms, and other sources. Sources are identified in the text and in a list at the end of each section.

What Are Issues?

Issues are topics of concern to the community. Key issues may involve unmet needs or be subject to dispute. The following are examples of issues:

- Protection of agricultural lands
- Traffic congestion
- High cost of housing

How Will Issues Be Used?

Issue identification will help to determine what community concerns which will be addressed in the update of the Countywide Plan.

The issues in this report represent the diverse views of working group members, and some issues may appear incompatible with others. Nevertheless, the issues listed in the report are important because they represent significant public concerns and should be considered during the preparation of the Countywide Plan Update.

What Are Strategies?

Strategies identify how we may work to achieve the goals and objectives of the Countywide Plan. Strategies include proposed courses of actions, such as policies and programs.

How Will Strategies Be Used?

These strategies will be considered when creating or modifying policies and programs to be contained in the updated Plan.

As the process of updating the Countywide Plan proceeds, staff will compare the proposed strategies in the report with policies and programs already in the Plan. All the strategies will be considered, but not all will be included in the final Countywide Plan.

What Are Indicators and Targets?

An *indicator* is a measurement that assists in demonstrating movement toward or away from a goal or objective. Indicators should be understandable, representative and relevant. A *target* is a nonbinding, quantifiable objective that is proposed to determine progress toward a goal. Examples include:

Indicator	Target
Acres of protected agricultural land	20 percent increase in agricultural conservation easements by 2020
Vehicle miles traveled	15 percent increase in carpools by 2010
Number of affordable housing units	133 very low and low income units construction by 2006

How Will Indicators and Targets Be Used?

Identification of proposed indicators and nonbinding targets will help us to measure our progress toward or away from the goals and objectives in the Countywide Plan. Each indicator will be monitored and reported on periodically. The results of this periodic monitoring will be useful in alerting the public and decision makers to the effectiveness of the policies and programs that implement the Countywide Plan. Such a process should also provide an opportunity to review our progress and consider the need for new or revised strategies and implementation measures.

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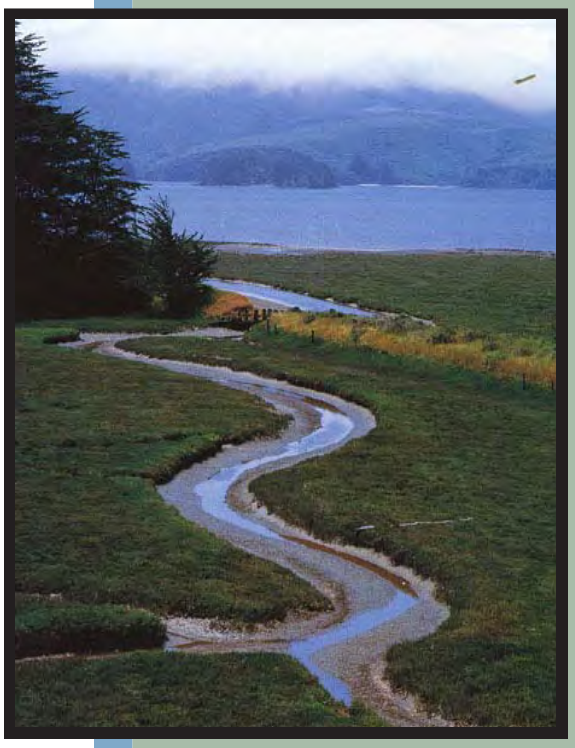
I

Cross-reference of subjects covered in more than one section

The report is organized into chapters which correspond with the three elements of the Countywide Plan: Natural Systems; Built Environment; and Economy, Equity, and Culture. A number of subjects are addressed in more than one chapter. The table below cross-references subjects and indicates where they are addressed in each chapter.

Subject	Natural Systems	Built Environment	Economy, Equity, and Culture
Agriculture	pp. 57–68		p. 157, Economy
Air Quality	pp. 35–36	p. 75, Automobiles and Roadways pp. 77, 88, Land Use	p. 180, Environmental Justice; p. 197, Transportation
Child Care			p. 170; p. 157, Economy
Education	p. 66, Agriculture, Education and Public Awareness; p. 67, Food and Food Systems	p. 141, Schools	p. 177; p. 157, Economy; p. 161, Economy Workforce Education; p. 199, Workforce Training and Compensation; p. 203, Arts Education; p. 207, Archaeological Resource;
Energy	p. 38	p. 91; p. 118, Community Design, Green Building	p. 168; p. 157, Economy
Fire Hazard	p. 45	p. 136, Emergency Preparedness; p. 139, Fire Protection; p. 146, Community Development	
Flooding	p. 41	p. 136, Emergency Preparedness; p. 146, Community Development	
Geologic Hazards and Landslides	p. 44	p. 136, Emergency Preparedness	
Hazardous Materials	p. 47	p. 134, Solid Waste	p. 180, Environmental Justice; p. 185, Public Health
Housing		p. 99; p. 109, Community Design	p. 183, Housing; p. 159, Economy, Workforce Housing; p. 175, Cultural and Ethnic Diversity

Subject	Natural Systems	Built Environment	Economy, Equity, and Culture
Seismic Hazards	p. 43	p. 136, Emergency Preparedness; p. 152, Community Development	
Transportation	p. 35, Air Quality; p. 36, Noise	p. 74; p. 109, Community Design	p. 197, Transportation; p. 163, Economy Transportation
Water Quality	p. 32	p. 112	



Natural Systems

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II. Natural Systems

Environmental conditions strongly affect not only our lives but the ability of many plant and animal species to thrive and reproduce. From the quality of the air we breathe to our enjoyment of outdoor recreation, we depend on nature to provide for us. Partnerships between humans and the environment provide many of the necessities of our daily lives. We depend on natural systems for food, minerals, and renewable energy, all essential to our high quality of life.

Planning areas that are based on watershed boundaries are already a part of the Marin Countywide Plan. Reinforcing the critical role of watershed planning and providing for "fish friendly" land use policies is an overarching objective of this Countywide Plan update. Although streams, creeks and other waterbodies are addressed principally in the Natural Systems section of this report, it is important to recognize and honor the whole that is a watershed.

A watershed is the region draining into a river or body of water. It is an area of land in which creeks, streams, swales and underground fractures in rock carry water from ridgetop to valley, from creek and river to the sea. Also called a drainage basin, a watershed is a concept that farmers and rural landowners have planned and lived by for centuries. The boundaries of large, rural tracts of land are sometimes defined by watershed boundaries.

In cities it can be harder to recognize a watershed. Buildings may shield the view of ridgetops. Soil may be covered with concrete and asphalt which increases runoff. Waterways may be replaced with pipes, culverts and concrete-lined channels, obscuring natural drainage patterns. When it is so difficult to recognize a watershed it can be hard to see the connection between daily human activities and the health of downstream creeks, fish, marshes and bays. But all of the modern conveniences of urban living profoundly affect watershed health and function. The fact is, a watershed is affected by all the organisms and activities within it. For that reason, watershed concerns also apply to the Built Environment and other sections of this report.

This chapter covers topics linked to the natural environment. Key issues related to native species and habitat protection, the quality of our air and water, noise levels, mineral resources, and renewable energy are presented. Hazards to people and the environment, such as flooding, seismic activity, landslides, fire, hazardous materials, and global warming are addressed, along with strategies for protecting the environment and minimizing hazards to it and its residents.

Although the chapter is organized into four main sections—Environmental Quality; Environmental Hazards; Open Space and Trails, and Parks and Recreation; and Food and Agriculture—many of the trends, issues and strategies posed here are interrelated, as are the elements of natural systems. Issues that threaten Marin County's biodiversity, such as weed invasion, land fragmentation, and development, are also threats to agriculture and food production. Protecting open space raises issues for recreation, agriculture, and habitat protection. How we treat streams and wetlands not only affects the creatures that live in them but also impacts flooding in low-lying areas.

A. ENVIRONMENTAL QUALITY

➢ Background and trends

From the high percentage of public land to relatively clean air and water, environmental quality in Marin County is high overall. Of Marin's 332,800 acres, park lands comprise 33 percent, while open space and watershed lands are 15 percent, resulting in nearly half of the county's land area being protected open space land. With Marin's having the largest amount of protected open space in the nine-county Bay Area, residents and visitors enjoy exceptional recreational opportunities and unparalleled scenic views. In addition to the human benefits that these public lands afford, they also provide habitat for myriad native species and communities. Marin County's rich biodiversity is illustrated by the fact that

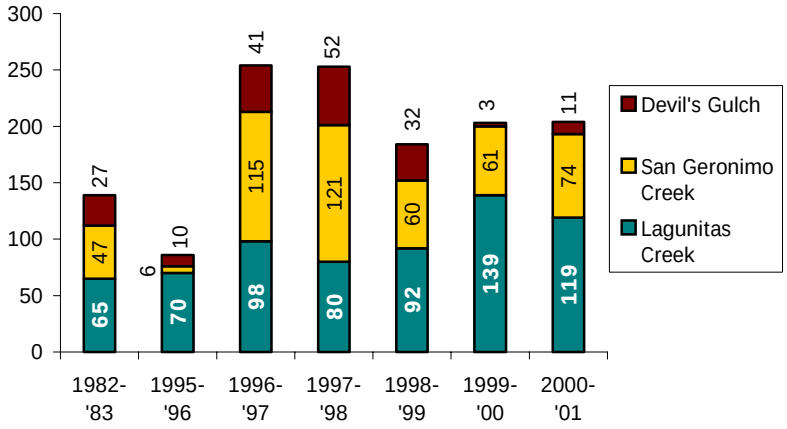
it ranked 17th out of 58 counties in California in the number of special status species documented in 2001—an amazing fact considering that Marin is among the smallest counties in California. Forty-one animal and 52 plant special status species are known to occur in Marin (California Natural Diversity Database) (Map II-1).

With the acquisition of these public lands by federal, state, and local agencies, habitat protection for many species was ensured. Point Reyes National Seashore, encompassing 70,000 acres—approximately 20 percent of the land area of Marin—includes coastal beaches, headlands, estuaries, and uplands. It is home to critical habitats that support nearly 15 percent of California's plant species, 30 percent of the world's marine mammal species, and 45 percent of the North American bird species. Coastal waters offshore of Marin County also support important marine habitats. The Gulf of the Farallones waters offshore of Marin County are the center of one of the most productive eastern-boundary coastal upwelling marine ecosystems in the world (Bakun).

Marin County holds 7 of the 13 units of the Golden Gate Biosphere Reserve. The Biosphere Reserve is a partnership of 13 units, established in 1988, which include a highly diverse complex of terrestrial, coastal, and marine ecosystems representing the Californian terrestrial and Californian-Temperate North Pacific coastal-marine biogeographic provinces. Marin's seven units include Audubon Canyon Ranch, the Golden Gate National Recreation Area, the Marin Municipal Water District, Mount Tamalpais State Park, Point Reyes National Seashore, Samuel P. Taylor State Park, and Tomales Bay State Park. There are presently only 337 reserves in 87 countries, 47 of which are in the United States (United States Man and the Biosphere).

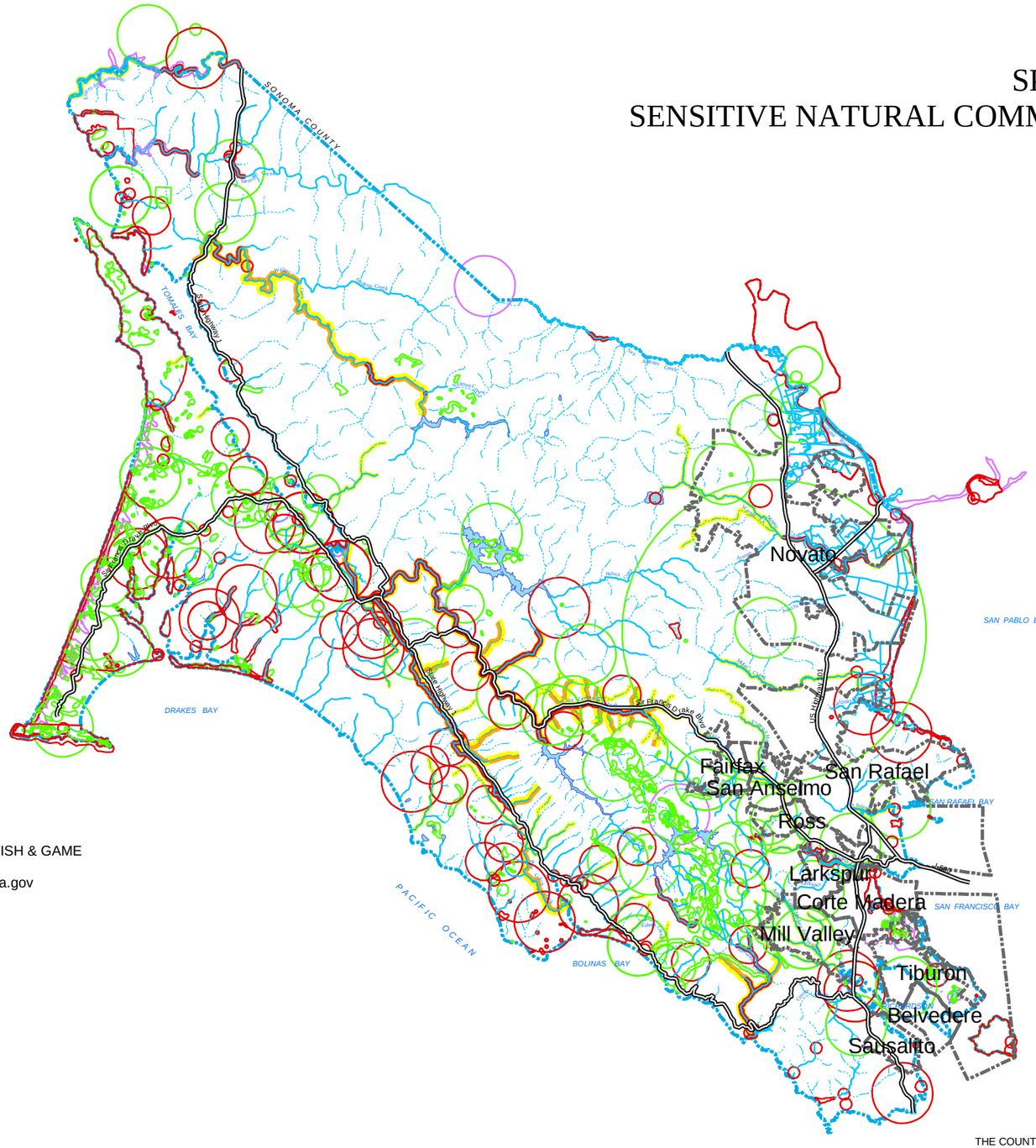
Despite the fact that stream alterations and land uses have had a significant impact on natural stream and drainage patterns (Clearwater Hydrology), the Lagunitas Creek watershed, which includes both public and private lands, supports the most important population of federally threatened coho salmon in California. Of the approximate 5,000 coho population in California, approximately 500 to 800 spawning adult coho salmon have been known to occur in the Lagunitas Creek watershed consistently since 1995 (Andrew). Recently, both species have shown modest signs of recovery in Marin in response to efforts aimed at restoring Marin's streams and riparian habitat. Approximately 80 to 250 coho salmon redds (spawning nests where the salmon deposit their eggs in the stream) have been observed in the Lagunitas Creek watershed since 1982 (Figure II-1). Juvenile population estimates for coho salmon and steelhead trout in the main stream of Lagunitas Creek have been stable historically (Figure II-2 & Map II-2).

Figure II-1
Coho Salmon Redds Observed in Lagunitas Creek Drainage



Source: 2001 Marin Municipal Water District

MAP II-1
SPECIAL-STATUS SPECIES AND SENSITIVE NATURAL COMMUNITIES OF MARIN COUNTY



Legend

- County Boundary
- City Boundary
- Highways and Major Roads

Streams

- Perennial
- Intermittent

Water Bodies

- Lakes

Special-Status Fish Occurrences *

- Steelhead
- Coho

Special-Status Species Occurrences **

- Plant
- Animal

Sensitive Natural Community Occurrences **

- Terrestrial Communities

*** BASED ON COUNTY RECORDS**

**** BASED ON RECORDS OF THE CALIFORNIA NATURAL DIVERSITY DATA BASE**

Mapped locations vary from accurate areas to areas that extend several miles and include potential habitat.

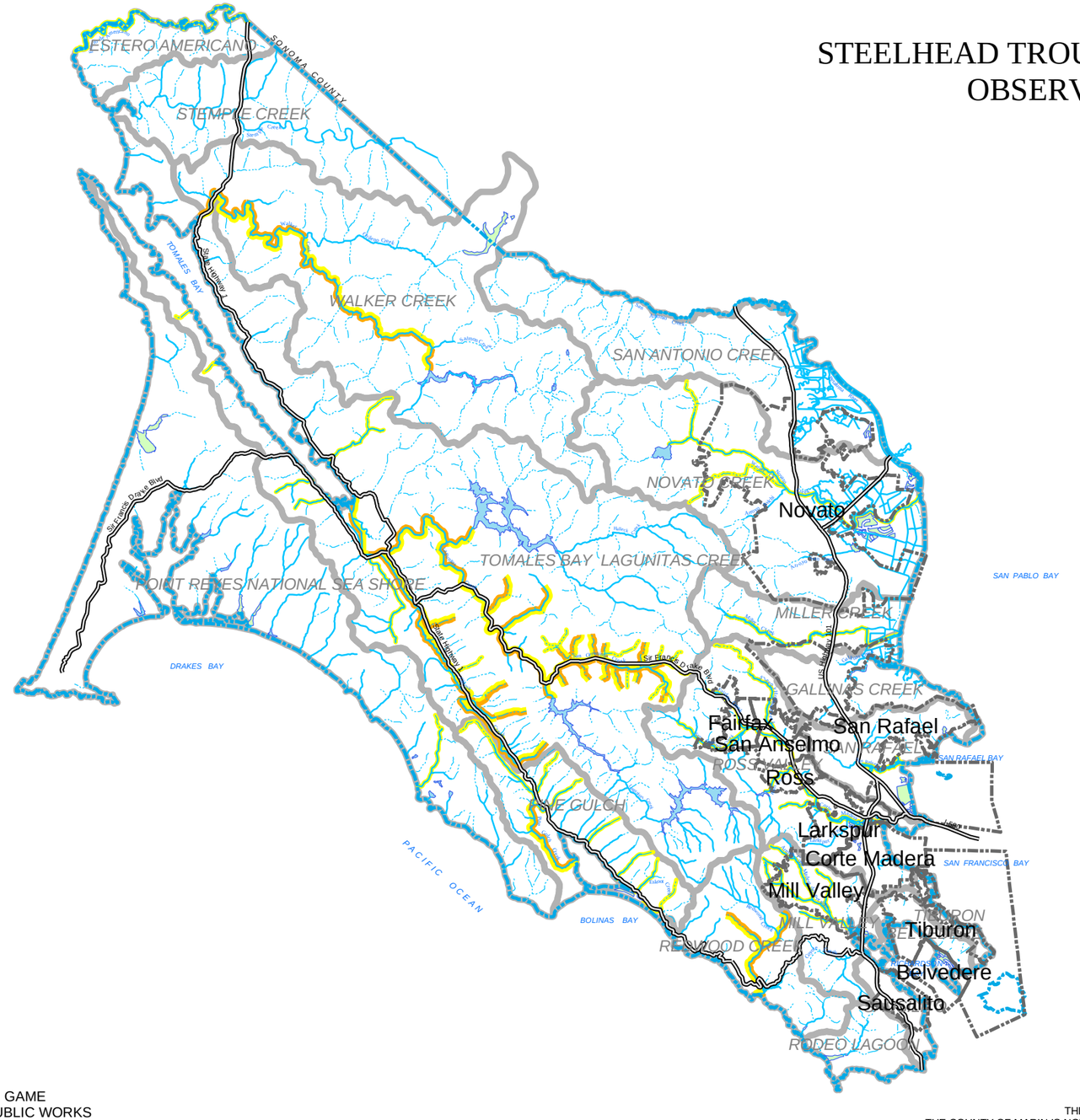
SOURCE: MODIFIED FROM CALIFORNIA DEPARTMENT OF FISH & GAME
CALIFORNIA NATURAL DIVERSITY DATA BASE
ADDITIONAL INFORMATION AVAILABLE AT www.dfg.ca.gov

The California Natural Diversity Data Base (CNDDB) is a digital inventory of the locations of the state's rare, threatened and sensitive plants, animals and natural communities that is continually refined and updated. CNDDB provides information on locations, condition, dates of observation, accuracy of sightings and comments regarding habitat associations, threats, population sizes, and state and federal listings, and more. CNDDB is a positive sighting database available at the time of the request and should not be regarded as complete data on the elements or areas being considered.

N

0 1 2 4 6 8 Miles

MAP II-2
STEELHEAD TROUT AND COHO SALMON OBSERVED IN MARIN COUNTY



Legend

- County Boundary
- City Boundary
- Highways and Major Roads

Streams

- Perennial
- Intermittent

Water Bodies

- Lakes
- Lagoons

Special-Status Fish

- Steelhead
- Coho

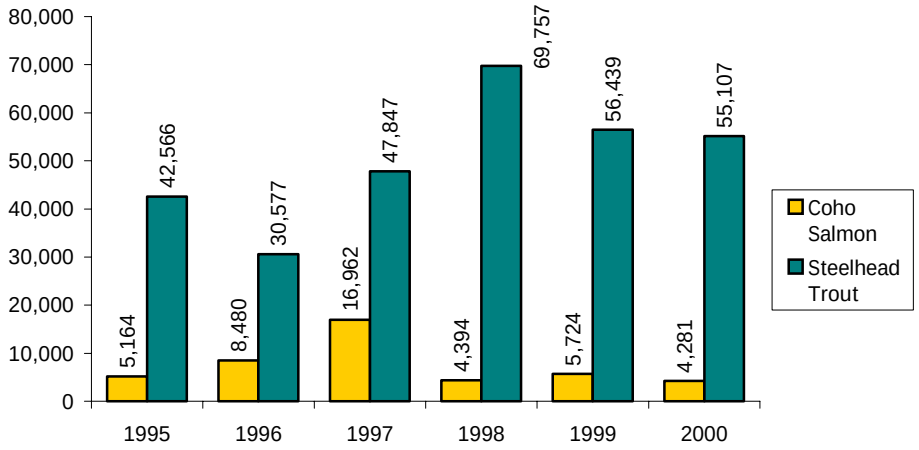
- Major Watersheds
- *MILLER CREEK* Watershed Names

N

0 1 2 4 6 8 Miles

SOURCE: BILL COX, CALIFORNIA DEPARTMENT OF FISH AND GAME
JOHN O'CONNER, SPAWN AND MARIN COUNTY DEPARTMENT OF PUBLIC WORKS

Figure II-2
Juvenile Population Estimates for Coho Salmon and Steelhead Trout in the Main Stem of Lagunitas Creek



Source: 2001 Marin Municipal Water District

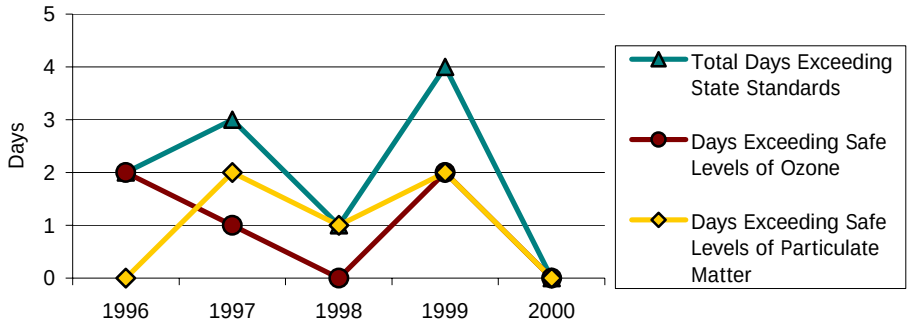
Steelhead trout are present in approximately 80 to 90 percent of perennial creeks in Marin County. Other significant streams in the Coastal Recreation Corridor that support coho salmon and the federally endangered steelhead trout include San Geronimo Creek, Walker Creek, Olema Creek, and Redwood Creek. In the City-Centered Corridor, the designated critical streams for both coho salmon and steelhead trout include Miller Creek, Corte Madera Creek, Arroyo Corte Madera del Presidio, and Novato Creek. Coho salmon population counts in Marin are stable yet tenuous (Andrew).

Urban influences on riparian habitat quality are illustrated by Marin County Macroinvertebrate Survey data of local watersheds and streams for fall 1999 through spring 2001 (Sustainable Land Stewardship for the Marin County Stormwater Pollution Prevention Program). These data showed an increase in sensitive taxa at higher elevations, which suggests that urban development, which is concentrated in the lower reaches of stream habitats in east Marin, has contributed to deterioration of environmental quality.

Although pesticide use is relatively low in Marin—it ranked 45th out of 58 California counties for pesticide use in 2000—all urban streams in the urban City-Centered Corridor are listed as impaired by the State Water Resources Control Board for the pesticide diazanon. Other chemical pollutants documented in central San Francisco Bay and San Pablo Bay include polychlorinated biphenyls (PCBs); pesticides such as DDT and dieldrin; and the trace metals copper, nickel, lead, mercury, and chromium (Clearwater Hydrology). In rural West Marin, the primary water pollutants include sediment, nutrients, pathogens, and heavy metals. Despite the fact that Tomales Bay and two of its main tributaries—Walker Creek and Lagunitas Creek—are listed as impaired for these four pollutants, the bay is often described as "pristine."

Marin has experienced a drop both in the total number of days exceeding State Ambient Air Quality Standards and in the number of days exceeding safe levels of ozone since 1996. Similarly, Marin has had an improvement in the number of days that the county has exceeded safe levels of particulate matter since 1996 (Figure II-3).

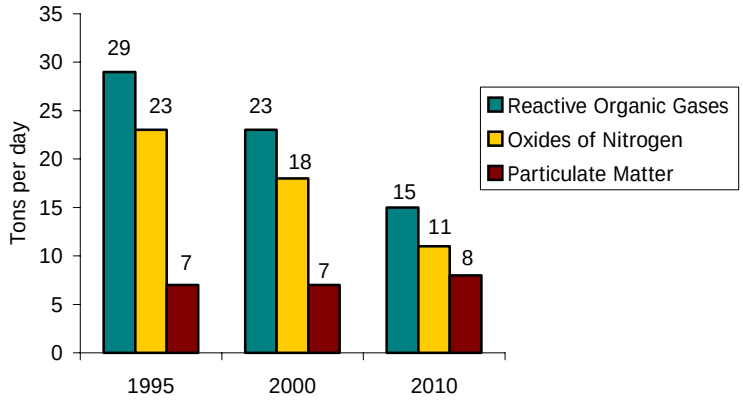
Figure II-3
Air Quality in Marin, 1996–2000



Source: 2001 Healthy Marin Partnership

Ozone precursor pollutants have decreased. An emissions inventory of ozone precursor pollutants, including reactive organic gases (ROG), oxides of nitrogen (NOx), and particulate matter (PM-10), for Marin County shows that ozone precursor pollutants have decreased. This trend is expected to continue through 2010. Meanwhile, PM-10 emissions are expected to remain relatively flat through 2010. Some reductions in PM-10 concentrations are expected (Figure II-4).

Figure II-4
Total Pollutant Emissions Inventory in Tons per Day for Ozone Precursors and PM-10



Source: 2001 Air Quality Technical Background Report

Noise levels have remained steady. Noise levels have not increased significantly in the last 14 years, although there has been a trend toward increased noise levels during the early morning hours because of changes in commuting patterns. Noise measurement for the existing Countywide Plan was conducted in 1987 at six locations. Those same six locations were measured in 2001, and only one location showed a difference in noise levels of 5 dB, namely at St. Vincent's Road (Illingworth & Rodkin).

1. Native Species and Habitat Protection

➢ Issues

Riparian habitats are impacted by development and agriculture.

a) Development projects can impact sensitive fish habitat and need to be reviewed in light of their proximity to such habitat.

b) The proximity of residential development to streams often contributes to invasive nonnative residential landscaping encroaching into riparian areas.

c) Riparian systems are essential to many species of wildlife, and the condition of riparian areas affects water quality. Efforts to protect riparian areas from damage by intensive agricultural uses need to be pursued.

Important wetland habitats are threatened by filling and other alterations.

a) Wetlands, which provide habitat for many plant and animal species and aid in flood control, and groundwater recharge have been altered over the years by filling, diking, draining, and other types of alteration. More than 95 percent of the nation's wetlands have been altered so that they no longer perform their important functions.

b) Much of the salt marsh ringing San Pablo Bay, which provides important habitat for several special status species, historically has been diked and drained for farming and other uses.

Marine environments are threatened by pollutants, sonar, and overfishing.

a) A five-year exemption from the Mammal Protection Act has been granted to the U.S. Navy to use a low frequency active sonar to identify enemy submarines, potentially resulting in seriously confusing, injuring, and eventually killing noise-sensitive marine animals, including whales (Hikida).

b) Any potentially significant changes to the chemistry and biology of natural streams, lagoons, or bays as a result of sewage outfalls, increased output from existing outfalls, and/or discharges from desalination plants should be subject to environmental review.

c) Point Reyes National Seashore's coastal ecosystem and its shoreline may be jeopardized by the impairment of Tomales Bay by mercury, offshore oil spills, and overfishing (Prado).

Marin's oak trees, oak woodlands and oak savannahs are seriously threatened by Sudden Oak Death.

a) *Phytophthora ramorum* is a funguslike microbe that is causing thousands of coast live oak and tanoak trees to die in Marin. More than 15 species in Marin County have been found to be susceptible since the disease was first discovered on a tanoak in Mill Valley in 1995. It is common in east Marin and spreading into West Marin (Map II-3).

b) Animals that rely on acorns and other vegetation may suffer because their food supply will be reduced.

c) Funding is limited for SOD research, removal of dead trees, fire protection, and quarantine enforcement.

Improved oak woodland conservation criteria are needed to ensure adequate protection.

a) Oak woodland conservation criteria in the Countywide Plan must factor in forest composition and structure, including site-specific data. Imagery generated data (such as GIS data) are incapable of accurately mapping oak woodland composition and structure (California Oak Foundation).

b) Oak woodland habitat suitability for wildlife can only be confirmed by a ground forest survey (California Oak Foundation).

c) Planning documents should specify measurable performance standards that will maintain existing oak woodland habitat adjacency and connectivity (California Oak Foundation).

Marin County's biodiversity is threatened by loss of habitat, habitat fragmentation, and invasion of exotic species.

a) Developments and land conversions at the edge of natural systems may cause habitat fragmentation through "edge effects," including increased predation by domestic animals, escaped exotic plants moving into wild areas, changes to fire regimes due to human intrusion into wild areas which can increase fire frequency, and artificial lighting. Loss of rare plants and wildlife from a fire is a very real threat. After the Mount Vision fire, mountain beavers were almost eliminated from the Point Reyes National Seashore.

b) Contiguous wildlife corridors are being incrementally lost by fragmentation resulting from developments, road construction, and other land use changes.

c) Loss of wildlife corridors that can support large predators such as coyotes and mountain lions may cause populations of smaller predators such as raccoons and domestic cats to balloon, in turn causing the decline of nesting bird populations.

d) Nonnative species are increasing in number, competing with native species and threatening biodiversity. Problem species include eucalyptus, broom, acacia, Monterey pine, numerous grassland species, starling, exotic deer species, domestic cats, nearly 100 exotic marine invertebrates, and an unknown number of terrestrial vertebrates.

e) The need to manage exotic plants with pesticides for protection of biodiversity conflicts with increasing community resistance to the use of chemicals.

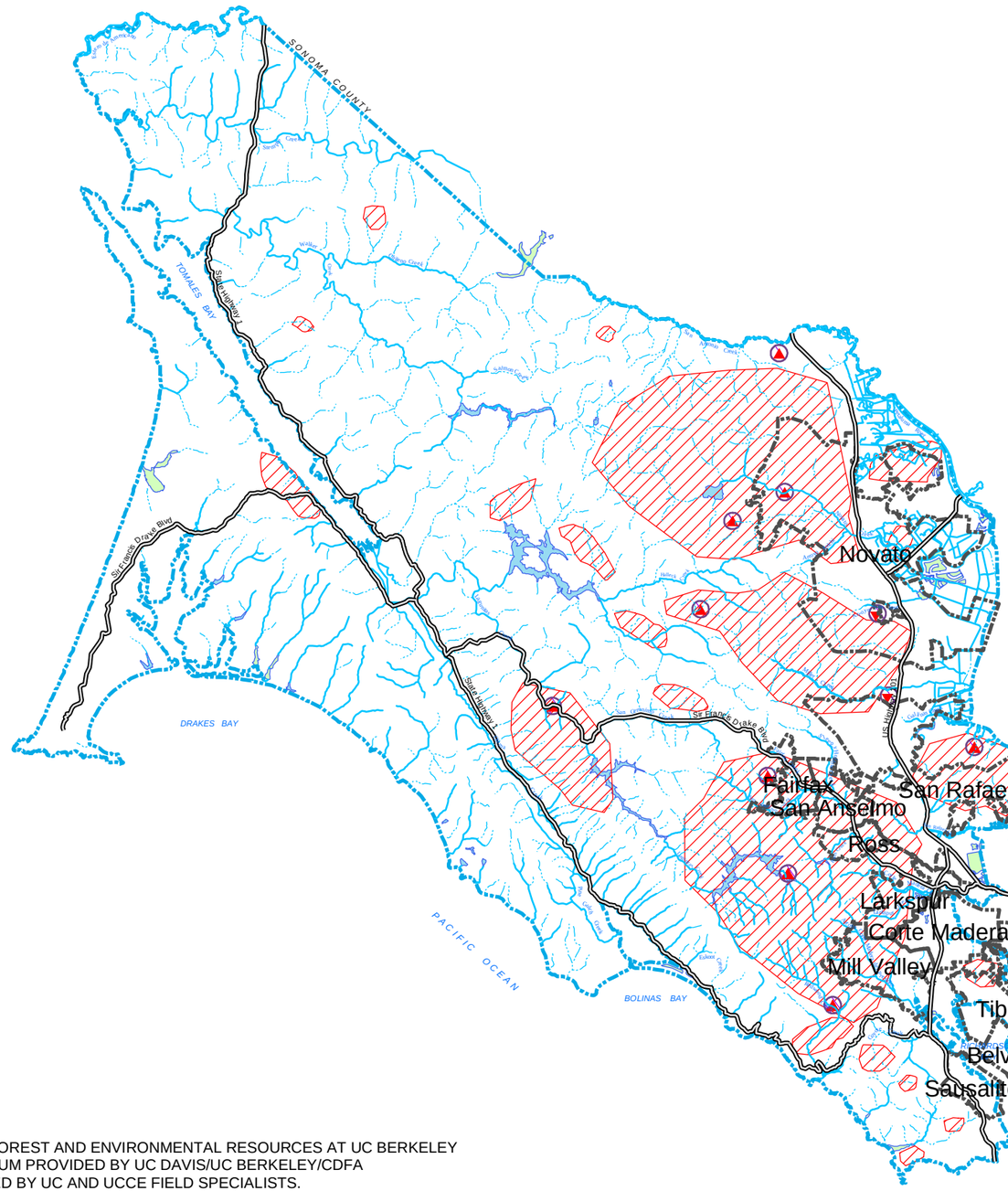
f) The reproductive capacity of flowering plants is harmed when movement corridors for species-specific pollinators are not retained.

Mitigation intended to replace habitat lost to development is not always adequate or successful.

a) There is growing uncertainty about the success of mitigation measures used to offset the impact of development, and growing pressure to evaluate whether mitigation measures are successful.

b) The applicability of mitigation banking policies for various types of species and habitats should be evaluated in Marin County.

MAP II-3
SUDDEN OAK DEATH



Legend

- County Boundary
- City Boundary
- Highways and Major Roads

Streams

- Perennial
- Intermittent

Water Bodies

- Lakes
- Lagoons

- Confirmed isolations of Phytophthora ramorum (data from CDFA)
- Confirmed isolations of Phytophthora ramorum (data from UC Davis/UC Berkeley)
- 1/4 mile buffer around confirmed SOD
- Areas suspected of having SOD

N

0 1 2 4 6 8 Miles

SOURCE: CENTER FOR THE ASSESSMENT AND MONITORING OF FOREST AND ENVIRONMENTAL RESOURCES AT UC BERKELEY
CONFIRMED ISOLATIONS OF PHYTOPHTHORA RAMORUM PROVIDED BY UC DAVIS/UC BERKELEY/CDFA
AREAS SUSPECTED OF HAVING SOD PROVIDED BY UC AND UCCE FIELD SPECIALISTS.

➢ Strategies

Strengthen policies to protect riparian habitats.

(See also 2. Water Quality.)

a) Consider the inclusion of floodplains as part of the creek and riparian corridor when setting environmental protection policies.

b) Consider specific regulatory provisions prohibiting or further restricting inappropriate development in the flood basins and flood zones including mandatory setbacks.

c) Require new developments to follow best management practices protecting riparian and aquatic habitats. Aspects of the policy could include technical assistance, education, incentives, and effective regulation via the development code.

d) Propose the enactment of stronger County protection policies for all streams, including ephemeral and intermittent streams and encourage other Marin towns and cities to enact similar policies. Such policies should require streams to be retained above ground (prohibit culverting), provide for adequate buffers, and prohibit diversions unless they can be done without adverse impacts to stream habitat.

e) Propose policies to the Countywide Plan that require, not just encourage, the retention of native vegetation and replacement of native streamside vegetation in denuded areas.

f) Propose making inland and coastal policies for riparian vegetation more uniform.

Review and refine Stream Conservation Areas to protect riparian habitats.

a) Change the Countywide Plan and zoning to make projects within an SCA subject to discretionary approval.

b) Adopt an implementation ordinance to carry out the protection of SCAs.

c) Review prohibited land uses in SCAs and ensure that they are adequate for protection.

d) Require new trails to be either located outside or carefully sited within SCAs to minimize disturbance to sensitive wildlife habitat.

e) Provide clear and consistent definitions in SCAs—define intermittent and ephemeral streams and riparian and riparian vegetation as terms in SCAs. Compare SCA definitions with other agency definitions to ensure consistency.

f) Require that restoration of damaged portions of SCAs accommodate flood flow capacity.

g) Require flood control improvements within the SCA to be designed with sufficient capacity to allow for retention of native vegetation in the channel, thereby improving habitat and minimizing need for routine maintenance.

h) Require revegetation with native plants in SCAs as part of new developments in a CWP policy or ordinance.

i) Require restoration monitoring to ensure reestablishment of the natural vegetation where removal is necessary in the SCA.

j) Explore development of setback standards for riparian areas that fall outside the SCA. Require that a qualified vegetation ecologist conduct a biological assessment to determine the riparian boundary.

k) Document and analyze cumulative impacts on SCAs and wildlife corridors.

Support positive management strategies that protect and restore riparian areas.

(See also 2. Water Quality.)

a) Support County, Natural Resource Conservation Service, Marin Resource Conservation District, and University of California Cooperative Extension efforts to provide education for farmers to participate in riparian and watershed restoration and planning efforts.

b) Seek funding to pay the cost of fencing sensitive streamside areas on private property that could be impacted by cattle grazing. Support existing riparian protection programs operated by the Marin County Resource Conservation District, Students Restoring a Watershed, and other groups.

c) Implement fish-friendly best management practices by providing technical assistance for bank stabilization, and educate homeowners and roadway maintenance crews.

d) Include monitoring for sensitive species and measuring habitat values in stream management programs.

e) Determine stream hot spots for stream preservation and restoration.

f) Pursue restoring the geomorphic stability and hydrologic function of degraded channels.

Maintain and improve in-stream conditions to protect and enhance fish habitat.

(See also 2. Water Quality.)

a) Prohibit development projects that impede fish passage. Encourage construction of bridges or arched culverts instead of culverts.

b) Implement measures to reduce the effects of County land use policies and management practices on salmonids and their habitats.

c) Require review of fish migration impacts caused by maintenance or emergency replacement of culverts.

d) Require new development and impoundments to be contingent on availability of stream water for fish.

e) Allow alteration of stream flow, beds, or banks only as part of stream habitat enhancement or removal of fish barriers.

f) Enact strategies for reducing in-stream temperatures to acceptable levels for fish.

g) Identify concrete channels and culverted creeks that could be daylighted and restore them to their natural channels where feasible.

h) Develop policies for public channel maintenance and bank stabilization projects.

Propose establishment of a Baylands Protection Corridor to protect San Pablo Bay wetland habitats.

a) Propose establishment of a Baylands Protection Corridor that would designate important habitat adjacent to San Pablo Bay primarily for resource conservation, wildlife habitat, and other natural resources.

b) Encourage the cities of San Rafael and Novato to consider amending their general plans to include a Baylands Protection Corridor and to amend plan maps and policies appropriate to this designation.

c) Consider policies that call for lower densities and other land use restrictions in the baylands. Consider applying protective land use designations and densities already utilized in the Coastal Recreation and Inland Rural Corridors.

d) Consider revisions to agricultural preserve boundaries to include lands currently in agricultural use where appropriate.

Modify the Bayfront Conservation Zone to better protect Bay habitats.

a) Clarify the definition of minor redevelopment that may be excluded from policies that apply to the Bayfront Conservation Zone (BCZ).

b) Consider redefining the BCZ to include low elevation grasslands and oak woodlands.

Seek public support to acquire and restore key Baylands parcels to protect important Bay wetland habitats.

a) Seek support of the acquisition of important bayland properties for public or protective nonprofit ownership.

b) Add diked historic salt marsh to the Countywide Plan priority list for acquisition with Open Space District funds because diked baylands are resources of regional value, are significant habitats, and function as open space and community separators. Once acquired, plan and implement salt marsh enhancements and restorations as part of Marin County Parks and Open Space management.

c) Continue to protect diked historic salt marsh remaining in the cities of Novato, San Rafael, Corte Madera, Larkspur, and Mill Valley.

d) Ensure that diked wetlands, unless currently in agriculture, are allowed to remain as seasonal wildlife habitat, with the ultimate goal of restoring them to tidal salt marsh.

Strengthen protections for wetlands.

a) Clarify the definition of wetlands in the Countywide Plan.

b) Protect existing wetlands rather than creating artificial wetlands or “restoring” damaged wetlands whenever possible.

c) Provide strong Countywide Plan protections and environmental review procedures for all wetlands, including those outside the proposed Baylands Protection Corridor.

d) Protect wetlands and associated transition zones—containing a mix of wetland and nonwetland plants—from development impacts. All wetlands and transition zones should be protected by adequate buffer areas as determined by a qualified ecologist.

e) Protect wetlands from damage due to public access by strictly limiting it. Other protective measures, such as fencing and plantings or moats, may also be needed.

f) Develop an overall policy on wetlands outside the SCA and the Bayfront Conservation Area (BCA), including polices for seasonal wetlands, freshwater seeps, freshwater springs, and vernal pools.

g) Prohibit grading changes to the banks of ponds or lagoons to ensure the integrity of these ecosystems.

h) Prevent the removal of pond vegetation to ensure the continued survival of animals dependent on them. Work with the Mosquito Abatement District on methods of vector control that are not destructive.

i) Enhance riparian and wetland function by increasing water infiltration throughout the watershed

j) Improve drainage patterns to decrease concentrated runoff and to allow natural infiltration

Increase water infiltration starting in the upper reaches of watersheds so that groundwater recharge, natural springs, wetlands and stream flow is enhanced throughout the watershed. Identify important, threatened marine environments and establish cooperative programs to protect them.

a) Identify areas of high diversity and sensitivity in the coastal zone of the county (extending three miles offshore).

b) Cooperate with CDFG in its planning process for designation of a network of Marine Protected Areas (MPAs) in the state.

c) Cooperate with CDFG in developing a strategy for sustainable fisheries in the county.

d) Pursue collaborative enforcement agreements for protecting areas with other state and federal agencies.

e) Develop an educational campaign on conserving marine resources of Marin County, including sustainable fisheries.

f) Develop a phased designation of use including a core area of high sensitivity with full protective status, surrounded by areas with reduced sensitivity and various levels of activities.

g) Establish a long term monitoring program of resources in the marine waters adjacent to Marin County. Monitoring programs should be designated to test the impacts of newly established MPAs on biodiversity, biomass, and spawning biomass both within and adjacent to MPAs.

Protect marine environments by establishing a Marine Corridor or including them in the Coastal Recreational Corridor.

a) Keep waters within a Marine Corridor or expanded Coastal Recreational Corridor free of low frequency sonar to protect marine mammals relying on sound for communication, feeding, and migration.

Support Sudden Oak Death prevention and treatment programs to protect oaks and other susceptible species.

a) Train employees in all aspects of County government so they are under compliance with the *P. ramorum* quarantine. Train staff so they don't spread the disease.

b) Manage hazardous trees affected by SOD, and leave trees in place if they are not hazardous until spreading effects are known.

c) Monitor the spread and impact of the disease by cooperating with ongoing efforts by the California Oak Mortality Task Force.

d) Offer financial support, staff, and educational support to prevent the spread of SOD.

e) Identify sensitive biological resources that could be affected by fuel reduction efforts and long term changes resulting from SOD, including exotic weed invasions.

Enact stronger conservation criteria to protect oak trees, oak woodlands and oak savannahs.

a) Specify measurable performance standards that will maintain existing oak trees and oak woodland and savannah habitat adjacency and connectivity. Measurable performance standards include defining oak woodlands and savannahs, scientifically based criteria for determining oak woodland and savannah ecological significance, and credible oak woodland and savannah habitat mitigation measures to reduce impacts to oak resources.

Protect native trees from damage due to construction.

a) Avoid soil compaction and siting of structures and impervious surfaces of soil near native trees.

b) Prohibit removal of portions of redwood and other types of native forest that might expose the remaining trees to wind throw.

Protect dune habitats.

a) Strengthen policies for protection of the dunes in Tomales.

Protect grasslands for their habitat, agricultural, and watershed protection values.

a) Promote recognition that grasslands are not “vacant” areas where nothing will be destroyed if development or crop agriculture takes place. Grasslands are among California’s most endangered habitats and are critical to effective watershed management.

b) Emphasize the importance of preserving not only agriculture but also the grassland ecosystem on which much of it is based in County planning practice.

c) Do not consider serpentine grassland to be “vacant” because of the lack of trees and scarcity of vegetation. Recognize that although it may not be a biologically productive community, it may be habitat for threatened or endangered species and thus requires a thorough biological assessment before any change is considered.

d) Encourage grazing methods that increase the cover of native perennial grasses and forbs (herbaceous plants), and discourage those that increase the cover of introduced and annual grasses.

Protect important shrublands for their habitat and watershed protection values.

a) Recognize in planning policies the importance of chaparral and coastal scrub vegetation for both wildlife habitat and watershed protection.

Minimize habitat fragmentation to preserve biodiversity.

a) Develop a plan to decrease habitat fragmentation by identifying and protecting important wildlife corridors and minimizing development at the edge of natural systems.

b) Minimize development at the edge of natural systems.

c) Retain intact, connected habitats.

d) Use wildlife corridor policies and programs to provide adequate protection and identify key areas for acquisition and restoration. Address both terrestrial and aquatic species, using the Stream Conservation Areas (SCAs) and upland wildlife corridors as mechanisms to provide habitat connectivity.

e) Propose standards for development and protection of both terrestrial and aquatic wildlife movement corridors to provide habitat connectivity throughout Marin.

f) Promote wildlife corridors in all jurisdictions throughout Marin County.

g) Include a watershed assessment in a proposed project analysis that covers an area that addresses cumulative impacts beyond the project site.

h) Develop pollinator corridors and work with other organizations to interconnect pollinator corridors for biological diversity.

Control exotic species to preserve biodiversity.

(See also 2. Water Quality.)

a) Adopt and implement policies that promote removal of invasive exotic plant species using Integrated Pest Management (IPM).

b) Support weed management and removal programs.

c) Develop policies and programs disallowing invasive exotics for both aquatic and terrestrial habitats, and identify target species for removal and control using IPM practices.

d) Remove and control invasive plant and animal exotics in any development over which the County has review authority. Establish requirements for removal as part of development approval and ongoing management, and identify target species for terrestrial and marine environments. Recommendation for removal or control of blue gum eucalyptus must recognize its importance as habitat for nesting raptors and monarch butterflies.

e) Promote the uses and benefits of seed-free hay.

f) Encourage farmers to compost farm and animal waste to decrease weed seeds. Publicize and promote the benefits of composting.

Prepare a habitat-based conservation plan to preserve biodiversity.

a) Prepare a plan that takes into consideration the overlapping habitat requirements of multiple species within the context of a functioning community or ecosystem. Thus, the functions and processes of communities and ecosystems are considered along with the needs of species.

b) Gather baseline data, including species inventories, and develop mapping of habitat types and wildlife movement corridors as the basis for biodiversity planning.

c) Prepare a master plan and governance structure for managing biodiversity with input from citizens, community-based organizations, and governments.

d) Protect essential habitat buffers.

e) Map the highest quality fish and wildlife habitats, vegetation, and Significant Natural Areas as defined by the California Department of Fish and Game to identify areas in need of protection.

Establish and implement habitat and species protection standards, policies, and programs.

a) Regularly review and update programs and standards for species protection because of possible listing or delisting of additional species as threatened or endangered.

b) Require development in Significant Natural Areas (as defined by the California Department of Fish and Game [CDFG]) to include an environmental assessment, which should identify special status species, sensitive natural communities, and wetlands.

c) Ensure that shoreline erosion protections, such as the building of revetments, sea walls, and groins, do not result in loss of biodiversity.

d) Plan for stream protection on a watershed basis (rather than according to jurisdictional boundaries) so that Marin streams receive the same level of protections countywide.

Improve the success of habitat mitigation by establishing and improving guidelines, standards, policies, and programs.

a) Establish standards for development conditions or mitigation measures that ensure that edge habitats are not destroyed or significantly altered. Integrate such standards with other relevant policies, such as the BCA and SCA.

b) Ensure that wetland mitigation results in an increase in habitat acreage and values.

c) Off-site wetland mitigation is preferable where on-site wetlands are of low value and are isolated from other habitat.

d) Require the use of native plants for mitigation, buffering, and habitat enhancement and restoration.

e) Require posting of bonds prior to development to ensure adequate funding for mitigation.

f) Evaluate whether or not tree planting is a viable method of mitigating oak woodland loss. Many important habitat elements, such as cavities, acorns, snags, and woody debris, will not be mitigated through a tree planting strategy alone (California Oak Foundation).

g) Require that development in the upper reaches of a watershed effectively mitigate water quality and riparian habitat impacts to ensure that watershed health is retained and restored.

Improve the success of habitat restoration by establishing and improving guidelines, standards, policies, and programs.

a) Encourage restoration of existing wetlands over artificial creation of new wetlands.

b) Establish site specific qualitative and quantitative goals for habitat restoration and the creation of habitat buffers.

c) Require monitoring of habitat restoration projects to measure success.

d) Develop an urban outreach program that provides technical assistance and funding sources for creek habitats and creek restoration.

➢ Sample indicators

a) Measure the degree of habitat fragmentation in various areas of Marin County.

b) Measure and map populations of exotic weed species that threaten biodiversity on open space lands.

c) Collect population counts for coho salmon and steelhead trout in creeks throughout Marin (Marin Municipal Water District and San Francisco Estuary Institute).

d) Measure the number of linear feet of creek habitat restored for anadromous fish on public open space lands.

e) Measure the distribution and quantities of the various classes of macroinvertebrates that are used to assess urban stream habitat health and water quality (Marin County Aquatic Macroinvertebrate Sampling Program).

f) Measure the number of trees or acres of land affected by SOD (California Oak Mortality Task Force).

g) Account for local, state, and federal funding for SOD (California Oak Mortality Task Force).

➢ Sample targets

a) Restore at least 500 linear feet of creek habitat annually for anadromous fish on public open space lands.

2. Water Quality

➢ Issues

Nonpoint source pollution is a primary source of sediment, pathogens, nutrients, and other chemical pollutants.

a) The use of automobiles, the largest source of water and air pollution, results in runoff as winter rains wash pollutants from automobiles through the higher reaches of the watershed, where the impact is the smallest, into urban areas, where the impact is greater, and the pollution ultimately runs into the bay.

b) Stormwater runoff affects the biotic health of both inland waterways and the downstream receiving waters of San Rafael and San Pablo bays.

c) Runoff from conventionally treated golf courses is an example of a pesticide source that needs to be addressed.

d) Residential landscaping choices combined with herbicide use are leading to increased groundwater pollution.

e) Livestock manure can negatively impact water quality.

Improperly functioning septic systems can cause water pollution and health risks.

a) Research on graywater systems and/or composting toilets as alternatives to, or additions to, septic use needs to be done.

b) Cumulative impacts of on-site septic systems on groundwater or surface water need to be evaluated.

c) A carrying capacity for on-site septic systems in a given area needs to be determined.

d) High risk or sensitive areas for on-site septic systems should continue to be established and mapped.

e) Growth considerations associated with on-site and innovative septic systems need to be evaluated.

Local water bodies are listed as impaired by sediments, nutrients, and pathogens.

a) Tomales Bay, Lagunitas Creek, and Walker Creek are listed as impaired by the following pollutants by the San Francisco Bay Regional Water Quality Control Board: Tomales Bay—heavy metals, nutrients, pathogens, and sedimentation; Lagunitas Creek—nutrients, pathogens, and sedimentation; and Walker Creek—metals, nutrients, and sedimentation.

b) San Pablo Bay is listed as impaired by the metal nickel. This water quality is strongly influenced by the runoff exiting the tributary channels from the City-Centered Corridor of Marin County (Clearwater Hydrology).

Increased runoff from development exacerbates flooding, erosion, and sedimentation.

a) Studies evaluating stream and wetland health consistently show that significant water quality impacts begin at impervious land coverage levels of as little as 10 percent. At impervious land coverage levels over 30 percent, impacts on streams and wetlands become more severe and degradation, is almost unavoidable without special measures (Bay Area Stormwater Management Agencies Association).

b) There is a need to reduce structured and engineered channelization of stormwater, and increase the use of more natural soft paths (vegetated pathways) throughout the watershed.

c) The County needs to require development and redevelopment projects to be designed to minimize stormwater runoff and migration of contaminants from the project site.

➢ Strategies

Reduce sediment, nutrient, and chemical sources of nonpoint source pollution.

a) Improve road maintenance to reduce erosion and sedimentation: Follow the Bay Area Stormwater Management Agencies Association best management practices for road maintenance. Utilize youth groups like the Marin Conservation Corps to work on unpaved road maintenance efforts to decrease runoff and sedimentation. Utilize the National Resource Conservation District and the National Park Service as resources for education and funding for maintaining unpaved roads and minimizing sedimentation. Require open space land management agencies to adopt a formal inspection and maintenance program for culverts draining from open space to roadways or private or public property.

b) Integrate the best management practices developed by the Natural Resources Conservation Service and the Marin Coastal Watershed Enhancement Project for nonpoint source pollution related to ranching.

c) Educate homeowners about toxicity issues related to pesticide use. Educate the public on pesticides—that contaminated runoff is generated and concentrated over impervious surfaces in the urbanized portions of the watersheds and enters storm drains, eventually reaching creeks in San Rafael and San Pablo Bay.

d) Train County staff about new designs for the prevention of nonpoint source pollution runoff.

e) Implement “watershed management approaches” to manage nonpoint source pollution, including pesticides.

f) Where appropriate, encourage materials such as Road Oyl Resin Modified Emulsion as a nontoxic, biodegradable, impervious alternative to driveways and pathways that should be used in conjunction with design features that divert water for irrigating landscaping or gardens on site.

g) Develop policies prohibiting use of hazardous chemicals in or near stream channels.

Improve location, installation, and maintenance of septic systems to reduce pathogen contamination of water bodies.

a) To ensure appropriate protection of public health, water quality, and the environment, locate septic systems at a safe distance from drinking water wells, surface and groundwater sources, and mariculture areas.

b) Locate septic tanks as far away as possible from wetlands and creeks.

c) Design and repair septic systems so as to avoid adverse impacts to wetlands, creeks (including seasonal, intermittent, and ephemeral), and their associated floodplains.

d) Improve management and maintenance of septic systems. The highest priority should be given to improving the management and maintenance of septic systems that have the greatest potential for impact to public health, water quality, and the environment.

e) Promote local and community involvement in the community outreach, technical assistance, and management and maintenance programs for septic systems.

f) Use existing monitoring data to determine if septic systems may be contributing pollution to a creek or water body. Additional monitoring should be conducted to evaluate surface water and groundwater impacts associated with septics. Track appropriate Health Department surveillance data for waterborne diseases.

g) Measure fecal coliform counts from humans and animals to determine impact on water quality.

h) Research and, if feasible, develop strategies for composting sewage.

Research alternative waste systems to help reduce the pressure on existing septic systems.

a) Conduct further studies on allowing alternative wastewater systems such as graywater systems and/or composting toilets.

b) Support application of septic bio-solids on agricultural lands where it is demonstrated that no additional growth or adverse environmental impacts will arise from such application and where they are demonstrated to have a neutral or beneficial effect on operation of agricultural lands.

c) Promote use of alternative technologies and community systems, where consistent with local zoning and public health protection, to improve operation of septic systems.

d) Experiment with the use of new wastewater technologies to understand feasibility and incrementally develop wastewater regulations as appropriate.

Work with the State and Regional Water Quality Control boards to address Total Maximum Daily Load issues in impaired watersheds.

a) Develop policies that are congruent with the state's standards for Total Maximum Daily Loads (TMDLs). Identify sources of pollution and develop strategies for best management.

b) Conduct a community-based water sampling program for recreational waters where creeks meet recreational swimming areas to determine the level of pollution and to meet state standards.

Improve regulations regarding runoff from new developments.

a) Better regulate runoff from new developments: Require development projects to minimize stormwater runoff and migration of contaminants from the project site. Integrate Start at the Source stormwater control principles into the County Development Code. Require 50 percent or greater of stormwater runoff to be diverted for new developments.

b) Where appropriate, encourage the use of natural soft paths (vegetated pathways) throughout the watershed to help restore natural stream and drainage patterns.

c) Develop policies to limit the amount of paved parking areas to reduce runoff into Tomales Bay.

➢ Sample indicators

a) Measure the performance rates of septic systems (Environmental Health Services).

b) Measure TMDLs for targeted pollutants in Marin County waterways (Environmental Protection Agency and the Regional Water Quality Control Board).

c) Measure the number of linear miles of erosion control efforts applied on unneeded fire protection roads or trails annually.

➢ Sample targets

a) Ensure that 95 percent of septic systems function at a high performance level by 2010.

b) Meet TMDL targets set by the State and Regional Water Quality Control boards in Marin County within established timeframes.

c) Apply erosion control efforts on at least three linear miles of unneeded fire protection roads or trails annually.

3. Air Quality

(See also III. The Built Environment, A. Transportation.)

➢ Issues

On-road motor vehicles, heating fuels, and exhaust fumes from businesses are the leading causes of air pollution in Marin.

a) Seventy-three percent of carbon monoxide, 66 percent of nitrogen dioxide, and 49 percent of reactive organic sources (smog) are produced by motor vehicles.

b) Forty percent of vehicle trips in Marin are two miles or less, which creates condensed pockets of air pollution.

c) Eighty-six percent of particulate matter comes from areawide sources, such as the combustion of wood and other nonclean fuels, and is also due to the absence of catalytic converters or other emission-control devices on residential chimneys or exhaust fumes from businesses.

d) Housing located close to highways and transit is also close to sources of air pollution.

Odors pose an air quality problem.

a) Odors are a harmful form of air pollution for people with environmental illnesses.

➢ Strategies

Develop cleaner alternative sources of energy.

a) Develop solar, wind, geothermal, vegetable biodiesel, and mini-hydroelectric production, with support from local, regional, and federal agencies.

Reduce air pollutants from heating sources and vehicles.

a) Adopt an ordinance limiting the installation of wood-burning appliances in new homes, or in renovations of existing homes that involve a fireplace, to pellet stoves, EPA-certified woodstoves, fireplace inserts, or natural gas fireplaces. Research how European wood burning stoves have internal baffles that reduce pollutants.

b) Replace retiring County fleet vehicles with low emission and alternative fuel vehicles.

Address odors through policy development.

a) Adopt policies and implementation measures addressing odors as an air quality problem.

➢ Sample indicators

a) Measure levels of ozone, particulate matter, carbon monoxide, nitrogen dioxide, reactive organic sources, and particulate matter (PM-10) (California Air Resources Board).

b) Measure the number of County fleet low emission vehicles (Department of Public Works).

➢ Sample targets

a) Reduce levels of ozone, particulate matter, carbon monoxide, nitrogen dioxide, reactive organic sources, and particulate matter (PM-10) by 10 percent by 2020 over 2000 levels.

b) Increase the number of low emission vehicles in the Marin County fleet by 20 percent by 2010 over 2000 levels.

4. Noise

➢ Issues

Vehicle traffic is the primary source of noise in Marin County.

a) Highest noise levels continue to be located along highways and major streets.

b) Noise will continue to be an important factor in the planning process as pressure increases to develop properties exposed to high noise levels and noisy activities occur near noise-sensitive receptors.

c) Truck traffic from the San Rafael Rock Quarry produces significant stationary noise for residences on San Pedro Road, which can reach 70 decibels at the A-weighted sound level (dBA). The day/night average noise level is about 49 dBA (Illingworth & Rodkin).

Flyover noise from aircraft is disturbing to some Marin residents.

a) The noise information for Gnoss Field and the Sausalito heliport needs to be updated.

b) Commercial aircraft overflight noise over Marin County exceeds the allowed 65 decibels (dB) community noise equivalent levels (CNEL) and reaches 70 dBA in Tiburon, Bolinas, and Point Reyes (Illingworth & Rodkin).

➢ Strategies

Develop guidelines, policies, and ordinances, to address noise issues.

a) Determine whether a "quiet areas" policy is needed for certain community areas (such as near sensitive animal species or retreats).

b) Define and designate quiet areas in the county and develop guidelines for implementation.

c) Consider adopting a quantitative noise ordinance, which would apply to existing noise sources in the county.

d) Develop an aircraft flyover policy to be used as a basis for discussion with the Airport Land Use Commission.

Research methods to reduce noise pollution.

a) Examine the effectiveness of sound walls, since it is not clear whether they increase or decrease noise. The County lacks an ordinance to set parameters for sound walls.

b) Continue to work with federal agencies on the issue of noise from the overflights of jet aircraft taking off and landing at the Oakland and San Francisco airports.

c) Continue to protect residential areas from excessive noise impacts from quarries and mobile noise sources.

d) Research any jurisdictions that address noise control of boom boxes, car stereos, and motorcycle use and determine applicability to Marin.

➢ Sample indicators

a) Measure noise levels that account for automobile commuting, aircraft overflight, and rock quarry truck traffic along high traffic areas and in sensitive noise receptor areas.

➢ Sample targets

a) Improve noise levels by 2 dBA in at least one sensitive noise receptor area annually.

5. Mineral Resources

➢ Issues

Evaluation of Marin County quarries is needed.

a) The quantity of rock remaining in quarries is unknown.

b) The adequacy of reclamation plans and acceptable land uses around quarries need to be evaluated.

c) Four of the six potential mineral resource sites in the county are located in unincorporated areas (Snyder and Smith Associates).

➢ Strategies

Evaluate Marin County quarries and potential quarry sites.

a) Evaluate the amount of the resource left in quarries, and evaluate the adequacy of reclamation plans and acceptable land use around quarries.

b) Establish a new overlay zoning designation for mineral resource sites to prohibit new land uses that would preclude eventual extraction of the mineral resource. Evaluate land uses around quarries for acceptable use.

c) Evaluate quarry locations and their effect on surrounding land uses to determine if current operations are appropriately located.

➢ Sample indicators

a) Measure the amount of mined lands reclaimed for other purposes (Marin County Department of Public Works).

➢ Sample targets

a) All quarry operations will be in compliance with reclamation plan requirements by 2005.

6. Energy

(See also III. The Built Environment, B. Energy, and IV. The Economy, Equity, and Culture, B. Energy.)

➢ Issues

Obstacles to development of nonpolluting renewable energy sources need to be overcome.

a) Height, noise, and neighbor perceptions have limited the installation of wind energy systems in many communities, especially urban ones. Improvements have been made to reduce noise and reduce the size needed to generate significant power. However, public perception of wind turbine aesthetics and concerns regarding bird collisions still remain issues.

b) There is a need for wind data within Marin to determine the feasibility of wind energy.

c) Cost, impacts on wildlife (especially salmon), and generation capacity are issues that need to be researched by the Marin Municipal Water District (MMWD) to determine the feasibility of using hydroelectric turbines at the lakes of Marin.

d) Opportunities for geothermal heating of buildings exist in Marin County. Geothermal issues include possible groundwater contamination, site disturbance, and high initial cost.

e) Data on solar insulation in Marin microclimates is needed to determine feasibility of harnessing in different locations.

➢ Strategies

Research nonpolluting renewable energy sources and educate the public about their application.

a) Map high wind velocity areas and investigate the feasibility of using wind to generate energy.

b) Research and map the various microclimates of Marin to determine the feasibility of solar energy in various locations. Target the best microclimates for publicity to encourage the use of solar energy.

c) Consider using existing dams on lakes to generate hydroelectric energy.

d) Encourage the use of methane digesters for agricultural energy needs through education, publicity, and subsidies.

e) Investigate the feasibility of using geothermal heating for buildings in Marin by preparing estimates for installation and operating expenses of such systems.

f) Encourage continued energy and water conservation programs by the water companies.

g) Encourage efficient farming techniques by providing information to farmers on the latest technological advances that enhance energy efficiency.

Increase the use of renewable energy to decrease fossil fuel dependence.

a) Increase the use of renewable energy, such as methane-powered processing facilities, solar energy, and wind energy, which are cost effective as well as reliable energy sources.

b) Use state and federal incentives to install solar, wind, and methane energy generation systems.

➢ Sample indicators

a) Measure the number and output of photovoltaic (solar electric) and solar thermal systems (Marin County Community Development Agency and other Marin cities' building divisions).

b) Measure the size and number of Wind Energy Conversion Systems (Marin County Community Development Agency and other Marin cities' Building Divisions).

➢ Sample targets

a) 2.5 MW of solar power are in use by 2010.

b) 200 KW of wind energy are in use by 2010.

B. ENVIRONMENTAL HAZARDS

➢ Background and trends

Environmental hazards in Marin County include flooding, seismic hazards, geologic hazards, fire, hazardous materials, and global warming. While some of these hazards occur naturally, human effects on the environment have affected their frequency and severity.

Flooding, which generally occurs when rainfall exceeds the capacity of a storm drain, stream, or watershed to move water downstream, can be exacerbated when high tides coincide with high rainfall events. Increases in impermeable surfaces, building in floodplains, and alteration of natural drainage patterns have increased the frequency and severity of flood events. Coupled with increases in sea level due to global warming, flooding is predicted to increase in the future.

The San Andreas and Hayward-Rodgers Creek fault systems are the two faults in the county with the greatest likelihood of seismic activity. The Working Group of California Probabilities (WG99) has predicted 21 percent and 32 percent probabilities, respectively, for an earthquake of magnitude 6.7 or greater on the Richter scale to occur by 2003 (Snyder and Smith Associates).

Landslide and slope stability hazards are prevalent throughout Marin County because of existing adverse geologic conditions. Collapsible soils are generally located in the low-lying flatland deposits in valley basins and along bays, while expansive soils are responsible for a large amount of slope failure in upland areas (Snyder and Smith Associates). In the western part of the County, surface deposits in and adjacent to the San Andreas Fault zone pose significant geologic hazards, including liquefaction potential, shaking amplification potential, subsidence and differential settlement, and shallow slope failures. Ongoing active erosion processes cause bluff erosion and landsliding along the coast (Snyder and Smith Associates).

Fire has become a greater hazard in Marin County as fuel loads have increased due to suppression of natural fires and as residential development has encroached on the edge of wildlands. The City-Centered Corridor is a high-risk area because there is a strong correlation between population density, travel corridors, and ignition density. This Corridor had the most fires reported between 1990 and 1997. However, the response times in these areas are good—primarily five minutes or less, with some areas eight minutes or less (Marin County Fire Department).

Risks from hazardous materials are greatest in the Inland Rural Corridor due to transportation through this area and because of a higher concentration of regulated hazardous material businesses than in more rural parts of the county. Although pesticide pollution has recently been detected in local water bodies, the quantity of pesticides used in Marin County has decreased over the past decade.

Increased temperatures due to global warming pose a worldwide threat to many species and environments.

Sea level is rising. The Bay Conservation and Development Commission has studied the global sea level rise caused by global warming along the San Francisco Bay. It is estimated that along the City-Centered Corridor at the Point Orient gauging station, the water level will increase from a 1986 elevation of +0.40 feet to +0.86 feet National Geodetic Vertical Datum (NGVD) in 2036. Similarly, the mean sea level at the Sausalito gauging station is estimated to rise from +0.30 feet to +0.48 feet NGVD in 2036. For the Presidio gauge, the mean sea level is predicted to increase from +0.29 feet to +0.65 feet NGVD in 2036 (Clearwater Hydrology).

Fire fuel loads are increasing. Vegetation is the fuel that feeds a wildfire. Due to the aggressive fire suppression policies during the last 50 years in America, fuel loads have been allowed to accumulate to dangerous proportions (Marin County Fire Department). This situation is exacerbated by the effects of Sudden Oak Death which has created a large amount of dead and dying vegetation that could increase the number and intensity of wild fires.

Global warming is increasing. Human-related activities such as transportation and energy production are increasing the amounts and concentrations of greenhouse gases (carbon dioxide, methane, nitrous oxide) contributing to global warming. Global surface temperatures have increased about 1.1°F since the late 19th century, and about 0.5°F over the past 25 years. The 20th century's 10 warmest years all occurred in the last 15 years of the century. Of these, 1998 was the warmest year on record. Scientists expect that the average global surface temperature could rise 1 to 4.5°F in the next 50 years, and 2.2 to 10°F in the next century, with significant regional variation. The difference in temperature between 1995 and the ice ages is 5 to 8°F.

1. Flooding

➢ Issues

Flooding in low-lying areas causes property damage and poses safety risks.

a) Significant flooding has occurred in portions of Corte Madera, Larkspur, Greenbrae, Ross, San Anselmo, San Rafael, and Novato over the last 30 years (Clearwater Hydrology). Flooding has also occurred in Mill Valley, Fairfax, and Muir Beach.

b) The risk of loss of life and extensive property damage is significant in inundated valleys downstream from major dam/reservoir complexes.

c) Significant, even catastrophic flooding can occur in valley areas downstream of major dams in the event of a complete or partial dam failure (Map II-4).

d) The rise in sea level due to global warming is expected to increase the frequency and severity of flooding.

e) The National Oceanic and Atmospheric Administration's Climate Prediction Center forecasts that El Niño conditions are likely to continue through the end of 2002 and into early 2003, resulting in an increased probability of flooding in relation to other non–El Niño/La Niña weather pattern years.

f) In some cases, the master plan level of flood protection does not equal that of the 100-year flood (Clearwater Hydrology).

g) Funding for levee reconstruction in the Santa Venetia area and financing options for the County Flood Control Zone are needed.

Traditional flood control practices can degrade biotic resources.

a) A nonstructural watershed-wide approach to stormwater and flood control management needs to occur in Marin County. This approach allows increased infiltration and groundwater recharge to occur and provides benefits to the ecosystem.

➢ Strategies

Address development impacts to reduce flooding.

a) Strengthen policies to discourage development in secondary floodplains.

b) Further consider impacts on 100-year floodplains in making land use development decisions.

c) Consider pursuing federal funding for levee reconstruction in the Santa Venetia area and a revenue-sharing program or other financing options for the County Flood Control Zone.

Improve water infiltration to reduce flooding.

a) Decrease the amount of non-permeable surfaces in new developments.

b) Improve drainage patterns by using contour ditches and other techniques to spread water flow and decrease velocity.

c) Increase water infiltration starting in the upper reaches of watersheds so that groundwater recharge is enhanced throughout the watershed.

Bioengineering and nonstructural techniques should be used whenever possible to minimize damage to streams and riparian habitats.

a) Examine the County's traditional engineering design and maintenance programs for flood control of streams, and develop and implement alternatives that involve hydrologic restoration of streams and their associated biotic habitats.

b) Implement nonstructural techniques to complete the flood control project for Corte Madera Creek.

Use mapping as a tool to assess potential flooding.

a) Conduct and review dam inundation mapping for the most significant dam/reservoir complexes where downstream valleys are inhabited and the risk of loss of life and extensive property damage is significant.

b) Conduct GIS mapping on the estimates for mean sea level rise due to global warming using the range of 0.005 to 0.05 feet per year and cross-referenced to zoning maps to ensure that future development will consider the water rise. This may require flood modeling based on an updated survey of watershed channel conditions and levee elevations to quantify the effects of sea level rise.

c) Address techniques used to generate all Office of Emergency Services and Community Development Agency threat maps to ensure that maps are updated using the most current data.

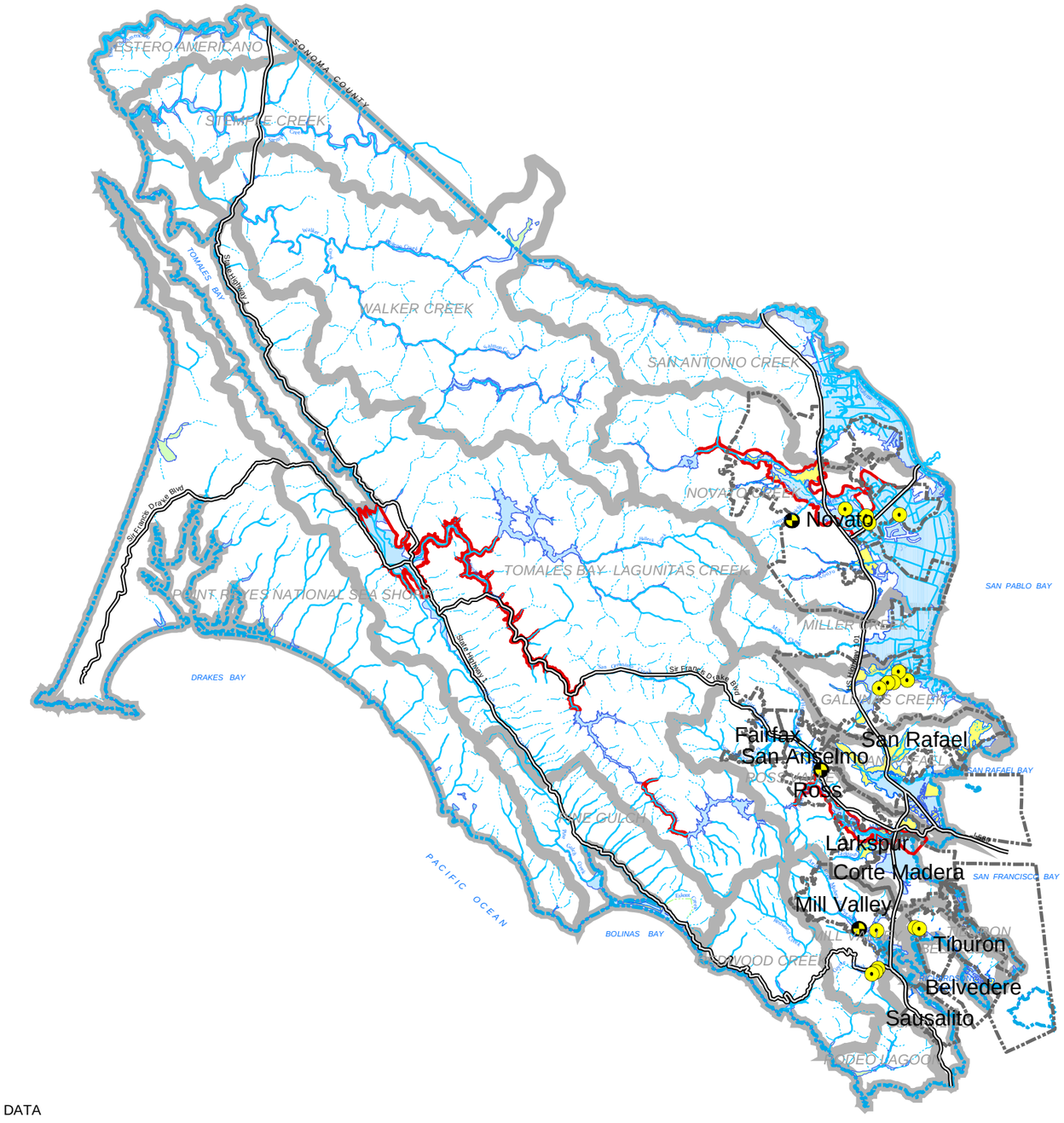
➢ Sample indicators

a) Measure the number and severity of property damage and personal injury incidents due to flooding.

➢ Sample targets

a) Incidences of property damage and personal injuries due to flooding are decreased by 10 percent by 2020.

MAP II-4
FLOODING



Legend

- County Boundary
- City Boundary
- Highways and Major Roads

Streams

- Perennial
- Intermittent
- Ephemeral

Water Bodies

- Lakes
- Lagoons

- Dam Inundation
- Major Watersheds
- MILLER CREEK Watershed Names
- Stream Gauge
- Stormwater Pump Station

Floodplain Zones

- Area of 100 Year Flood
- Areas Between Limits of the 100 Year and the 500 Year Flood

N

0 1 2 4 6 8 Miles

SOURCE: NATIONAL FLOOD INSURANCE PROGRAM Q3 FLOOD DATA

2. Seismic Hazards

(See also A. Environmental Quality, 1. Native Species and Habitat Protection.)

➢ Issues

Marin coastlines are located in the active San Andreas Fault "A", an active tsunami-producing region of the world.

a) Use maps of "Known Active Fault Near-Source Zones" prepared by the California Department of Conservation in coastal planning and development to avoid high-risk areas.

b) Use tsunami wave run-up and inundation maps in coastal planning and development to avoid high-risk areas.

Building code standards and FEMA guidelines for seismic safety need to be reviewed.

a) Standards in the California Building Code and FEMA guidelines related to seismic safety related to seismic safety need to be addressed in the design of new buildings and seismic retrofits of existing structures.

➢ Strategies

Increase public awareness to reduce the risk of damage or injury from seismic hazards.

a) Conduct a public safety outreach program before and after a seismic event and provide evaluation forms to collect public input.

b) Develop local initiatives for earthquake preparedness.

c) Install and test communication systems for tsunami warnings.

Upgrade structures to reduce the risk of damage or injury from seismic hazards.

a) A risk reduction program would encourage upgrading of seismically vulnerable buildings located in geologically hazardous areas. Encourage upgrading of seismically vulnerable buildings located in geologically hazardous areas by using a risk reduction program.

b) Establish a residential seismic retrofitting incentive program similar to the City of Berkeley's.

c) Conduct a study to evaluate seismic stability of the County's key structures.

d) Require seismic retrofits and strapping down of water heaters when remodeling existing structures.

e) Require seismic retrofits for any non-reinforced masonry buildings and chimneys.

f) Require automatic natural gas shut-off valves at time of sale or major remodel.

g) Encourage the North Marin Water District to do seismic upgrades.

h) Use disaster mitigation measures such as fire resistant roofs, fire resistant landscaping within a minimum of 30 feet from the structure, emergency vehicle access, and earthquake retrofit.

Improve land use planning to reduce the risk of damage or injury from seismic hazards.

a) Strengthen land use policies to prevent development in tsunami zones.

b) Map and utilize tsunami zone maps in land use planning decisions.

c) Base policies for addressing development near geologically sensitive areas on the Fault Hazards map (Map II-5).

d) Focus on disaster prevention within the development and building code—require geotechnical studies for all new projects near earthquake faults and liquefaction zones.

e) Waive building permit fees and property taxes for seismic retrofits.

➢ Sample indicators

a) Measure the number of public events or initiatives conducted to increase public awareness to reduce the risk of damage or injury from seismic hazards.

b) Measure the number of County buildings that have been assessed for seismic stability.

c) Measure the number of natural gas shut-off valves installed at time of sale or major remodel.

d) Assess the number of measures taken to reduce the risk of damage or injury from seismic hazards.

➢ Sample targets

a) Increase the number of public events or initiatives conducted to build public awareness to reduce the risk of damage or injury from seismic hazards by 20 percent by 2020.

b) Increase the number of measures taken to reduce the risk of damage or injury from seismic hazards by 20 percent by 2020.

3. Geologic Hazards and Landslides

➢ Issues

Landslide and slope stability hazards are prevalent throughout Marin County because of existing adverse geologic conditions.

a) Because much of Marin's easily developable land is either already developed or protected from development, sites with development constraints such as landslide and slope stability issues are increasingly being proposed for development.

b) A hillside safety and hazard mitigation program is needed for the hilly "marginal" areas within the county.

c) The potential threat of a significant number of failures occurring at the same time is great during strong seismic shaking or during intense rainfall events.

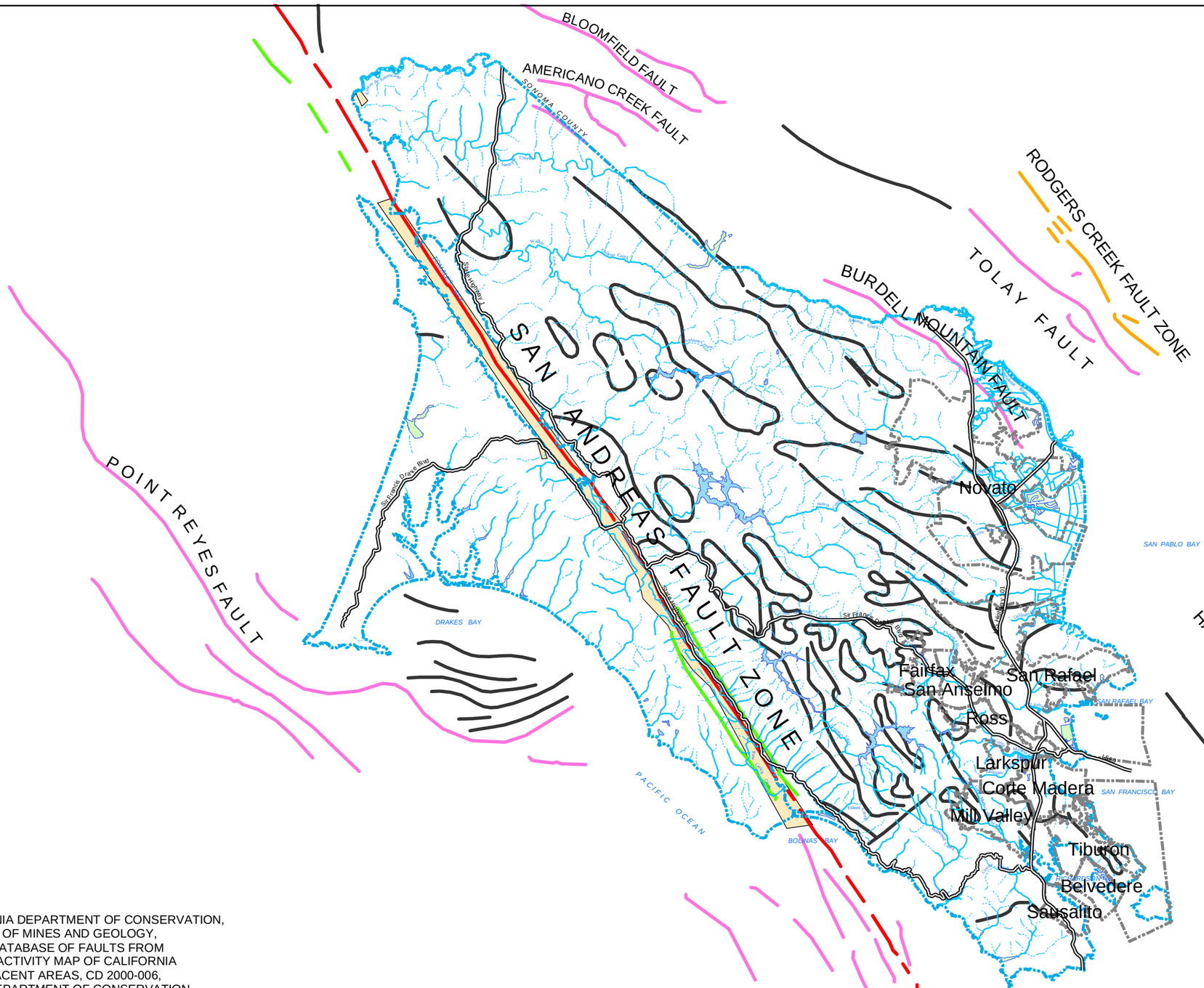
Landslide and slope stability building standards need to be reviewed.

a) The County should modify existing policies and programs to address expansive soils which are responsible for a large amount of superficial creep and slope failure in upland areas.

b) Coastal bluff erosion and coastal landslide hazards need to be addressed.

c) The County does not require both a geotechnical engineer and a certified engineering geologist to perform slope stability investigation, analysis, and monitoring of construction activities.

MAP II-5
FAULT HAZARDS



Legend

- County Boundary
- City Boundary
- Highways and Major Roads

Streams

- Perennial
- Intermittent

Water Bodies

- Lakes
- Lagoons

- Alquist Priolo Zone
- Historic (200 yrs to today)
- Holocene (10,000 yrs to today)
- Late Quaternary (700,000 yrs to today)
- Quaternary (1,600,000 yrs to today)
- Pre-Quaternary (4.5 billion to 1,600,000 yrs ago)

N

0 1 2 4 6 8 Miles

SOURCE: CALIFORNIA DEPARTMENT OF CONSERVATION,
DIVISION OF MINES AND GEOLOGY,
DIGITAL DATABASE OF FAULTS FROM
THE FAULT ACTIVITY MAP OF CALIFORNIA
AND ADJACENT AREAS, CD 2000-006,
CALIFORNIA DEPARTMENT OF CONSERVATION,
DIVISION OF MINES AND GEOLOGY, 2000

➢ Strategies

Carefully review new development in geologically hazardous areas.

a) Use current data to reevaluate the landslide hazard area definition and to update information and policies as necessary.

b) Include in Marin County's geographic information system (GIS) database new, additional, or updated information on geology and geologic hazards. Plotting historical and future landslide and slope stability areas would help determine if there is a trend for future policy decisions.

c) Use U.S. Geological Survey (USGS) landslide maps and slope stability maps to determine locations of future development.

d) Allow only structurally sound redevelopment or additions on liquefaction zones, and prohibit new development on liquefaction zones (Map II-6).

e) Recognize the possible incompetence of the underlying serpentine rock to support structures, and require a thorough geologic and soils analysis of any serpentine site proposed for development.

Improve building standards and policies to reduce risks from geologic hazards.

a) Review the County's grading policies, regulations, and enforcement to ensure that they are properly mitigating hazards. These policies and procedures are the core of hillside safety and a hazard mitigation program.

b) Reevaluate hillside policies regarding geology as necessary to improve hillside safety and hazard prevention measures.

c) Strengthen polices that discourage building on extreme slopes. Have County staff review regulations to ensure that the spirit or intent of state and federal regulations is being implemented.

d) Apply coastal zone steep slope protection policies countywide.

➢ Sample indicators

a) Measure the number of incidents and severity of property damage and personal injuries resulting from landslides.

➢ Sample targets

a) Incidences of property damage and personal injury resulting from landslides are reduced by 10 percent by 2020.

4. Fire Hazards

(See also A. Environmental Quality, 1. Native Species and Habitat Protection, and 2. Water Quality.)

➢ Issues

Development at the wildland-urban interface introduces fire to areas with high fuel loading.

a) Marin County has numerous structures located within the wildland-urban interface. Homes with wood siding, wood decks, and wood shingled roofs are at extreme risk from a wildland fire.

b) The primary causes of fire between 1990 and 1997 were equipment use, arson, playing with fire, smoking, and burning of debris.

c) Steep slopes and narrow roads pose hazards to fighting fires at the wildland-urban interface.

d) Homes surrounded by trees and brush increase the threat of ignition and difficulty fighting fires.

e) Coast live oaks and tanbark oaks that have died from SOD increase the fuel load.

Wildfires can cause severe economic losses.

a) Fire costs can soar to millions of dollars a day from suppression cost, destruction of homes, loss of home-based businesses, damage to utilities, and impacts on recreation areas.

➢ Strategies

Undertake cooperative fire preparedness and prevention planning.

a) Develop a cooperative wildland fire evacuation plan for residents involving cities, County Office of Emergency Services, State and Federal agencies, and special districts. This plan should also recognize the potential for catastrophic landslides in years following a fire due to soil instability.

b) Organize stakeholders through FIRESafe Marin to identify the hazards, design mitigation strategies, and seek funding from unconventional sources for fire prevention.

c) Determine critical fire areas so that prevention efforts can be focused.

d) Increase fire preparedness in the Mount Tamalpais area. Support fire engineering, code enforcement, staff training, and public education as the main components of fire prevention.

e) Encourage the Community Development Agency to collaborate with the County Fire Department to educate the public on the causes of fire and provide prevention information.

f) Prepare a countywide tactical plan that would divide the county into pre-identified zones in conjunction with the existing County Master Mutual Aid Plan. The zones need to be mapped, and firefighting considerations need to be identified. Considerations such as water sources, safety zones, access, and assets at risk need to be included for each zone. Suppression strategies need to be addressed based on assets protected and resource management goals.

g) Support and implement the California Fire Plan.

Implement the Marin County Fire Management Plan.

a) Reduce the frequency, severity, and size of wildfires through fuel reduction and fuel breaks, ignition management, and fire safe engineering activities.

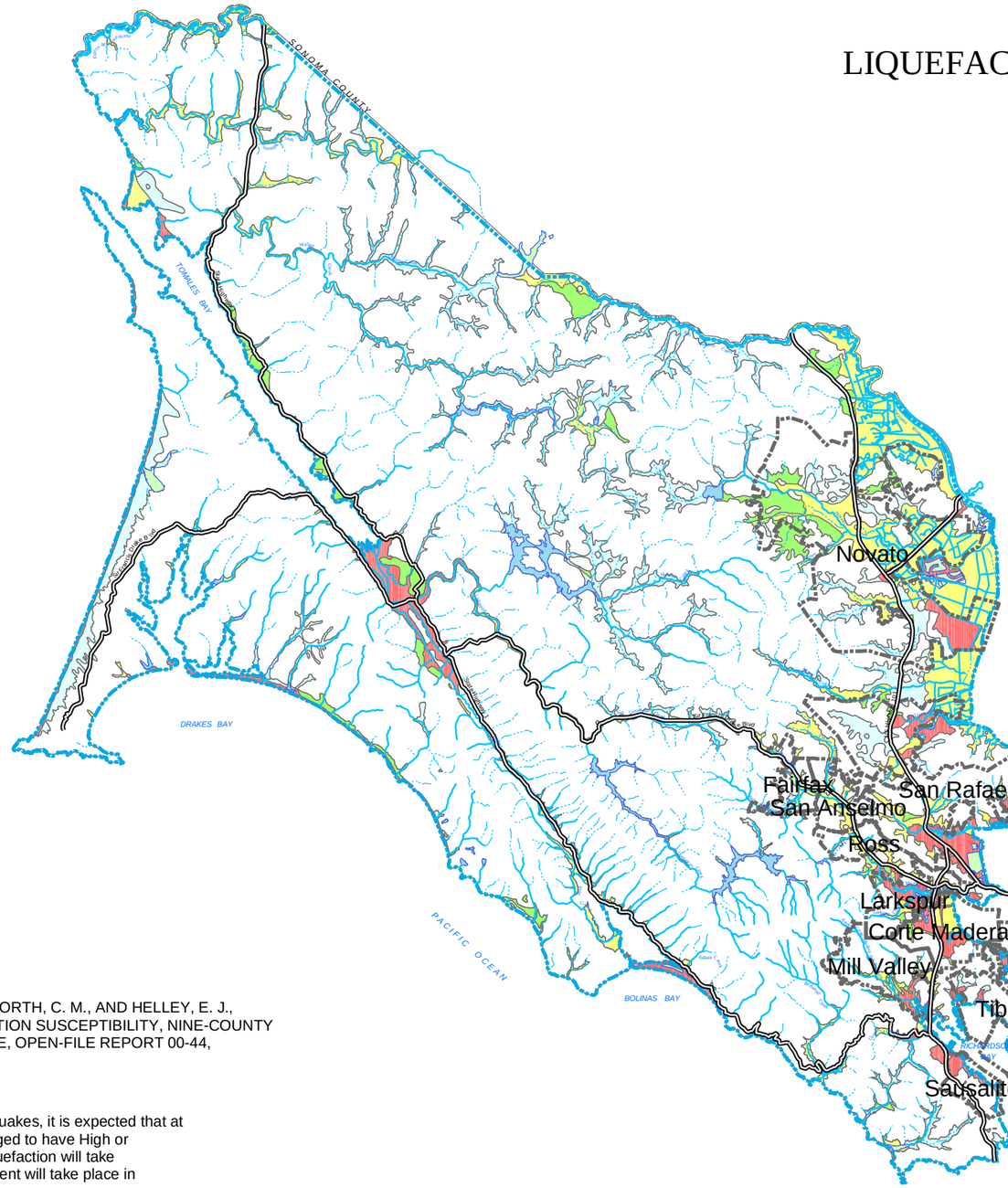
Reduce fire fuels through vegetation management.

a) Undertake cooperative vegetation management planning on both public and private lands involving cities, County, state, and federal agencies, and special districts.

b) Support controlled burns to reduce fire risk.

c) Update the Strategic Vegetation Management Plan. Expand this plan with a list of prioritized projects and an implementation plan.

MAP II-6
LIQUEFACTION SUSCEPTIBILITY HAZARDS



Legend

- County Boundary
- City Boundary
- Highways and Major Roads

Streams

- Perennial
- Intermittent

Water Bodies

- Lakes
- Lagoons

Level of Liquefaction Susceptibility*

- Very High
- High
- Moderate
- Low
- Very Low

N

0 1 2 4 6 8 Miles

SOURCE: KNUDSON, K. L., SOWERS, J. M., WITTER, R. C., WENTWORTH, C. M., AND HELLEY, E. J., PRELIMINARY MAPS OF QUATERNARY DEPOSITS AND LIQUEFACTION SUSCEPTIBILITY, NINE-COUNTY SAN FRANCISCO BAY REGION, CALIFORNIA: A DIGITAL DATABASE, OPEN-FILE REPORT 00-44, ONLINE VERSION 1.0, U.S. GEOLOGICAL SURVEY, 2000.

*On the basis of the liquefaction failures that occurred during past earthquakes, it is expected that at least 80 percent of future liquefaction failures will take place in areas judged to have High or Very High susceptibilites. We expect that 20 percent or less of future liquefaction will take place in areas judged to be Moderate and Low, and that less than 1 percent will take place in areas judged Very Low (Knudson et al., 2000).

d) Promote manual brush removal and grazing to reduce fuel load. Encourage vegetation reduction programs for buildings adjacent to heavily vegetated property.

Limit and/or condition development at the urban-wildland interface to reduce fire risk.

a) In view of the high potential for wildfire at the urban-wildland interface, restrict the introduction of further development into areas of chaparral, for the safety of present and future residents.

b) Encourage use of fire-resistant landscaping.

c) Create defensible space around structures on the urban interface.

d) Promote replacement and educate the public about the purposes of fire safe roofing.

Improve infrastructure for firefighting.

a) Create escape routes, widen roads, and develop better infrastructure for firefighting.

➢ Sample indicators

a) Measure the number of buildings damaged by structural fire (Marin County Fire Department).

b) Account for acres of land that have had controlled burns (Marin County Fire Department).

➢ Sample targets

a) Decrease structural fire damage by 10 percent by 2010 over 2000 levels.

b) Increase controlled burns for fuel load reduction and habitat enhancement by 20 percent by 2010 over 2000 levels.

5. Hazardous Materials

➢ Issues

Hazardous materials are concentrated in populous areas where they pose the greatest risk to human health.

a) The City-Centered Corridor is considered most susceptible to public health concerns and environmental degradation caused by long-term conditions and by secondary disasters. This corridor has the greatest concentration of people and industry in the county.

b) The Inland Rural Corridor has one of the greatest risks for hazardous material releases in Marin County from transportation of hazardous materials because response times would be great, sensitive environmental receptors are abundant, and many roads are narrow and twisting.

c) More than 500 Marin County businesses are regulated hazardous material businesses (Snyder and Smith Associates).

d) Coordination with the cities is needed to prevent placement of hazardous materials near sensitive receptors, such as schools, hospitals, high occupancy buildings, or nursing homes, particularly as mixed-use development increases.

e) Specific regulations are needed for development of land on or adjacent to a known solid or hazardous waste site.

f) There needs to be planning for a major multirelease of hazardous materials and how this emergency will be safely addressed.

➢ Strategies

Reduce human exposure to hazardous materials.

a) Adopt a precautionary principle ordinance like one adopted in the city of San Francisco.

b) Develop and implement a policy to reduce or eliminate the use of hazardous materials in County buildings, on County property, and in County operations that contain hazardous components.

c) Provide incentives to use ecologically friendly products.

d) Review proposed developments for their proximity to hazards including but not limited to high levels of electromagnetic radiation (EMR) and to electromagnetic frequency (EMF) rays, and information about EMR and EMF levels should be provided on request.

e) Develop a hazardous materials subsection for the Countywide Plan that includes policies and programs for reducing or eliminating hazardous and toxic materials.

➢ Sample indicators

a) Measure the number of toxic spills in Marin (CUPA).

b) Account for the number of businesses that use regulated hazardous materials (CUPA).

➢ Sample targets

a) Reduce toxic spills by 20 percent between 2002 and 2010.

b) Reduce the number of businesses that use regulated hazardous materials by 10 percent by 2010 over 2000 levels.

6. Global Warming

➢ Issues

Increased temperatures from global warming are expected to increase flooding and fire and to decrease air quality.

a) The EPA estimates that in 2100, with the absence of emission control policies, carbon dioxide concentrations are projected to be 30 to 150 percent higher than today's levels.

b) The EPA estimates that the sea level is likely to rise two feet along most of the U.S. coast by 2100. Sea level rise and higher evaporation rates will increase storm activity.

c) Wildland fires are increasing due to increased temperatures and droughts caused by global warming.

Global warming may have serious financial ramifications.

a) The global cost of natural disasters is anticipated to top $300 billion annually by the year 2050 if the likely impacts of climate change are not countered with aggressive disaster reduction measures.

Increased temperatures from global warming are expected to negatively affect biological resources.

a) Desalinization of the world's oceans due to the melting of polar ice caps could cause much sea life to die. Phytoplankton, the foundation of the ocean's food chain, is in jeopardy of mass die-off due to the decrease in salinity.

b) Accelerated desertification is associated with higher temperatures.

c) The Delta – an important food production area – may flood in the future due to global warming. This would seriously affect our food supply.

➢ Strategies

Recognize global warming as a serious issue for Marin County.

a) Recognize global warming as a trend in the Countywide Plan.

Become a national model for promoting positive climate change.

a) Set aggressive reduction targets for vehicle emissions

Increase public awareness and participation on the causes and impacts of global warming.

a) Set reduction targets for greenhouse gas emissions and implement a program to reduce emissions.

b) Use the International Council of Local Environmental Initiatives' Cities for Climate Protection Campaign to develop programs for reduction of the county's greenhouse gas emissions.

c) Develop and disseminate information on opportunities to reduce greenhouse gas emissions.

d) Continue gathering data from the United Nations and the EPA to determine the impact of global warming.

➢ Sample indicators

a) Monitor greenhouse gas emissions from energy, transportation, and waste (Marin County Community Development Agency).

➢ Sample targets

a) Reduce greenhouse gas emissions by 20 percent by 2020 over 2000 levels.

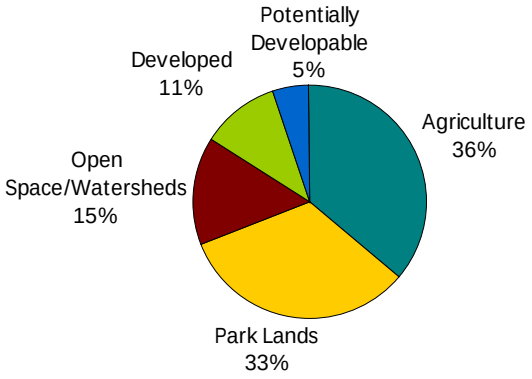
C. OPEN SPACE AND TRAILS, AND PARKS AND RECREATION

➢ Background and trends

Marin's public parks, open space and watershed lands provide recreational and scenic opportunities for the Bay Area and beyond. Marin County residents and visitors are fortunate to have access to nearly half of the county's land base as parks and open space. While parks allow for high intensity recreational uses, the primary function of open space lands is protection of natural resources with low intensity recreation as a secondary purpose. With the largest amount of public land in the nine-county Bay Area, Marin's 109,824 acres of park and open space and comprise 33 percent of the County's land base, while open space and watershed lands comprise another 15 percent (Figure II-5). Approximately 500 miles of trails allow access through much of this land (1994 Marin County Community Development Agency). City, county, state, and national parks offer varied recreational opportunities, from hiking through oak woodlands and redwood forests to playing soccer, golf, or baseball. In addition, open space lands protect important habitat from development and protect scenic viewsheds.

The ample and varied recreational opportunities available in Marin draw visitors from around the world, with more than 2.5 million annual visitors to Point Reyes National Seashore alone. These visitors support a $500 million per year tourism industry that includes 100 bed and breakfast inns just in West Marin (Point Reyes National Seashore).

Figure II-5
Marin County Land Uses



Source: 2001 Marin County Assessor

Travel spending in Marin has doubled in the past eight years. In 1992, travelers spent $275 million in Marin. This figure increased to $532 million by 2000. In addition, the number of jobs generated by travel during this period increased from 5,010 to 7,760, and related tax revenues nearly doubled from $18.7 million to $35 million.

1. Open Space and Trails

➢ Issues

A regional approach to open space management is needed.

a) As far as their respective missions and purposes allow, all public land management agencies in Marin should work toward a common vision for open space and trails.

b) There is increasing cooperation among agencies to manage open space. Policies should be encouraged and Memorandums of Understanding (MOUs) developed that strengthen this collaboration.

c) There is a need for a systems approach to land management decision making. For example, if a resource manager makes a decision for the Point Reyes National Seashore, the decision affects other surrounding areas and systems, and these consequences need to be considered.

Funding is needed for open space acquisitions.

a) Of all public land management agencies in Marin, the Open Space District is the most actively involved in land acquisition. In contrast to its earlier years in which the District could apply most of its locally generated annual property tax revenues toward land purchases, the Open Space District must now use nearly all of these funds for administering and maintaining its 14,000-acre open space system. Less than ten percent of the District's annual property tax revenues for each of the past ten years have been allocated for land purchases. Consequently, the Open Space District must rely heavily on grants or other sources to purchase open space. Many grants are available only on a competitive basis.

b) Increased land acquisition is needed to protect ecologically significant corridors, as well as unprotected ridge and upland greenbelt and community separator lands.

c) There are targeted open space lands identified in the 1994 Countywide Plan that still need to be acquired.

d) There should be an effort to preserve lands adjacent to water, particularly San Francisco Bay, the Pacific Ocean, and streams.

Stewardship is needed to ensure proper management of open space and trails.

a) Land stewardship activities need to have a high priority.

b) For many land management agencies including the Open Space District, annual budgets, even without allocating money for land purchases, cannot accommodate increased expenditures for stewardship. Grants for general land maintenance do not exist. Additional sources of funding are needed to ensure adequate stewardship of open space lands.

c) There is high use of open space in some areas and low use in other areas. Monitoring of high use areas, as well as maintenance and restoration plans, are needed to ensure ecological protection. A clear vision of environmental quality needs to be established for open space lands.

d) There is a need to develop data that indicates the performance of erosion control measures and vegetation management measures that are being used on open space, including fire management, invasive species management, and ecological restoration.

User conflicts on open space lands have increased.

a) There is a conflict between quality of experience and quantity of visitors.

b) Bicyclists want access to narrow trails, which some equestrians and hikers oppose because of concerns related to trail safety, trail user experience, and resource protection.

c) An increase in the number of commercial uses (such as organized hiking, kayaking groups, dog walking, and interpretive walks) raises concerns related to resource protection and the experience of other users.

d) There is an increased demand for "extreme" or individual sports, such as downhill skateboarding, BMX biking, and scooter riding on open space lands. These uses are generally incompatible.

e) Proposed land acquisitions and land management actions are increasingly scrutinized by neighbors concerned about parking, the number of people passing through neighborhoods, and user conflicts.

f) Open space areas, which were originally intended to serve local communities, are increasingly serving regional park needs, in part due to increased public awareness. Information about Marin's open space land is much more easily accessible by regional users due to technology and popular printed materials.

g) Increased user demand and community pressure are requiring increased land stewardship and enforcement of safety and resource protection. The role of open space ranger staff, historically education focused, is increasingly focused on enforcement.

Trail assessment and planning is needed to optimize public use.

a) Assess and prioritize each trail in the system for its potential use by persons with disabilities, and remove barriers where possible.

b) As the demand for trails-related recreation increases, there should be an effort to complete the trails network set forth in the Trails Element of the 1994 Countywide Plan.

c) Legal issues concerning easements and prescriptive rights need to be evaluated and clarified.

d) The present Countywide Plan Trails Element has not been merged with the Parks and Recreation Element.

e) There is a need to develop long-distance trail connections (San Francisco Bay Trail, Bay Area Ridge Trail).

Planning for tourism is needed.

a) Tourism master planning needs to occur to assess accommodation demands and environmental impact.

b) Marin serves as a regional greenbelt with recreational areas for the Bay Area and beyond, which contributes to road and user congestion.

➢ Strategies

Develop a regional approach to open space management.

a) Continue to improve land management decision making and activities through regular and ongoing communication among Marin County's public land management agencies and with similar agencies throughout the Bay Area.

b) Continue to identify and address open space–related issues that cross jurisdictional or agency boundaries, such as availability of public transit to public open space, fire hazard reduction, and Sudden Oak Death, through communication and cooperation with public transportation, fire protection, planning, or other agencies as necessary.

Develop public and private partnerships to fund acquisition of key parcels.

a) Continue cooperative efforts with other Bay Area land management agencies and conservation organizations to propose, support, and monitor state and federal open space and park funding legislation.

b) Establish partnerships with other public agencies and private conservation organizations to obtain funding and/or public support as necessary.

c) Close key gaps in the countywide system of public lands. Continue efforts to acquire or otherwise protect such lands for wildlife corridors and habitat, rare and endangered species protection, public recreation, and the completion of upland greenbelt/community separator areas. Continue efforts to preserve baylands, coastal lands, and stream corridors.

d) Pursue Board of Supervisors endorsements of state and federal legislation that provides funding for habitat conservation and enhancement activities.

Enhance open space stewardship by identifying and treating threats to natural resources.

a) Continue efforts to identify and address erosion, the spread of invasive plant species, and other resource protection problems on public open space.

b) Identify indicators to assess the ecological health of public lands and the sustainability of current uses.

c) Continue to reduce dependence on the use of pesticides and herbicides for parks and open space maintenance purposes.

Minimize user conflicts through education and appropriate levels of use.

a) Continue efforts to inform and educate the citizens of Marin County and open space visitors concerning the county's public open space lands and their appropriate uses. Continue to improve available information (guidebooks, Web sites, maps) to enhance visitor enjoyment of Marin County's public open space and trails.

b) Research the concept of the sustainability of public open space in relationship to the impact of visitors, ranging from parking congestion to open space recreational usage, so that open space can be preserved and maintained for future generations.

Optimize public use of trails through proper planning.

a) Continue to accommodate needs of the physically challenged in trail planning and construction when practicable.

b) Close key gaps in the countywide system of public trails. Continue efforts to create an interconnected system of public open spaces, complete the Bay Area Ridge Trail, complete the San Francisco Bay Trail, and enhance public trail recreation opportunities.

c) Address legal issues concerning trail easements and prescriptive rights.

d) Address issues related to maintaining proposed new trails of countywide significance with Marin's cities, towns, and public land management agencies.

e) Address the issue of providing parking at trailheads. Design trails with multiple ingress and egress points and signage to minimize the need for parking at trailheads.

f) Seek methods to establish partnerships and cooperation among trail interest groups to increase and improve trail recreation opportunities.

Plan for the impacts of tourism.

a) Prepare a tourism master plan to assess demand for accommodation and environmental impact.

b) Provide maps and information showing how public recreational lands can be accessed by public transportation, by bicycle, or on foot.

➢ Sample indicators

a) Determine funding needs for highest priority open space acquisitions for the next 10 years (MALT).

b) Measure the percentage of open space land preserved (Marin County Community Development Agency).

c) Measure the percentage of trails accessible to physically challenged persons (Marin County Department of Parks, Open Space and Cultural Services).

➢ Sample targets

a) Obtain funding for targeted open space lands identified in the 1994 Countywide Plan and/or other high priority properties of equivalent size and public value by 2012.

b) Increase the mileage of trails accessible to physically challenged persons by 10 percent over 2002 mileage by 2007.

2. Parks and Recreation

➢ Issues

High user demand and diversity of uses causes competition for parks and recreational facilities.

a) Marin does not have a large number of youth park facilities, such as skate parks.

b) There is an increasing need for soccer and softball fields. Optimizing use of existing school play fields might help alleviate this situation.

c) Adult team sports, such as “over 40” and “over 50” leagues, compete with youth sports for playing field time. In one instance, an “over 50” soccer league considered funding a new field in exchange for an allotment of reserved field time.

d) Users engaged in both team sports as well as individual activities (in-line skating and skateboarding) need space for their activities.

e) There is a growing need for specialized parks, such as dog parks, community gardens, and skateboard parks.

f) There is a need to explore possible locations for overnight camping.

g) Safety on bike paths needs to be improved.

Diversity in population requires diversity in parks.

a) As the average age in Marin increases, the demand for recreational facilities to accommodate a more mature population grows.

b) People with lower incomes may lack access to private recreational facilities and thus rely more on public facilities.

c) Neighbors adjacent to proposed park facilities may object to any such development.

Creative financing may be required for new park facilities.

a) The high cost of land makes acquisition of park sites in Marin difficult. City and County collaboration provides more facilities. For example, the proposed skateboard park at McInnis is a collaboration of the County of Marin, the City of San Rafael, and the Marinwood Community Services District.

Pesticides and other toxins can effect the health of park users.

a) There is a need to evaluate the use of toxins such as pesticides in all parks and determine whether further limitation of use is needed.

➢ Strategies

Develop an assessment of user needs and park and recreation facilities.

a) Develop an updated Master Plan for Marin County Parks to assess current facilities in order to determine appropriate areas for expansion and suitable locations for new facilities, and to explore mechanisms to fund new park development.

b) Develop an updated park facility assessment, including examination of city facilities, other public facilities such as schools, private facilities, and County facilities.

c) Develop an updated user needs assessment to determine current and projected community park and recreation requirements. Include consideration of Marin's aging community, cultural diversity, and economic diversity in developing such an assessment.

d) Study the feasibility of allowing community gardens in some park areas and create a pilot program to implement the study.

e) Explore opportunities for overnight camping in existing parks. Determine other appropriate locations for new facilities that could accommodate overnight camping.

f) Work to ensure that all parks are designed to meet the needs and financial means of the handicapped and senior populations.

g) Ensure that green spaces are integrated into urban areas as urban infill and densification increase.

Ensure that pesticides and other toxins don't pose health risks for park users.

a) Determine the least toxic means of reducing weeds and other pests, if necessary, to acceptable levels.

b) Conduct annual training of all Parks Department crews in the use of Integrated Pest Management practices.

➢ Sample indicators

a) Compare the ratio of park area per person available in Marin County with guidelines outlined in the Quimby Act or by the California Park and Recreation Society (Marin County Community Development Agency).

b) Conduct a user needs assessment for parks and recreational facilities (Marin County Department of Parks, Open Space and Cultural Services).

c) Monitor park reservations and park revenues for consideration as indicators of use (Marin County Department of Parks, Open Space and Cultural Services).

d) Measure the number of annual play field uses and compare with industry guidelines (Marin County Department of Parks, Open Space and Cultural Services).

➢ Sample targets

a) Eighty-five percent of user needs for parks and recreational facilities are being met by 2010.

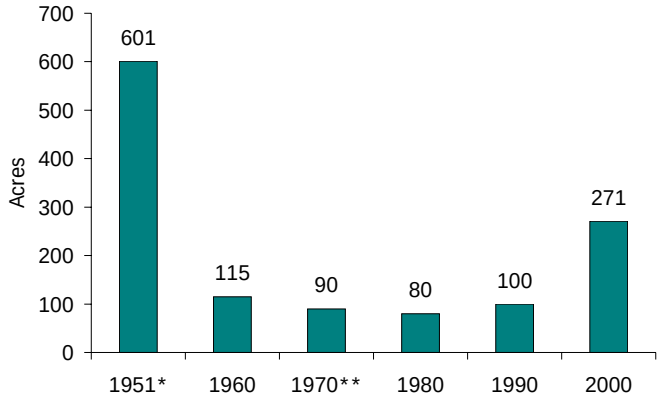
D. FOOD AND AGRICULTURE

➢ Background and trends

Agriculture remains vital to Marin's rural landscape and way of life. Marin County's rural landscape, culture, and economy have depended on a viable agricultural industry to sustain them for the past 150 years. Located on the urban edge in one of the wealthiest localities in America, Marin County still has agriculture as one of its primary land uses. Despite this, the agricultural way of life in Marin is threatened by the increasing difficulty of making a living farming and ranching . At the core of this problem is the fact that agricultural production costs have outpaced agricultural revenues. This state and nationwide trend is exacerbated by especially high land values in Marin.

The diversity and relative proportions of products generated by Marin farmers and ranchers have fluctuated over the years. Livestock-based products have traditionally been the mainstay here, and they still account for a vast majority of Marin County agriculture both in value and acreage, due primarily to the nature of West Marin's rugged topography, soil limitations, and scarcity of water. As of 2001, the value of livestock, livestock products, and livestock feed crops in Marin County was $47,268,410, or 93 percent of the $50, 900,357 total value of Marin County's agricultural production. Vegetable production, in its heyday in the 1930s and 1940s, has seen an increase during the past decade after years of decline. In 1935, more than 1,800 acres of vegetables and nearly 1,000 acres of fruits and nuts were raised in Marin. In the 1930s and early 1940s, artichokes and peas were important crops in coastal areas, with 2,000 acres of peas alone at the peak of production. By 1951, fruit, nut, and vegetable production had declined to 601 acres and continued declining until the 1980s, when row crops began a slight upward trend. The acreage of fruit and vegetable crops had more than doubled to 271 acres by 2000, due in part to 95 acres of vineyards (Figure II-6).

Figure II-6
Marin County Vegetable, Fruit, and Nut Acreages



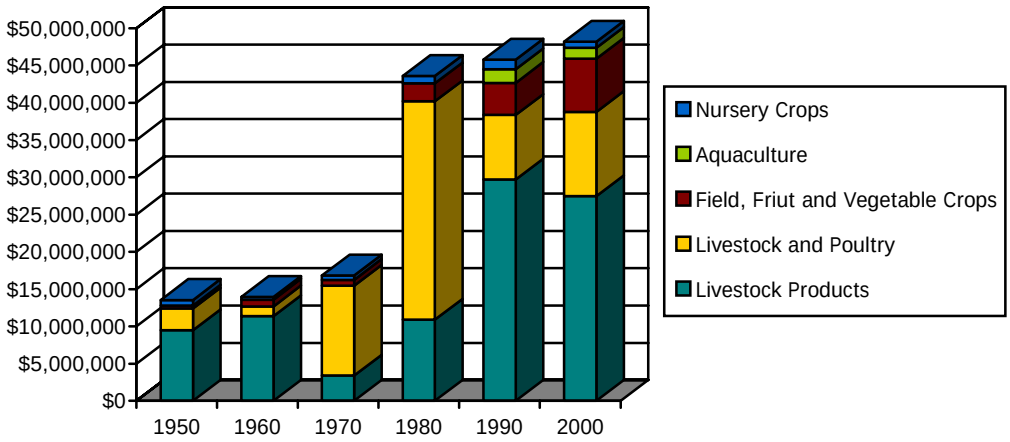
* 1950 data not available.
** In 1970, vegetables were not listed in the Crop Report; this figure is presumed to include only fruits and nuts.

Source: 1935-2001 Marin County Department of Agriculture

Of the 133,444 acres of land used for agriculture in Marin County (U.S. Department of Agriculture), as of 2000, approximately 177 acres were in vegetable and nongrape fruit production, 94 acres supported vineyards, 6,065 acres were used for livestock feed crops, including hay and silage, and the remaining acreage was used as pasture for livestock grazing.

Recent increases in organic food production, creation of specialty products and markets, and on-farm diversification offer promise of increased revenues and more stable income streams to ranchers and farmers. Local food production enhances a community's food security by ensuring that food is available to local people regardless of transportation or trade issues that can affect food supplies. Because of Marin County's proximity to population centers in other Bay Area counties, Marin food products also offer greater food security to this population. Opportunities for Marin farmers and ranchers to market food locally abound. The majority of products sold at Marin's well-developed farmers market system continue to come from out-of-county sources. Diversification of local farm products has the potential to increase revenues for farmers and contribute to the viability of local agriculture, as well as providing more locally sold food. The recent interest in locally grown, natural grass-fed beef, farmstead cheeses, high value organic strawberries, and olive oil are examples of agricultural diversification that offer locally produced food choices (Figure II-7).

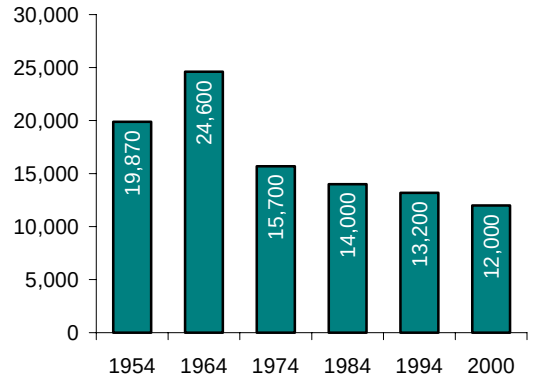
Figure II-7
Crop Values for 50 Years



Source: 1935-2001 Marin County Department of Agriculture

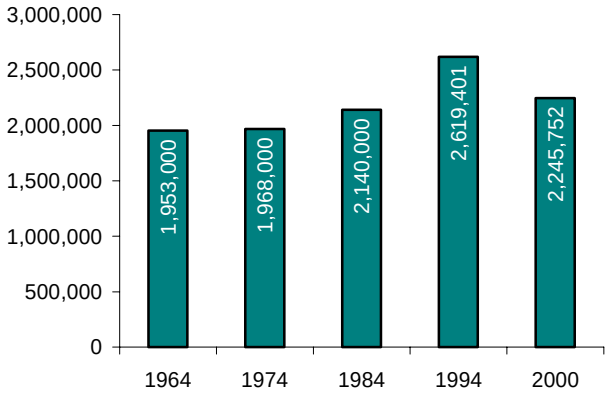
While the number of dairies has declined, dairy herd size has increased and milk production has remained fairly constant. In 1862, Marin ranked first among California counties for milk production. Since that time, a steady decline has marked Marin County's dairy industry, and Marin is now ranked 12th in the state (out of 58 counties) in terms of milk production. Between 1950 and 2000, the number of dairies decreased from 200 to 31, and the number of head of dairy cattle in the county decreased from approximately 20,000 to about 12,000 (Figure II-8). Despite this downward trend in dairies and animal numbers, countywide milk production has increased slightly due to increased milk production per cow and other improvements in farming practices.

Figure II-8
Number of Dairy Cattle (Head) in Marin County



Source: 1935-2001 Marin County Department of Agriculture

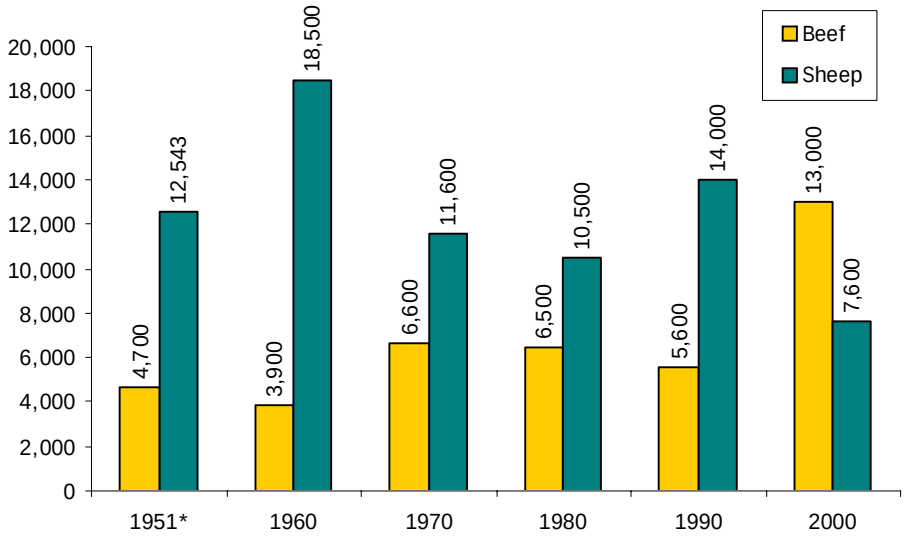
Figure II-9
Milk Production in Pounds, Marin County



Source: 1935-2001 Marin County Department of Agriculture

Beef production has replaced dairies and sheep ranches. As dairy operators have sold their herds, they have either leased their ranches out to other producers or have switched to raising beef, dairy replacement heifers, or a combination of the two (Figure II-9). This pattern—as well as a steep decline in the number of sheep ranches—have resulted in an increase in the number of beef producers and head of beef cattle produced in the county, despite the fact that beef producers are struggling financially (Figure II-10).

Figure II-10
Marin County Cattle and Sheep Numbers



* 1950 data not available.

Source: 1935-2001 Marin County Department of Agriculture

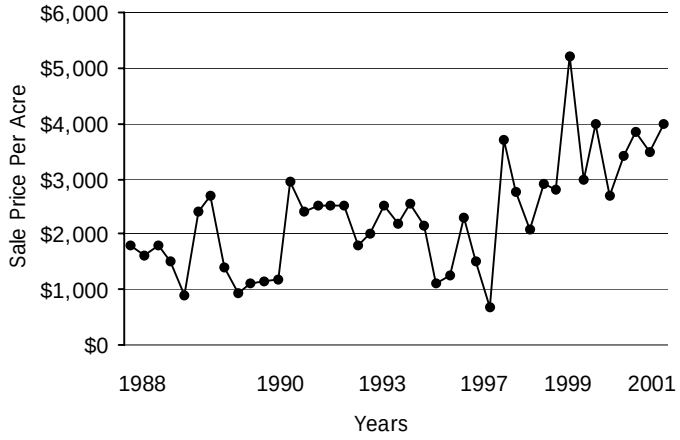
Recent increases in organic acreage and number of certified organic growers show promise. The past 10 years have seen an increasing interest in organic farming, with 28 certified organic growers registered in the county in 2000, compared with 4 in 1990—a seven-fold increase. Organic acreage has also increased from 67 acres in 1990 to 1,017 acres in 2000, with approximately 170 acres attributed to vegetables and fruits and the remaining 800-plus acres in organic dairying and livestock feed production. Nationwide, organic food production is the faster growing sector in agriculture, at a rate of 20 percent per year (Dimitri and Greene).

Product diversification and direct marketing are on the rise. Direct marketing to consumers by local agricultural producers, as well as development of niche markets, are gaining interest and appear to be essential to the economic survival of some farms and ranches. Direct sales of Marin-grown organic produce, farmstead cheese, and beef products have gained market shares at local farmers markets and are being sold through a popular farm box subscription program, and a successful farmstand operation.

The average age of Marin County agricultural landowners has increased. The question of who will succeed or take over ranches and farms is a serious concern. The number of California farmers under the age of 35 declined by 51 percent between 1987 and 1997. California farmers age 65 and older outnumber farmers 25 years old and younger by 60:1 (California Farmlink).

Agricultural land prices have risen sharply due in part to residential "estates." Agricultural land values in Marin have increased dramatically in recent years. While the sales price of agricultural land zoned A-60, APR-60, and CAPZ-60 has greatly fluctuated over the years, it remained fairly stable at around $2,000 per acre through most of the 1990s, and then rose dramatically between 1998 and 2001 to $5,000 per acre. During these three years, the average price of agricultural land in parcels of 150 acres or greater with 60-acre zoning increased from $2,200 per acre to $3,780 per acre (Figure II-11). Although many of Marin's ranches have been in family ownership for several generations, recent purchases by nonagricultural landowners account for the recent dramatic sales price increases.

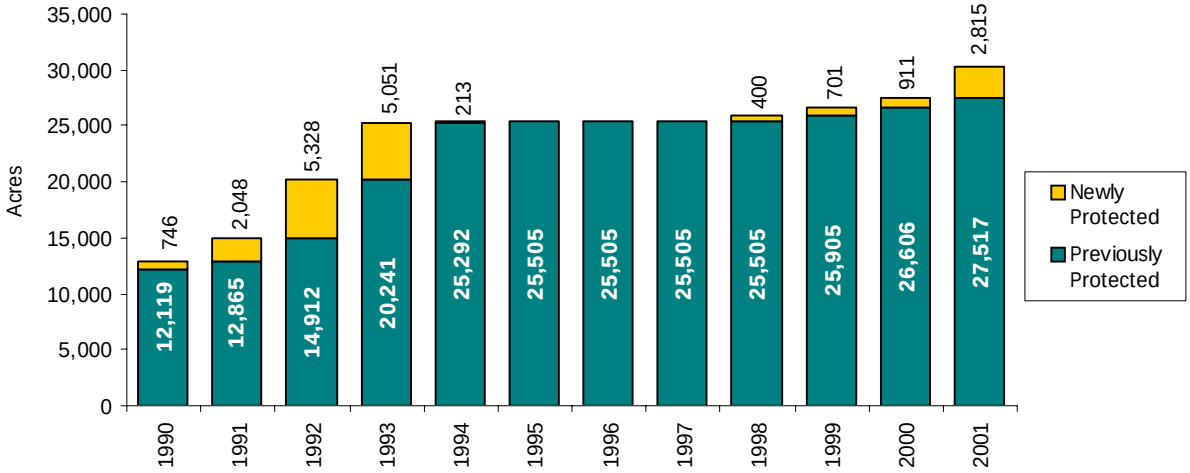
Figure II-11
Marin Agricultural Land Sales
for Properties Zoned as A-60, APR-60, and CAPZ-60
1988–2001



Source: 2002 Marin Agricultural Land Trust

The tradition of land protection continues. Marin Agricultural Land Trust (MALT) is continuing to help farmers and ranchers protect their land from development through purchase of agricultural conservation easements. Since MALT acquired its first conservation easement in 1983, 32,000 acres—25 percent of the privately owned ranches over 150 acres in size—have been protected in this manner (Figure II-12).

Figure II-12
Agricultural Conservation Easements in Marin County
Acquired by MALT



Source: 2002 Marin Agricultural Land Trust

The value of organic food produced in Marin has increased. Organic food production rose from $2.4 million in 1995 to $3.2 million in 2000—a 33 percent increase. Most of this increase is attributed to organic dairy products.

1. Agricultural Viability

➢ Issues

Increasing economic pressure on ranchers and farmers is a threat to the viability of agriculture in Marin.

a) The long term viability of agriculture is important to a balanced economy in Marin.

b) Agricultural profit margins need to be retained or improved for agriculture to be economically viable.

c) Many ranchers and farmers are being forced to sell their operations or change their products to be economically viable, or to sell their operations. A decrease in the number of farms impacts the farm support system of business related to agriculture. A critical mass is needed to maintain an agricultural economy.

d) Financial incentives are needed for appropriate agricultural uses, agricultural sustainability and innovation, and growing of organic products.

e) Regulatory restrictions make traditional agricultural production and development of new crops and products difficult.

f) International and global policies affect feed prices and revenues, and make the market more volatile.

g) Agricultural pest management with pesticides toxic to non-target organisms conflicts with increasing community resistance to the use of chemicals.

Diversification of agricultural products is needed for long term viability of agriculture.

a) Some traditional farming and ranching operations are threatened, due to increased regulations. For example, sheep ranching is at stake due to tighter predator control restrictions.

b) Alternatives are needed to help make agriculture in Marin more financially viable. Potential alternatives could include production of olives and cheeses, “you pick” farms, farm-stay operations, and roadside stands.

c) Allowing bed and breakfast operations and second units for income generation is important as long as these uses don’t result in the unintended consequence of conversion to primarily nonagricultural uses.

d) Agricultural diversification would guard against development of a monoculture, such as the widespread conversion to vineyards.

e) The feasibility of supplying an adequate supply of water at a reasonable cost to farmers needs to be examined. Water supply is essential to increased production of vegetables and other crops important to diversification, and economic stability cost needs to be examined.

Preservation of family farms is threatened by the advancing age of farm owners and a decline in young farmers and ranchers.

a) High land values make it virtually impossible for young farmers and ranchers to acquire land unless they inherit it or marry into a land-owning family.

b) Long hours, hard work, and low pay discourage young people from choosing farming and ranching as an occupation.

➢ Strategies

Support diversification of products and services to strengthen agricultural viability.

a) Support agricultural diversification through development of local markets and education.

b) Promote biological diversity in the agricultural gene pool through seed saving and exchange, livestock breeding, and non-GMO (genetically modified organism) plant propagation.

c) Diversify agricultural products and related services such as organics, grass-fed beef, value-added dairy products, and small-scale agricultural tourism.

d) Assist farmers with development of water sources for conversion to organic row crop farming. Analyze opportunities for water conservation and efficiency techniques, and use sustainable water management practices. Encourage water recycling and conservation, including graywater use and on-site rainwater harvesting, storage in catchment ponds, and treatment with constructed wetland systems.

Develop marketing opportunities for local products to strengthen agricultural viability.

a) Assist in the development, promotion, and funding of marketing campaigns and an advertising campaign to promote organic agriculture in Marin.

b) Develop a cooperative marketing program.

c) Increase direct marketing opportunities. Selling agricultural products to local restaurants, stores, and farmers markets allows farmers and ranchers to market their products directly to customers and to receive a fair price for their food.

d) Explore a distribution and warehousing model that would provide the infrastructure needed for small farmers to more easily make their farm products available to schools, specialty supermarkets, and restaurants.

Support educational programs to enhance agricultural viability.

a) Provide educational programs to farmers and ranchers that encourage and promote diversification, such as organics, grass-fed beef, value-added dairy products, and small-scale agricultural tourism. Continue to support the University of California Cooperative Extension (UCCE) program that offers these programs.

b) Support educational programs that help young farmers and ranchers become established (such as 4-H and Future Farmers of America).

Support intergenerational transfer of family farms.

a) Support programs and organizations that encourage the transfer of farms from generation to generation, such as California Farmlink, the purchase of agricultural conservation easements by MALT, and other programs.

Continue to address livestock predation to reduce economic losses to ranchers.

a) Work with the Agricultural Commissioner's office to support a program that addresses the predation of farm animals by coyotes and other predators.

Research methods for strengthening agricultural viability.

a) Explore a financial incentive program (similar to the European direct payment) for on-farm conversion of small (5–10 acres), suitable pasture to organic row crop farming, or financial incentives for the leasing of those lands to organic farmers.

b) Study the economic viability of Marin Agricultural operations, and develop strategies for strengthening it.

c) Include a vision of a tactical plan for long term viability of agriculture in the Countywide Plan update.

➢ Sample indicators

a) Inventory farms and ranches by number, size, and net income categories (Marin County Agricultural Commissioner, Marin Community Development Agency, Marin Agricultural Land Trust, USDA National Agricultural Statistics Service).

b) Use the 2002 survey of ranchers and farmers to determine types of support needed to diversify farm operations for greater economic viability (University of California Cooperative Extension).

➢ Sample targets

a) By 2013, the number and size of farms will have remained constant or increased, and the number of farms and ranches in higher income categories will have remained constant or increased.

b) A follow-up survey of ranchers and farmers will show a 50 percent increase in sales of value added products to local markets by 2005.

2. Agricultural Land Use and Land Protection

➢ Issues

Conversion of agricultural land to residential use diminishes the agricultural land base.

a) Development of agricultural land into “rural estates” removes that land from agricultural production when new landowners choose not to lease it to an agricultural operator and/or price it so that existing operators cannot afford to lease it. Often, leased land is an essential part of an agricultural operation, and losing acreage decreases its viability.

b) The minimum parcel size for agricultural zoning is 60 acres. This size allows individuals or families to purchase a parcel and build a large home on it.

c) There is not an exclusive agricultural zoning district prohibiting all incompatible nonagricultural uses.

Regulations and land use policies need improvement.

a) Local, state, and federal regulations often overlap and are not consistent. Changing regulations and land use patterns and policies concern landowners who view regulations as threatening to their property rights and the underlying value of their property.

b) Zoning limitations for housing can be an impediment to family farms that need additional housing to accommodate multigenerational family farming.

c) The County’s permitting process and planning regulations are mostly written for an urban setting and are often incompatible with policies that could better support agriculture.

➢ Strategies

Protect against conversion of agricultural land to residential and other uses.

a) Study the economic impacts of the conversion of agricultural production land to residential estates, and consider regulations that address the size of residences on agricultural lands.

b) Enact policies to ensure that only agricultural uses and related ancillary uses are allowed on agriculturally zoned land.

c) Continue to support land protection programs, including acquisition of agricultural conservation easements by the MALT, agricultural preserves and Farm Security Zone contracts, and transfer of development rights from agriculture/open space land to properties within the city center and village areas.

d) Improve the effectiveness of agricultural management plans so that rural estate properties in agricultural zoning continue to be used for agriculture.

e) Ensure that land zoned for agricultural uses is being utilized even if it is not in production.

f) Explore opportunities to utilize additional public and private land for agricultural leases.

g) Create incentives for residential estates to lease land to organic farmers.

h) Develop a program that simplifies and streamlines the process of obtaining County permits for agricultural endeavors. Assist farmers and ranchers with obtaining permits.

Improve regulations, permitting, and land use policies.

a) Interpret local, state, and federal regulations, and assist landowners in understanding and addressing regulations and obtaining necessary permits.

b) Establish a more uniform, countywide agricultural zoning district that resembles the current Coastal Agricultural Production Zone classification.

c) Develop additional policies that focus on preserving and preventing the development of agricultural land.

d) Develop policies that encourage new, nonagricultural landowners to keep their land in agricultural production through leasing or agricultural diversification.

e) Explore additional measures to protect agricultural zoning in key greenbelt areas.

f) Research ways to accommodate housing for multigenerational family farming where zoning limits it.

g) Expand the current definition of agriculture to include the distinction between “production” and “residential” agriculture.

h) Expedite the processing of seasonal, time-sensitive-production agricultural projects.

➢ Sample indicators

a) Measure the number of acres of agricultural land in active agricultural production, and track changes to this number every two years (Marin County Agricultural Commissioner, Marin Community Development Agency, Marin Agricultural Land Trust, USDA National Agricultural Statistics Service).

b) Measure the acreage of agricultural land protected by conservation easements and Williamson Act contracts (Marin Agricultural Land Trust and Marin County Assessor).

➢ Sample targets

a) In 2013, the number of acres in agricultural production will be at least as high as the number measured in 2003.

b) An additional 20,000 acres of private agricultural land will be protected with conservation easements by 2012 (2,000 acres per year), bringing the total to 52,000.

3. Agricultural Education and Public Awareness

➢ Issues

Increased education about agriculture is needed by the public and government.

a) The urban community knows less and less about agriculture. Educating students about agriculture as well as natural resources needs to be strengthened.

b) County staff needs to develop greater understanding and knowledge about the agricultural industry.

c) The public does not understand the relationships between "open space," environmental appreciation, and farming.

➢ Strategies

Educate the public and government through public awareness and education programs.

a) Enhance County staff support for production agriculture by training Marin County Department of Agriculture staff to serve as agricultural liaisons, and establish an agricultural resource specialist position in the County.

b) Support local nonprofit organizations that are currently conducting public awareness and educational programs.

c) Develop an educational and public awareness campaign to promote the value and benefits of supporting locally grown agriculture and farmers markets by building a coalition of farmers, hospitality businesses, grocery stores, farmers markets, and schools to promote agriculture. Include education about the full costs of production, processing, distribution, and consumption of different agricultural systems. Include costs to human health, the environment, and rural and urban communities.

d) Create an educational and demonstration farm in Marin.

e) Arrange for governmental and public officials to tour farms to better understand the issues and needs of farmers.

f) Encourage school districts to work with local farmers to offer farm tours to children at least once per school year.

g) Support the College of Marin's sustainable agriculture program, which was started in 1999.

h) Promote agriculture's historical and cultural roles in the development of Marin through local media coverage and other methods.

➢ Sample indicators

a) Number of Marin school children participating in the annual Farm Day, Harvest Fair, or farm to school tours offered by MALT, UCCE, Slide Ranch, and the Marin County Office of Education at Walker Creek Ranch (MALT, UCCE, Slide Ranch, and the Marin County Office of Education).

➢ Sample targets

a) Ninety percent of Marin County children will have participated in a farm education event and will understand the connection between agriculture, people, and the environment by 2006.

4. Food and Food Systems

➢ Issues

Marin needs to become more self-reliant in the food it consumes.

a) The majority of food produced locally is exported and is not eaten locally.

b) The County and schools do not buy locally grown organic food for their cafeterias.

c) Economic and environmental contributions need to be measured to formulate and advocate policies.

d) The public needs to understand the value and benefits of local food security

➢ Strategies

Strengthen local food security.

a) Incorporate community food security in the development and planning of communities, transportation programs and in the allocation of County resources.

b) Promote local food processing.

c) Support locally grown organic food by encouraging its purchase and serving by local institutions, businesses and County government; promoting it in Marin's towns and cities; instituting a locally grown organic food buying policy; and promoting farmers markets in each of Marin's communities.

d) Better utilize public spaces for food production: Encourage development of community gardens on vacant or underutilized land; encourage conversion of office space landscaping, greenways, and lawns to community gardens or small farms; and promote edible, drought-resistant landscape on public land to provide food for humans and wildlife.

e) Keep prime soil available for food production.

f) Encourage local towns and cities to produce a certain percentage of their food locally. This is linked to the fact that we don't have enough farmers even to supply our farmers markets. At the Civic Center farmer's market there are 4 Marin farmers to 14 from outside the county. We need more Marin County farmer participation.

g) Include food delivery in the County's disaster preparedness plans.

h) Encourage the distribution of locally grown organic food through food banks by developing a program in which unsold foods from local markets are brought to the Marin food bank; creating an additional food bank.

i) Conduct a countywide nutritional survey to determine areas of the county that need additional nutritional support.

Increase public awareness and education about the importance of local food production and food security.

a) Enact an educational and public awareness campaign to promote the value and benefits of supporting local agriculture and farmers markets.

b) Prepare an inventory of local farms and their products, and make this list available to Marin residents to enhance direct sales to consumers.

c) Conduct celebrations of local organic food and agriculture. Feature local food and agriculture at the Marin County Fair and adopt a "Grown in Marin" day dedicated to locally grown food and products.

d) Prepare a "Grown in Marin" cookbook and map of local farms.

e) Promote programs that support sustainable food systems, including the Marin Food Systems Project, the Marin Food Policy Council and Marin Organic promotional program.

f) Work with the Marin County Office of Education to implement a food policy program similar to those in the Lagunitas and Berkeley school districts and offer a "Grown in Marin" meal at least once a year to local students.

g) Support current school gardening programs offered by the Marin County Stormwater Pollution Prevention Program (MCSTOPP), the Marin Conservation Corps, the Marin Master Gardeners, and the Marin Food Systems Project.

h) Support the Marin Food Systems Project to supply locally grown food to school cafeterias; to include the studies of food and agriculture in school curriculum; to institute a composting program for each school; and to encourage nutrition programs that emphasize the importance of eating local, organic, and seasonal food.

i) Increase education and access opportunities for low income residents and local communities to learn about food production and nutrition.

➢ Sample indicators

a) Measure the number of schools with gardens. Coordinate with Marin Food Systems Project, as data was already gathered in 2001 (Marin County Office of Education).

b) Measure the percentage of food produced in Marin that is distributed locally (University of California Cooperative Extension).

c) Measure the number of farmers able to produce food for local markets (including school programs, restaurants, and so on). Compare that with the number of available market opportunities (UCCE).

➢ Sample targets

a) Fifty percent of all public and private schools have organic gardens by 2010 and 100 percent by 2020.

b) Increase the local distribution of food grown locally by 15 percent by 2010 and 30 percent by 2020.

c) Increase the number of organic and diversified farms by 30 percent by 2020.

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The Built Environment

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III. The Built Environment

The heritage of Marin's built environment is one of small towns set in the natural and agricultural landscape. Historically, much of Marin's housing was concentrated in its downtowns—the centers of commercial, cultural, and civic activity—and in adjoining, walkable neighborhoods. These places, and the images and lifestyles associated with them, remain among Marin's most treasured and valuable assets.

With the growth of the population and economy in the Bay Area metropolis in the past 50 years, and the increasing influence of automobile access, Marin's urban and rural areas have been subject to the same outward pressure for auto-dependent suburban development as other regions surrounding America's great cities have experienced. Unlike most counties, however, Marin has aggressively sought to protect its irreplaceable natural and agricultural assets from being overrun by low density, low quality sprawl development. And in this effort it has been quite successful.

While many of Marin's open spaces—the habitat for natural and agricultural species—have been protected, the quality of the human habitat has suffered in some cases because of the following:

- Investment in transportation systems has been focused primarily on mobility by private automobile. This has led to fewer public transit alternatives, and to roadways that are congested with automobiles and not well designed to accommodate pedestrians and bicyclists.
- Investment in housing has been focused on the construction of relatively low density developments of single-family houses, often poorly connected to the older neighborhoods and downtowns. This type of development has consumed larger amounts of land to house a small number of residents, is affordable only to those with high incomes, and generates an automobile trip for most activities of daily life.
- Investment in retail and office buildings has been primarily in the form of low density, single-use buildings, each surrounded by its own parking lot. Such buildings are relatively inflexible to respond to the pressures of a changing economy, do not create places compatible with Marin's heritage and character, and generate an increasing number of automobile trips from their occupants.
- Investment in schools, libraries, and other civic facilities has not always been focused in the traditional town centers, and has in some instances put civic activities that bring people together in single-use buildings surrounded by parking lots on the edge of town.

Marin is updating policies that will guide new investment and construction to sustain the cities, towns, and neighborhoods of Marin in ways that better support the life of their residents, while at the same time ensuring the protection of the surrounding open spaces.

An overarching objective of this report is to reinforce sustainable land use practices that supports the core values of the residents of Marin, including:

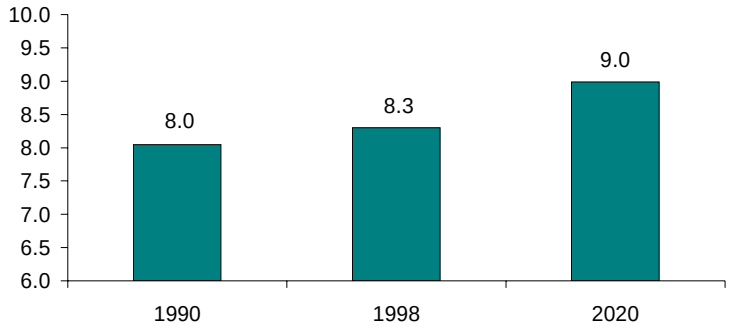
- Communities designed with many transportation choices.
- The chance to live close to public transportation or to where they work, shop, or play.
- A range of housing types, including those affordable to our workforce and families.
- Housing choices that include mixed-use villages in our downtowns, above parking lots, within commercial areas, and near transit.
- Environmentally sensitive design and resources conserving construction practices.

A. TRANSPORTATION

➢ Background and trends

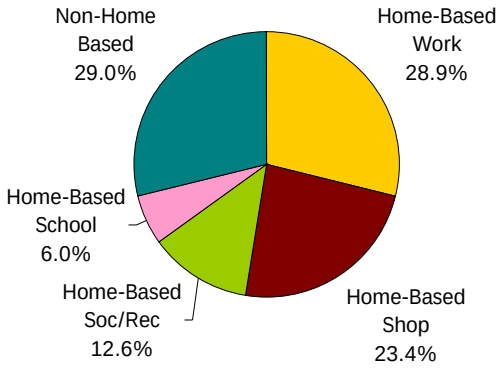
Marin County residents are making more trips within the county. Ninety percent of all trips originating in Marin County are made in automobiles on roads built to standards established several decades ago. In 1998 people living in the county made more than 750,000 trips, an increase of 10 percent in less than a decade, outpacing growth in employment and households (Marin County Congestion Management Agency). The number of daily vehicle trips per household has also increased steadily since 1990 and is projected to continue increasing (Figure III-1). Seventy percent of the daily vehicle trips start from home and go to one destination and back home again. Only 30 percent of the trips are linked (Figure III-2).

Figure III-1
Total Daily Trips per Household in Marin



Source: 2001 Marin County Congestion Management Agency

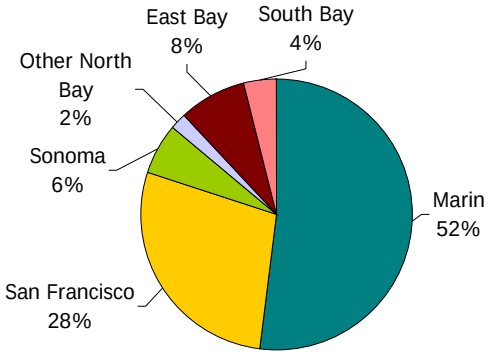
Figure III-2
Total Daily Trips Generated in Marin County



Source: 2001 Marin County Congestion Management Agency

More than half of Marin residents making a commute trip travel to jobs within Marin County, while 28 percent of work trips made by Marin residents are to San Francisco (Figure III-3). During the morning peak hour, 50 percent of the vehicles are going from one Marin location to another Marin location (Figure III-4).

Figure III-3
Work Location of Marin Residents—Percentage by Location/County



Source: 2002 Nelson\Nygaard

Figure III-4
Traffic—A.M. Peak Hour

Marin to Marin	50%
External to Marin	22%
Marin to External	20%
Through	8%

Source: 2001 Nelson\Nygaard

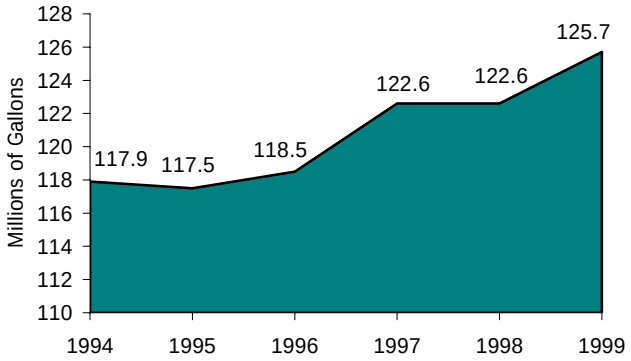
Increasing travel choices is the only way to reduce congestion. Widening freeways and roads to meet projected demand is no longer a feasible solution for traffic relief. Road widening is expensive, may harm the environment and quality of life, and can no longer keep up with demand. A plan for transportation improvements for many modes with effective hubs where transfers can be made will offer choices: rail, ferry, bus, bicycle, pedestrian. Planning to build new facilities needs to be part of an overall system. A fully implemented plan could increase transit ridership by 5,000,000 annual riders and double the number of pedestrian and bicycle trips. Funding from state and federal sources is available to partially pay for some transportation improvements. Local funding is also needed.

1. Automobiles and Roadways

➢ Background and trends

Fuel consumption and transportation costs in Marin are high and increasing. Transportation costs for each Marin household average $7,150 per year. The highest transportation expenses and amount of driving are by West Marin residents, who have fewer transportation choices. Fuel consumption in Marin increased from 118.5 million gallons in 1996 to 122.6 million gallons in 1997. Fuel consumption is increasing at a higher rate than the rate of population growth for some of the following reasons: more frequent driving by residents, driving vehicles with poor fuel economy, traffic congestion, a larger part of the population driving longer distances to work (Figure III-5).

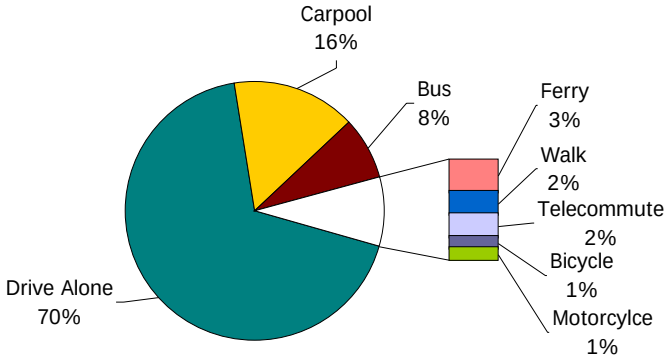
Figure III-5
Marin Vehicle Fuel Consumption



Source: 2001 Marin Economic Commission

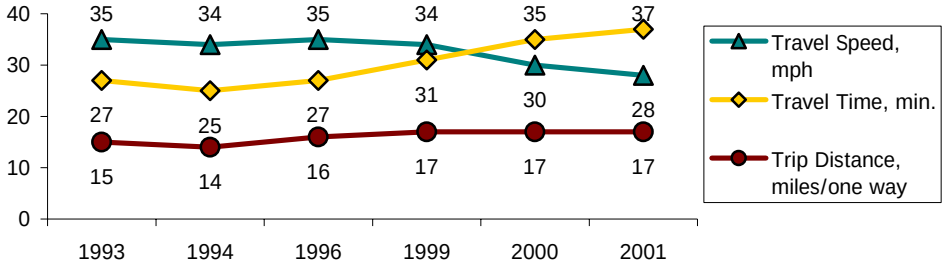
Most people in Marin drive alone, even though carpooling offers advantages. Seventy percent of people driving in Marin drive alone (Figure III-6). Vehicle commute miles and travel times have been increasing and are estimated to continue to increase, while average vehicle speeds have decreased (Figure III-7). Bay Area carpool lane users have saved an average of 16 minutes daily on their way to work since 1993 (Figure III-8). In 2001, vehicles in high occupancy vehicle (HOV) lanes in Marin saved an average of 14 minutes on their southbound morning commute and 3 minutes on their northbound afternoon commute (2001 California Department of Transportation). Carpoolers tend to have the longest commutes, averaging about 22 miles each way.

Figure III-6
Marin County Primary Commute Mode, 2002



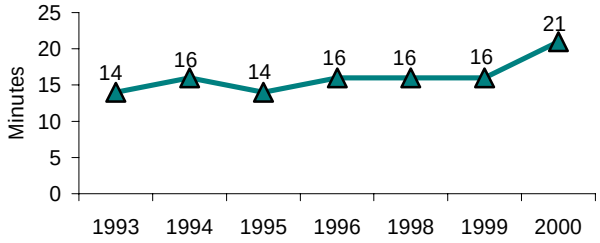
Source: 2002 RIDES for Bay Area Commuters

Figure III-7
Commute Distance and Time



Source: 2001 RIDES for Bay Area Commuters

Figure III-8
Minutes Saved (One Way) by Using Carpool Lane



Source: 2001 RIDES for Bay Area Commuters

West Marin has special issues because of recreational travel to the coast. The Marin County Department of Public Works has completed a Transportation Planning Project for the Point Reyes National Seashore in order to plan mid-term and long-term transit alternatives for visitor travel to and within the park. In addition, the Public Works Department is considering a mid- and long-range scenario of offering a shuttle service to alleviate traffic through Inverness and Inverness Park (Crain & Associates).

➢ Issues

There is a lack of choice for alternatives to the automobile.

a) Historically, transportation funding has been dedicated only to roadways instead of to multimodal transportation expenditures. There are few bike routes between cities.

b) Roadway design should always include safe bike passage and be pedestrian friendly at crossings.

c) Ride-sharing and dial-a-ride services are needed.

d) People need to be further encouraged to use public transit.

People lack incentives to get out of their vehicles.

a) Fewer people are using shuttle buses to the ferry because parking is free.

b) Only selected ferries are served by shuttles.

People need to use more fuel-efficient vehicles.

a) Vehicle fuel consumption is rising in Marin County and the nation.

III

b) Over reliance on imported petroleum raises national security concerns.

Better roadway maintenance is needed, and recycled and energy-conserving materials should be used in road construction.

a) Roadway maintenance should be done frequently and adequately, which would include smooth transitions from the old roadway to the new roadway patching area.

b) The materials used for roadway construction should include recycled vehicle tires.

c) The use of "climate-friendly" concrete, which utilizes recycled products in processing, would use significantly less energy and produce less emission of greenhouse gases than traditional concrete.

d) Road and parking lot shading with tree planting would minimize urban heat islands.

Opposing views about transportation and land use are an issue for planning in Marin and make consensus building difficult.

a) An overarching goal needs to be to decrease the miles driven in automobiles, not to widen the freeway.

b) The freeway needs to be widened and more housing needs to be provided in Marin.

c) Marin has done a great job of protecting the environment but not linking the economy and housing to public transportation.

d) There is spillover traffic from Highway 101 into neighborhoods such as Marinwood and Terra Linda.

➢ Strategies

Increase employer trip-reduction programs to reduce vehicle traffic.

(See also IV. The Economy, Equity and Culture, A. The Economy, Transportation.)

a) Develop a model trip-reduction program and promote the program to businesses.

b) Expand trip-reduction programs for County employees.

c) Design a web site to include a carpool forum to link carpool riders.

d) Require businesses to have an employee carpool program.

e) Require all employers with 50 or more employees to develop and operate a trip-reduction plan.

f) Encourage employers to use the parking cash-out law, which allows workers to trade their employer-provided parking space for money.

Encourage major employers to reduce fuel consumption and increase use of alternative fuels in vehicle fleets.

a) Adopt a County "green fleets" program to eliminate underutilized vehicles from the County's fleet, require the purchase of the most fuel-efficient options for various vehicle classes, and increase the number of low emission vehicles that use alternative fuel.

b) Encourage employers to include hybrid or low emission alternative fuel vehicles in their vehicle fleets.

c) Lobby the State to enact financial incentives such as graduated vehicle license fees and tax credits that encourage fuel efficiency and alternative fuel vehicles.

Secure funding sources for road improvements and repairs, and for transit.

a) Seek funding to maintain street safety.

b) Identify a mechanism to secure additional transit funding.

c) Include an additional ¼ percent sales tax on all vehicle sales to go toward roadway improvements in the county where the vehicle is registered.

Design streets to be accessible to people with disabilities and to bicyclists.

a) Redesign handicapped ramps so they don't exit into the center of the street.

b) Design streets to comply with the Americans with Disabilities Act.

c) Design streets to include bicycle lanes.

➢ Sample indicators

a) Measure the total amount of transportation funding being applied to roadway improvements (Metropolitan Transportation Commission).

b) Track the number of vehicle miles traveled in Marin (RIDES for Bay Area Commuters).

c) Track the number of vehicles registered in Marin (California Department of Transportation).

d) Track the length of average daily commute trips (Metropolitan Transportation Commission).

e) Track the number of residents participating in a registered carpool (RIDES for Bay Area Commuters).

f) Track the amount of time lost to traffic congestion (California Department of Transportation, RIDES for Bay Area Commuters).

g) Track the number of hybrid and alternative fuel (biodiesel and natural gas) vehicles per capita in county government and for all of Marin County (Marin County Department of Public Works).

h) Track fuel sales and the average fuel efficiency of vehicles registered in Marin (California Department of Motor Vehicles, other).

i) Track fuel sales in Marin.

j) Track the number of vehicles per capita in Marin (California Department of Motor Vehicles).

k) Determine the contribution of private vehicle use to overall air pollution and greenhouse gas emissions in Marin.

l) Track the number of accidents per mile of County-maintained and total roads (Marin County Department of Public Works).

m) Record the condition of County-maintained roads (Marin County Department of Public Works).

n) Monitor the percentage of roadway material that includes recycled vehicle tires and other recycled materials (Marin County Department of Public Works).

➢ Sample targets

a) Increase the number of residents participating in registered carpools by 15 percent in 2010 from the 2000 level.

b) Increase the number of hybrid and alternative fuel (such as biodiesel) vehicles by 100 percent in 2010 from the 2000 level.

c) Increase the average fuel efficiency of private passenger vehicles by 10 percent in 2010 from the 2000 level.

d) Decrease vehicle miles traveled in single occupancy vehicles by 20 percent in 2020 from the 2000 level.

e) Decrease the number of private passenger vehicles achieving less than 30 miles per gallon by 20 percent in 2020 from the 2000 level.

f) Increase bike route mileage in the roadways in the City-Centered Corridor by 80 percent in 2020 from the 2000 level.

g) Include recycled vehicle tires in the paving of 50 percent of county roads by 2020.

2. Pedestrian and bicycle

➢ Background and trends

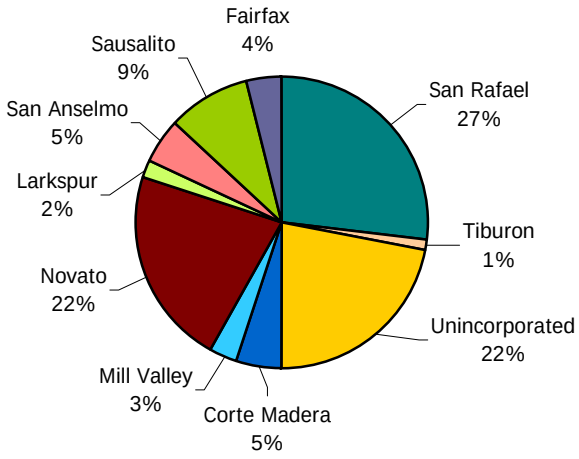
Bicycling and walking as a means of transportation have been growing in popularity. Many communities are working to create more balanced transportation systems and reclaim streets from auto dominance. In addition, recent national and local surveys find that people are willing to cycle more frequently if better bicycle facilities are provided (Marin County Department of Public Works). Through the passage of the Clean Air Act in 1990, the Intermodal Surface Transportation Efficiency Act in 1991, and the Transportation Equity Act for the 21st Century in 1998, there has been a surge in funding available for bicycle and pedestrian projects.

The Marin County Bicycle and Pedestrian Master Plan provides a blueprint for making bicycling and walking an integral part of daily life in Marin County. The Plan calls for the completion of a countywide network of primary and secondary bikeways, pedestrian improvements, and intermodal connections with direct and convenient bicycle and pedestrian ways to major transit stops. The existing bikeway system in Marin's unincorporated regions consists of an incomplete network of approximately 8.75 miles of signed bikeways, although many roads have shoulders wide enough to be signed as bicycle lanes. As of mid-1999, there were bike racks on 88 percent of Golden Gate Transit's buses, all coaches, which are 40 feet in length. Currently, state law prohibits the installation of bicycle racks on express buses, which are 45 feet in length.

Bicycle and pedestrian safety is an important issue affecting the willingness of people to walk or ride bicycles. In 1998, 27 percent of traffic fatalities were pedestrians (Marin County Congestion Management Agency). Between April 1996 and April 1999, approximately 100 serious pedestrian accidents per year were reported in Marin County (Figure III-9). According to an April 1991 Lou Harris Poll, there is a large reservoir of potential bicyclists in unincorporated Marin who do not ride (or ride less often) simply because they do not feel comfortable using the existing street system and/or do not have appropriate bicycle facilities at their destinations. Students riding a bicycle the wrong way on streets account for the greatest number of recorded bicycle accidents in California. This statistic points to the need for safety education. Fewer than 10 percent of Marin students have received bicycle-safety education, and 51 percent of the students incorrectly answered that bicyclists should ride against traffic,

rather than with traffic. Data from April 1996 to April 1999 indicates that approximately 170 bicycle–motor vehicle crashes per year were reported in Marin County. Of those crashes, approximately 39 occurred in the various unincorporated areas of the county. This number of crashes is average compared with those in other communities in California.

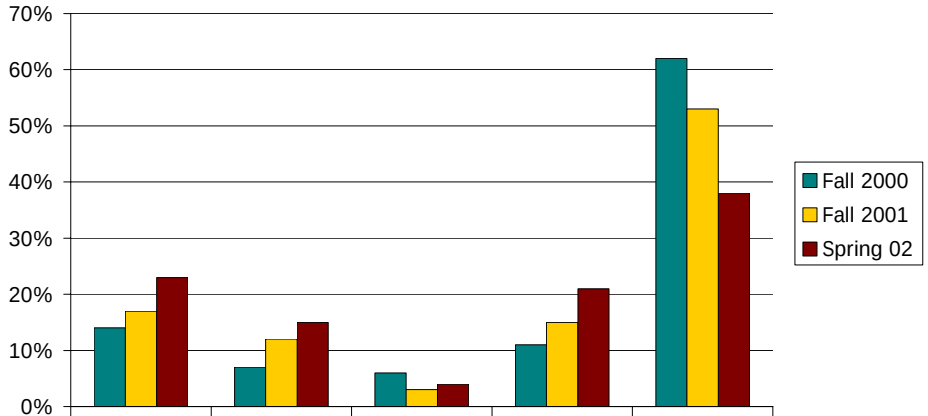
Figure III-9
Marin County Pedestrian Crash Distribution



Source: 2001 Marin County Department of Public Works

Since 21 percent of all morning peak-hour trips are home-based school trips, strategies to encourage trip reduction are an effective way to reduce traffic congestion. About 11 percent of Marin students report riding a bicycle to school daily or in good weather, while 89 percent say they ride either rarely or never. Safe Routes to Schools programs that promote walking, biking, or carpooling to Marin County schools are increasing in popularity (Figure III-10). Auto trip reductions of 15 percent were recorded at schools receiving Safe Routes training in 1999–2000.

Figure III-10
Safe Routes to School Pilot Program



	Walk	Bike	Bus	Carpool	Drive Alone
Fall 2000	14%	7%	6%	11%	62%
Fall 2001	17%	12%	3%	15%	53%
Spring 02	23%	15%	4%	21%	38%

Source: 2001 Safe Routes to Schools

Worldwide, the United States ranks as the first-world country with the lowest percentage of people who walk and bicycle for transportation. A year 2000 report by Rutgers University showed walking and biking for only 6 percent of trips in the United States, compared with 12 percent in Canada, 16 percent in England and Wales, 34 percent in Switzerland and Germany, 39 percent in Sweden, and 46 percent in the Netherlands. In the United Kingdom, Germany, the Netherlands, Denmark, and Japan, there has been a trend to build model bicycle and pedestrian communities to demonstrate the effectiveness of shifting auto trips to bicycle and pedestrian trips. Recent federal and state initiatives urge that the needs of bicyclists and pedestrians be included in the planning, design, maintenance, and construction of all roadway and transit projects (U.S. Department of Transportation, 2001 California Department of Transporation).

➢ Issues

Improvements are needed to make walking and bicycling feasible and safe.

a) People want to be able to walk and bike to work and to other destinations, but the routes are not continuous, and they discourage biking and walking.

b) Pedestrian right-of-way improvements are needed to encourage walking.

c) Residents have expressed the need for building paved sidewalks for pedestrian safety while retaining a rural or small-town character of the community.

d) Choices of transportation to cultural events and to parks and open spaces need to be developed.

e) There needs to be a countywide effort to develop safe routes to schools and to find ongoing funding to support Marin's successful Safe Routes to Schools program, which was chosen in 2000 by the National Highway Traffic Safety Administration to be a national model.

f) We need to improve sidewalks, bring back school buses, create a network of bike routes, and reopen neighborhood schools so that children can live close to schools.

g) Marin's senior population needs safe nonmotorized transportation networks in order to be able to continue walking and bicycling as a safe physical activity.

h) Trips of two miles or less could be shifted to walking and biking if safe nonmotorized networks were provided. At present, 25 percent of all trips in the United States are for one mile or less, but 75 percent of them are being made by car. Forty percent of all trips are for two miles or less (1995 U.S. Department of Transportation).

i) A lack of bicycle parking is an important reason why people do not ride their bicycles for errands and local trips. Attended bicycle parking has worked well at transit hubs in other Bay Area counties.

j) The County needs to track increases and decreases of bicyclists and pedestrians by doing regular traffic counts.

k) Marin could become a model community by building the bicycle and pedestrian network identified in the County's Bicycle and Pedestrian Master Plan. Implementation of the plan could show how improved infrastructure leads to increased bicycle and pedestrian trips, and a decrease in the number of crashes.

➢ Strategies

Develop facilities to encourage walking and bicycling.

a) Enact the roadway design and maintenance criteria that accommodate bicycle and pedestrian needs (Highway Design Manual).

b) Implement the recommendations in the Bicycle and Pedestrian Master Plan, including a Class 1 north-south bikeway along the railroad right-of-way parallel to Highway 101, and an east-west bikeway that would run parallel to Sir Francis Drake Boulevard along surface streets and along the railroad right-of-way where feasible, and in West Marin.

c) Include bicycle and pedestrian routes, bicycle storage facilities, and showers in all new commercial and industrial developments, and schools.

d) Create incentives for businesses to install shower facilities to encourage people to bike to work.

e) Continue applying for grants for bicycle and pedestrian infrastructure projects, and seek to expand funding sources for these important and cost-effective methods of transportation.

f) Include bicycle stations at major transit nodes such as the Manzanita park and ride lot, the San Rafael transit center, the Larkspur ferry terminal, and future Sonoma Marin Area Rail Transit stops. These facilities should offer bike repair, storage, and rentals.

g) Do an assessment of roads with shoulders wide enough to be designated as bicycle lanes, and stripe and sign these roadway segments as bike lanes.

h) Require any event for more than 1,000 people to have bicycle parking.

i) Establish public bike-share programs.

j) Locate bicycle racks near bus stops, and provide rental bikes for bus and rail users.

k) Publicize the benefits of bicycle riding to potential cyclists.

l) Continue to promote and find public funding for the Safe Routes to Schools program.

m) Encourage bicycle riding for seniors and persons with disabilities by promoting electric, three-wheeled, and recumbent bicycles.

n) Educate County staff on the needs of bicyclists and pedestrians, and new design techniques for accommodating them.

➢ Sample indicators

a) Do annual traffic counts of bicyclists and pedestrians in key locations to gauge increases and decreases (Marin County Department of Public Works).

b) Track miles of maintained bicycle-way in Marin (Marin County Department of Public Works).

c) Track number of vehicle-bicycle collisions annually (Marin County Department of Public Works).

d) Track number of vehicle-pedestrian collisions annually (Marin County Department of Public Works).

e) Track number of students walking or biking to school in Safe Routes to Schools program (Marin County Bicycle Coalition).

f) Measure number of participants in Bike to Work Day (Marin County Bicycle Coalition).

g) Track the number of county government employees and all Marin County employees (per capita) who bike or walk to work or school (Marin County Department of Public Works).

➢ Sample targets

a) Increase the miles of maintained bicycle-ways in Marin by 200 percent between 2000 and 2010.

b) Increase the number of students walking or biking to school by 100 percent in 2010 from 2000 level.

c) Increase participation in Bike to Work Day by 200 percent in 2010 from 2000 level.

d) Achieve an increase from 3 percent of trips in Marin County made by walking or biking in 2000 to 10 percent by the year 2010.

e) Decrease pedestrian and bicycle accident levels by 15 percent in 2010 from the 2000 level.

f) Increase the number of people who walk or bicycle to transit hubs by 100 percent by 2010 over the level in 2000.

g) Ensure that by 2010, 100 percent of public events that draw more than 1,000 people will have attended bicycle parking.

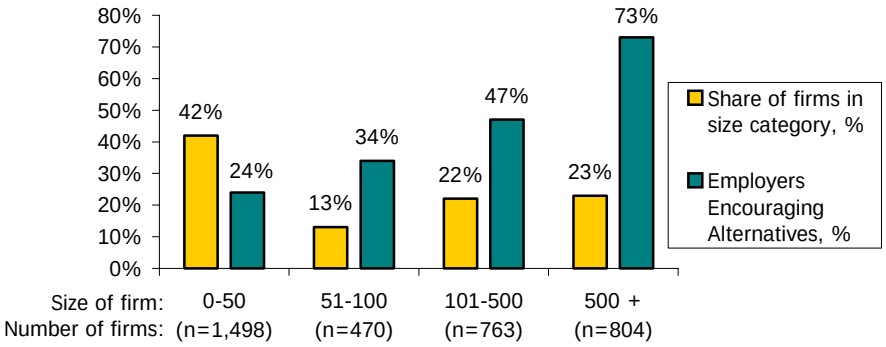
h) Complete the four highest priority multiuse pathway projects by 2010. These projects include, from south to north: opening the Alto Tunnel, completing the Central Marin ferry connection, opening the Cal Park Hill Tunnel, and building the multiuse pathway parallel to the planned commuter rail.

3. Bus

➢ Background and trends

Plans to expand local and express bus service will improve service and increase ridership. At present, 54 percent of local transit users need to transfer from one bus to another or from one mode source to another to get to their destinations. The canal neighborhood of San Rafael has the highest bus trip activity in Marin County. Marin City has the second highest activity. The need for transit and paratransit service is expected to increase. Bus ridership is expected to increase from 13,200 to 16,900 between 2000 and 2020, while the demand for paratransit consistent with the Americans with Disabilities Act is expected to increase by 23 percent during the same period. Marin employers can contribute to bus transit use. Generally speaking, the larger the business, the more the employer encourages alternative transportation modes, including bus tickets at reduced fares (Figure III-11).

Figure III-11
Percentage of Employers Encouraging Alternatives by Firm Size



Source: 2001 RIDES for Bay Area Commuters

Marin Bus Transit Futures, a comprehensive long-range vision combined with practical strategies for implementation over the next 20 years, includes local express bus service at 15-minute intervals along the 101 corridor, intercommunity bus routes, specialized local community services and shuttles, school shuttles and buses, and additional bus transit junctions with timed transfers. Proposals made in the Marin-Sonoma Express Bus Study, prepared by Golden Gate Transit, would expand express bus service between Sonoma and Marin on Highway 101 to more than double the current service levels and serve major employment centers in Marin, although recent funding shortfalls have resulted in route reductions. When the HOV lane system is completed, buses would take advantage of faster travel time on Highway 101.

➢ Issues

Bus transportation service needs to be improved.

a) The public transportation system for moving within the county is not seamless.

b) An intra-Marin bus system is needed to reduce automobile use, with a plan for bus routes within a quarter mile of locations where 90 percent of the population lives.

c) Public transportation service is needed seven days a week, including grocery store jitneys and employee jitneys.

d) Day and year passes for public transit are needed.

Increased funding and marketing for alternatives to the automobile are needed.

a) A carbon tax with the proceeds used for public transit is needed.

b) Marketing for public transportation, walking, and biking is needed.

c) The Golden Gate Bridge toll increase provides an opportunity to market bus service to San Francisco commuters.

d) Marin needs to become a self-help county to get more matching funds.

➢ Strategies

Increase ridership with improved bus service.

a) Implement the Marin County Transit Master Plan.

b) Schedule buses to run frequently, have extended hours, and have seamless connections between buses.

c) Implement priority for buses at traffic signals.

d) Provide more bus trips over the Richmond–San Rafael Bridge.

e) Review local bus routes to determine proximity to park entrances. Explore opportunities to increase bus transportation to regional state and national parks, especially on weekends.

f) Capture some value of increased taxes for transit.

g) Include diverse sizes and routes for buses to serve neighborhoods.

h) Complete transit connections between tourist attractions and buses.

i) Use buses that vary in size depending on capacity demands, and include amenities such as music and lap top computer stations on buses.

j) Enhance service to such constituents as school children, low income people, the elderly, and day-care centers.

k) buses for transport of schoolchildren in the morning and afternoon, and for senior transport midday.

l) Employ improved bus technology for bus details, using global positioning systems to identify bus locations and estimated arrival times.

Create incentives for people to use buses.

a) Develop a public relations campaign for public transit.

b) Increase bus use with incentives including free ride days, extended service, and rewards for riders.

c) Require employers to offer employees incentives to use alternative transportation instead of driving alone.

d) Give creative names to buses, as is done in Palo Alto.

e) Use clean-fuel buses and ferries, such as those running on biodiesel.

f) Provide passes and subsidies for students, low income people, and seniors.

g) Allow transfers and encourage use of Fast Passes between rail, bus, and ferry services.

h) Work with businesses to wholly or partially subsidize employee bus commuting.

i) Make the experience of using the bus pleasant, safe, and fun.

Support public transit with complementary land use policies.

a) Design smart growth and infill development to support rail and bus modes.

b) Identify transit hubs, increase residential densities, and allow mixed use at the hubs.

➢ Sample indicators

a) Measure the number of bus runs (Golden Gate Transit).

b) Measure bus ridership (Golden Gate Transit).

c) Measure fuel type and quantity used on buses (Golden Gate Transit).

➢ Sample targets

a) Increase bus ridership by 15 percent in 2010 over 2000 level.

b) Increase clean fuel usage such as use of biodiesel in buses and ferries by 20 percent by 2010 over 2000 levels.

4. Rail

➢ Background and trends

Rail is part of a multimodal system. The proposed Sonoma-Marin Rail Transit (SMART) system will run from Cloverdale to San Rafael on a railroad right-of-way that is already in public ownership. A second phase will connect to a ferry terminal in central Marin. Trains will run every 30 minutes during peak periods, carrying an estimated 5,100 riders per day. Rail stations will become intermodal hubs, with convenient service from local and express buses and with at least one major ferry link.

Trains will serve inter-county trips between Sonoma and Marin, as well as trips between Novato and San Rafael. There will be two stations in Novato and two in San Rafael, one near the Civic Center and one downtown.

➢ Issues

Local support and planning are needed for a successful rail transit system.

a) Local support for rail transportation is needed if rail is to be adequately funded.

b) Cities with proposed rail stations need to carefully plan around these areas.

c) Tunnels for rail need to be planned as appropriate.

➢ Strategies

Plan for effective service, incentives to attract riders, and land use to support transit.

a) Develop a long-term vision for transit-station locations, and auto and bicycle parking, that would include demand under the Sonoma County build-out.

b) Utilize the existing rail right-of-way and also extend rail to a new ferry terminal at San Quentin.

c) Complete transit connections between tourist.

d) Remove a lane of freeway and replace it with a train monorail or similar "people mover".

e) Select trains that use clean fuel.

f) Allow transfers, and encourage use of Fast Passes between rail, bus, and ferry services.

g) Include free bicycle repair, storage, and rentals at transit stations.

h) Encourage employers to subsidize ticket prices for employees' train tickets, and provide shuttle service or free bicycles from the train station to the place of employment.

i) Design smart growth and infill development around rail stations.

➢ Sample indicator

a) Track rail ridership (Sonoma Marin Area Rail Transit).

➢ Sample target

a) Enact rail transportation in Marin and Sonoma by 2010.

5. Land Use

➢ Background and trends

Smart infill improves transit viability. "Smart infill" concentrates development in areas that can be served by transit, bicycle, and pedestrian travel, and includes multiple uses—residences, offices, and stores—so that people can walk to work and shopping. Smart infill development tends to result in fewer increases to traffic congestion, but will improve the viability of transit and other modes of transportation.

➢ Issues

Land use policies are needed to support transit and reduce traffic congestion.

a) The public needs more information about housing density, parking demand, and vehicles per household.

b) The availability and low cost of public parking throughout the county creates a disincentive to utilize alternative modes of transportation.

c) Incentives for local hiring are needed to reduce commuting.

d) The lack of affordable housing and transit requires the lower income Marin workforce to drive long distances to work. Traffic congestion is worse as a result.

e) Affordable workforce housing and multiple services, including child care, need to be located near transit centers.

f) Coordination with neighboring counties is needed.

➢ Strategies

Increase densities and change parking requirements in areas that can become transit nodes.

a) Locate new mixed-use development within ¼ to ½ mile from transit, and provide pedestrian and bicycle connection to adjoining uses.

b) Purchase land for affordable housing.

c) Establish minimum-density zoning in infill areas and increase the minimum densities near transit nodes.

d) Transfer development rights for additional very low to moderate income housing from environmentally sensitive areas to urban areas near jobs and transit.

e) Rezone the San Quentin Prison site to enable planning for a transit-oriented, sustainable community.

f) Amend commercial and office zoning districts to allow mixed-use development and rezone commercial areas to allow for mixed-use infill development in or above parking lots.

g) Amend parking requirements to require 80 percent compact parking spaces in each parking lot, and bicycle parking.

h) Include provisions for increasing building height to accommodate parking structures with housing.

i) Eliminate the policy requiring "no net loss of parking," provided that traffic-demand-management or similar strategies are employed.

j) Encourage the conversion from gas stations to stations that provide natural gas, electric-vehicle recharge, biodiesel, and hydrogen fuel cells.

Analyze the relationship between traffic congestion and development. Discourage development in environmentally sensitive or hazardous areas.

a) Do not intensively develop floodplains, except for already developed infill areas in the City-Centered Corridor.

b) Establish a nexus between the need to preserve land from development and the need to decrease traffic congestion on major roadways, such as Highway 101 and expand the use of conservation easements in applicable areas.

Use economic incentives to support land use and transportation goals.

a) Provide incentives and bonuses for infill and transit-oriented development.

b) Work with local lenders to offer location-efficient mortgages.

c) Develop affordable housing to attract service-sector employees, the younger population, and the aging population.

d) Prioritize purchasing land for environmental protection in environmentally sensitive areas, in areas designated as community separators, and in greenbelt areas.

e) Encourage the State of California to adopt tiered vehicle-registration fees to discourage the use of gasoline-consuming vehicles.

f) Encourage a higher tax on owners of a high number of vehicles per household and/or vehicles with low fuel efficiency.

g) Allow people using public transit to write off fees from their personal taxes.

h) Publicize the comparative costs to operate a vehicle (including insurance, maintenance, gas, and road repair) versus traveling by bicycle, bus, train, or ferry.

Land use policies that support telework can contribute to a reduction in traffic congestion.

a) Promote telework and satellite work centers to help serve all Marin residents, and to decrease vehicle traffic within the county.

b) Modify the Development Code to encourage telework and satellite workstations.

c) Develop additional performance standards and regulations to encourage home occupations.

d) Offer home office credits in the property tax structure.

➢ Sample indicators

a) Track density of new housing starts (Marin County Community Development Agency).

b) Measure percentage of new housing starts that qualify as infill (Marin County Community Development Agency).

c) Measure the number of businesses with telework programs (Marin Economic Commission).

d) Track the level of automobile subsidy with a goal to decrease it.

e) Track the number of parking spaces and bicycle racks/lockers, and track the use and vacancy of both.

➢ Sample targets

a) Increase the percentage of businesses that have telework programs by 30 percent by 2010.

b) Increase the amount of new housing that is infill/mixed by 50 percent by 2020.

B. ENERGY

(See also II. Natural Systems, A. Environmental Quality, 6. Energy.)

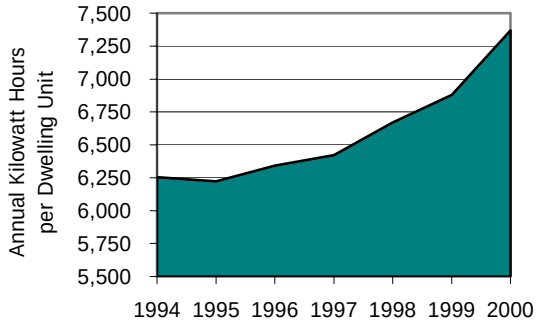
➢ Background and trends

The manner in which the built environment is designed, constructed, and operated has a significant impact on energy use. Built-environment design decisions on every scale—from the region to the city to the neighborhood block, street, and building—determine the rate at which people use energy in their daily lives. On the regional and local scale, Marin County residents consume energy to light, heat, cool, and run appliances in homes and offices, and to operate motor vehicles, mostly single-occupant private automobiles.

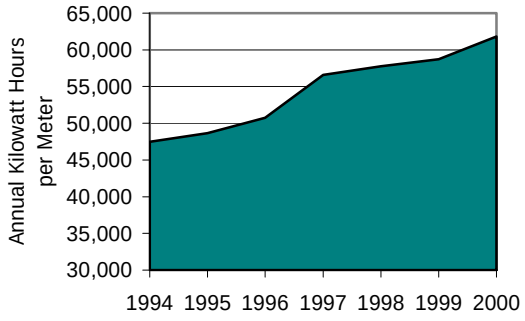
The amount of energy consumed by residential and nonresidential users in Marin is increasing. Residential energy consumption has been climbing since 1995, with the greatest jump occurring between 1999 and 2000 (over 7 percent), but with little increase in population (approximately 0.7 percent). Total consumption increased 18.5 percent from 1995 to 2000, from 619 million kilowatt-hours (kWh) to 734 million kWh. The per capita rate increased 17.7 percent in the same period. Nonresidential energy consumption has also increased, from 47,742 kWh per meter in 1994 to 61,828 kWh per meter in 2000, a 30 percent increase. Total consumption increased from 646 million kWh to 834 million kWh during the same period. During the same time frame, the number of nonresidential meters actually decreased, from 13,608 in 1994 to 13,489 in 2000 (Figure III-12).

Figure III-12

Residential Energy Consumption, 1994–2000



Nonresidential Energy Consumption, 1994–2000



Source: 2000 California Energy Commission

In an effort to counteract these trends, the County of Marin is encouraging energy efficiency by providing rebates and technical assistance to County employees and residents. As of February 4, 2003, Marin County has provided $45,456.29 in energy efficiency rebates and saved county residents and County employees $80,993.93 in projected energy costs.

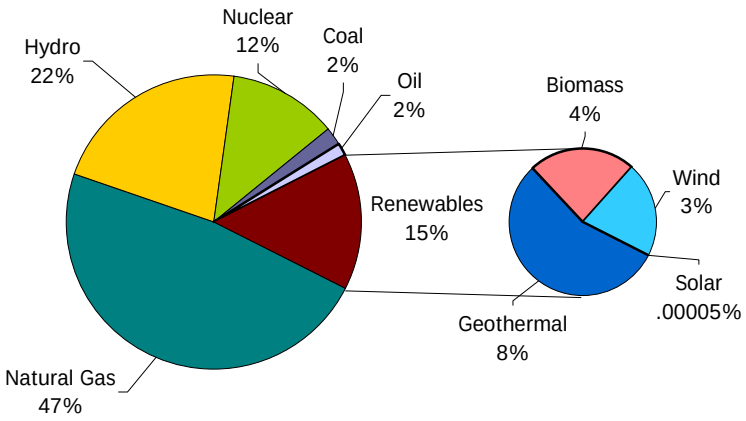
In spite of the trend toward higher energy use in Marin, the increase in use of energy efficient appliances has resulted in reduced energy intensity nationwide. The average electricity use of new refrigerators declined from 1,735 kWh per year in 1972 to 685 kWh per year by 1999. At the same time, new refrigerators became larger and had more features. The average energy efficiency of new refrigerators nearly tripled from 1972 to 1999 (American Council for Energy-Efficient Economy). The sales of energy-efficient compact fluorescent lamps (CFLs) increased nearly fivefold from 1990 to 1999 in the United

States. Eighty-two million CFLs were sold in North America in 1999. National energy intensity (energy use per unit of GDP) fell 42 percent between 1973 and 2000. About three-quarters of this decline is attributable to real energy efficiency improvements, and one-quarter is due to structural changes and fuel switching (American Council for Energy-Efficient Economy).

Although more than half of California's energy is generated from nonrenewable sources, primarily natural gas, there is a gradual trend toward diversification. Over the past 10 years, the relative makeup of California's generation sources has remained steady. The greatest percentages of electricity generated are from natural gas, hydroelectric power, and nuclear energy, respectively. Overall, use of fuel oil has had the largest decrease, followed by nuclear, coal, and renewables decreasing by less than 1 percent. The percentage of natural gas used in cogeneration facilities, which generate electricity by using both oil and natural gas, has grown, while natural gas for combustion power plants has decreased.

While the majority of energy consumption involves natural gas, there has been a gradual migration toward diversifying the mix of energy resources in California (Figure III-13).

Figure III-13
PG&E Energy Sources



Source: 1999 California Energy Commission

Although solar power provides a minuscule percentage of California's energy, solar electric generation (photovoltaics) is gradually increasing in Marin. Four system permits were approved in 2000, and 44 permits were submitted from January 2001 to October 2001 (Marin County Community Development Agency).

Alternative energy sources are growing in popularity. Solar energy use within the county for both electricity and heat is steadily growing in popularity. The number of permits granted by Marin County alone for the installation of photovoltaics increased from 4 in 2000 to 44 in 2001 in the unincorporated areas. This growth in solar energy use has been primarily in the residential and small business sectors of Marin. A maturing renewable energy infrastructure also exists in Marin to support this growth and includes distributors, designers, installers, and maintenance. Passive solar, solar thermal, and photovoltaic systems are growing in popularity throughout the state of California due to reduction in cost (approximately $9/watt), state government subsidies ($4.50/watt), improvement in technology, and the clean energy they produce (Marin County Community Development Agency).

1. Energy Assessment

➢ Issues

More information about energy sources and consumption is needed.

a) Houses are being designed for greater energy efficiency, but the occupants are using more energy.

b) The sizes of houses are increasing, and there are fewer people in each household.

c) The energy shortage creates a new challenge to air quality, which has generally been improving in the Bay Area. The recent energy shortage has prompted the use of small, polluting power generators.

d) The increase in natural resource costs is taking away from essential services.

e) Monitoring different land uses and their energy consumption is necessary.

➢ Strategies

Carry out an energy assessment to measure energy sources, and use it in order to have baseline data.

a) Inventory energy sources (such as coal, nuclear, natural gas, hydroelectric, renewable), including their economic and environmental costs and reliability.

b) Inventory current use of energy, and estimate future needs by end-use sector (for example, residential, commercial, industrial, agricultural, institutional).

c) Identify opportunities for energy efficiency in each end-use sector, and prioritize by economic, equity, and environmental benefit criteria.

d) Use the International Council of Local Environmental Initiatives Cities for Climate Protection Campaign to measure and set targets for greenhouse gas emissions. Reducing these emissions will necessitate decreased petroleum-based energy use.

e) Map locations and availability of renewable resources in the county, including solar, wind, small hydro, and methane from agriculture and landfills. Identify opportunities for using renewable resources and clean-distributed generation in existing and new developments, and in redevelopment projects.

f) Assess the financial impacts of the status quo and proposed energy policies on populations such as low income residents, on small businesses, and on essential services (such as schools, fire, and police).

Establish goals for reduction of resource and energy consumption, and monitor progress.

a) Set goals and targets for conservation, efficiency, and renewable energy. Goals need to be clear, bold, and timely. The county government should set a higher goal for itself than for the private sector (residential, commercial, industrial, and agricultural) to lead by example.

b) Update planning documents to encourage energy efficiency, such as the Countywide Plan and all Community Plans; the zoning ordinance, including use permits and variances; the subdivision ordinance; the building code; the planned-development ordinance and guidelines; environmental impact review guidelines; and other relevant special-purpose ordinances.

c) Use indicators (such as energy consumption and peak demand, or renewable energy production) to determine progress toward goals and measure the success of programs and policies.

d) Research and adapt valuable policies and programs that have been created and implemented by other local governments throughout the state, nation, and world.

e) Analyze energy policies by sustainability criteria that include the true economic, social, and environmental costs to the community and the society at large.

f) Compile an energy report biannually to track the progress in meeting the goals established by the County for each sector. Modifications of the County's energy strategies should be proposed as necessary to achieve the goals. This report should track the indicators for residential, commercial, and public facilities. A breakdown by city and county jurisdictions will be helpful in determining challenges and successes.

g) Make public transmission lines available to potential renewable energy generators. There are regulatory and institutional hurdles to major renewable energy generation projects. For example, MMWD has tried in the past to retrofit existing dams to generate hydropower, but PG&E denied access to its transmission lines.

h) Refine the data being used to calculate Marin's ecological footprint to accurately reflect local conditions, and develop plans to reach goals.

➢ Sample indicators

a) Track residential energy consumption (California Energy Commission).

b) Track nonresidential energy consumption (California Energy Commission).

c) Track the sources ("mix") of energy provided to Marin County residents and businesses (California Energy Commission).

d) Track greenhouse gas emissions through Cities for Climate Protection (Marin County Community Development Agency).

e) Track Marin's ecological footprint (Redefining Progress).

➢ Sample targets

a) Increase the amount of Marin's energy coming from renewable sources by 25 percent by 2010 from the 2000 level.

b) Decrease greenhouse gas emissions by 20 percent by 2020 over 1990 levels.

c) Reduce Marin's ecological footprint by 20 percent by 2020 over 2000 levels.

2. Government Initiatives

➢ Issues

The County and other public agencies can lead by example in promoting energy conservation and use of renewable energy sources.

a) There is an increased desire to move toward renewable energy, but there is a need for more leadership in government at all levels on this issue.

b) Long-term government policies and programs for energy efficiency need to be adopted. The potential for decreased energy consumption is significant. California decreased energy use by 12 percent in 2001 over 2000 levels due to conservation, energy-efficiency programs, and retrofits.

c) More local government staff needs to be knowledgeable about energy issues.

d) Marin Municipal Water District is the largest energy user in the county. There is a conservation, efficiency and renewable energy opportunity here.

Changes in government regulations are needed to support changes in energy use.

a) Policies and programs encouraging energy efficiency and conservation are needed.

b) Green building construction and compatible permitting procedures across jurisdictions need to be encouraged.

Government should sponsor outreach and initiatives to encourage energy efficiency and use of renewable energy sources.

a) There is a lack of solar insulation information for Marin County.

b) Increased major renovations and significant remodels are opportunities for energy efficient retrofitting.

c) People need to be more proactive in becoming energy efficient.

Financial issues concerning utilities involve a complex and changing mix of private funds and public regulation. Public funding is available for energy conservation programs.

a) There is increasing uncertainty in the energy market. Utilities have gone from a regulated monopoly to a more competitive market. System reliability, price stability, bankruptcy, and various public policies cause uncertainty about the future of energy.

b) After deregulation, approximately five corporations purchased most power plants in California. Less than 20 percent of in-state capacity is now owned by in-state utilities.

c) The energy utility companies are currently in charge of handing out Public Goods–funded rebates for energy-efficient measures to consumers rather than nonprofit or government distribution of those funds.

d) The State of California has to pay pollution fees for power plants under current negotiated energy contracts. This provides no incentive for plant owners and operators to reduce pollution.

e) There are opportunities for business and commerce to conserve energy. Funding for incentives needs to be investigated. Requirements for businesses to conserve energy could be enacted at the point of sale.

f) Money is available for energy programs from the state and federal governments, which all Marin local governments could be seeking out.

g) There is a lack of state funding for renewable energy resources for affordable housing.

New laws are needed to support energy efficiency and renewable energy.

a) Some strategies and standards can be implemented only at the state or federal level.

b) Local elected officials and staff need to support and advocate for energy related legislative initiatives.

➢ Strategies

Public and private organizations and businesses should demonstrate leadership in conservation and renewable energy use.

a) Establish countywide energy efficient and green procurement policies for all goods and services.

b) Require all new public facilities to meet the Leadership in Energy and Environmental Design (LEED) Silver standards.

c) Assist special districts, such as school, water, and sanitation districts, to investigate and implement energy efficiency and renewable energy measures.

d) Create a Joint Powers Authority or other joint venture between local jurisdictions to aggregate energy efficiency and renewable energy programs and initiatives. Since most Marin jurisdictions are small, they can benefit by sharing resources, administration, and infrastructure required for implementing energy strategies.

e) Recapture and/or create energy through falling water from reservoirs and water pressure reduction in distribution buildings and irrigation systems.

f) Encourage the MMWD to enact a solar roofs program, if the district pursues desalinization of bay water.

The County of Marin can become a model for others by conserving energy and using renewable sources in County buildings.

a) Continue to implement all cost-effective energy efficiency and renewable energy measures. Install solar power generation capabilities on County buildings.

b) Continue to retrofit County buildings for energy efficiency and require County equipment to meet Energy Star standards for efficiency.

c) Meet the requirements for the County of Marin to become certified as a green business.

d) Coordinate with the City and County of San Francisco to establish a partnership and/or use model programs such as installing photovoltaics on municipal buildings.

Change regulatory procedures and implement programs to increase energy efficiency and use of renewable energy sources.

a) Adopt the zoning code and design review guidelines to eliminate regulatory barriers to conservation, efficiency, and renewable energy.

b) Implement the Single Family Dwelling Energy Efficiency Ordinance. This ordinance will reduce energy consumption in homes over 3,500 square feet to Title 24 levels of a 3,500-square-foot house.

c) Use solar energy and other renewable energy sources, where feasible, in existing and new structures to meet the criteria of the Single Family Dwelling Energy Efficiency Ordinance.

d) Mandate solar-oriented building design for residential and nonresidential buildings.

e) Enforce Section 20.20.030 of the Development Code requiring that subdivisions "provide, to the extent feasible, for future passive or natural heating or cooling opportunities."

f) Require that energy efficiency be addressed in the building project descriptions as a condition of approval from the Planning Division. Require, at a minimum, that plumbing and electrical connections be provided to facilitate the retrofit of solar water heating and solar electric or other future clean generation technology.

g) Establish energy efficiency standards to be met upon change of ownership of residential and commercial buildings.

h) Incorporate cost-effective energy efficiency and renewable energy use as criteria for design review, environmental studies, and local programs that affect energy use.

i) Implement community aggregation (as may be allowed if the Community Choice or similar bill becomes law) when feasible to provide reliable and cost-competitive electricity from clean and renewable sources to reduce the county's greenhouse gas emissions.

Establish a variety of outreach activities and incentives to encourage energy efficiency, use of renewable energy, and awareness of the ecological footprint.

a) Create a regional energy office to serve all participating local governments and offer education, policy development, rebates, technical assistance, and renewable energy procurement. Provide incentives for property owners or renters to conserve energy or install renewable energy systems.

b) Train architects and contractors in basic energy efficiency, renewable energy, and green building design practices through seminars sponsored by the County. Host workshops for the public and building professionals on cost-effectiveness for energy efficiency, passive solar energy, and other renewable energy.

c) Encourage the use of the U.S. Green Business Council's Leadership in Energy and Environmental Design (LEED) Rating System for new commercial development by providing free technical assistance and introduction to LEED.

d) Utilize the Building Energy-efficient Structures Today (BEST) program to provide resources, technical assistance, and outreach to promote energy efficiency and green building. Promote energy efficiency upgrades in existing buildings through education and/or retrofit service for all structures—commercial, residential, public, and private.

e) Adopt and reprint the Alameda County Green Building Guidelines with information on the County's energy efficiency and green building programs. Provide this resource to other local jurisdictions and the public.

f) Support existing water conservation programs and develop new ones. Since energy is required to pump and treat water and to heat it at the end use, water conservation is an important energy conservation strategy as well.

g) Allow permit fee waivers and over-the-counter permits for solar energy equipment to stimulate the advancement of solar energy applications.

h) Enact a program to accelerate the weatherization of low income residences and rental units.

i) Encourage the replacement of wood stoves with natural gas or pellet stoves.

j) Conduct public education on Marin's ecological footprint, and promote choices that utilize resources efficiently.

Make use of public and private financial strategies to pay for increasing energy efficiency and increasing use of renewable energy sources.

a) Facilitate access to rebates, loans, grants, and other forms of public assistance available through local, state, and federal programs.

b) Develop public/private partnerships for loans, financing, and leases.

c) Facilitate energy efficient retrofit performance contracting with energy services companies.

d) Utilize revenue bonds, revolving loan funds, and other mechanisms available to local governments.

e) Utilize the Public Utilities Commission funds for energy efficiency rebates and renewable energy in public and private buildings.

f) Use energy services companies (ESCOs) to do energy efficient retrofits in public and private buildings. Schools, hospitals, local government buildings, and businesses can all take advantage of the services of an ESCO. Savings on cost of energy due to retrofits can be utilized for additional energy retrofits, energy projects, and/or other sustainability projects with money back via savings.

g) Promote programs such as PG&E's CARE and Energy Partners Programs, which provide free weatherization service to qualified low income individuals and families.

Advocate for legislation at the state and federal level.

a) Track and support legislative efforts to promote energy efficiency and renewable energy development on the local level.

b) Work with the county's state and federal legislators to promote legislation to implement sustainable energy strategies that can only be implemented on the state or federal level (for example, Corporate Average Fuel Economy standards and appliance efficiency standards).

➢ Sample indicators

a) Track energy used in County buildings and countywide (Marin County Public Works Department and Community Development Agency).

b) Track the number of new residential and nonresidential projects exceeding Title 24 standards (Marin County Community Development Agency).

c) Track renewable energy installations (Marin County Community Development Agency).

d) Track funding obtained for renewable energy projects (Marin County Community Development Agency).

➢ Sample targets

a) Decrease the amount of energy used in County buildings by 25 percent by 2010 from the 2000 level and by 10 percent per capita countywide.

b) Increase the number of building projects exceeding Title 24 by 100 percent by 2010 from the 2000 level.

c) Increase the number of renewable energy installations by 100 percent by 2005 from the 2000 level.

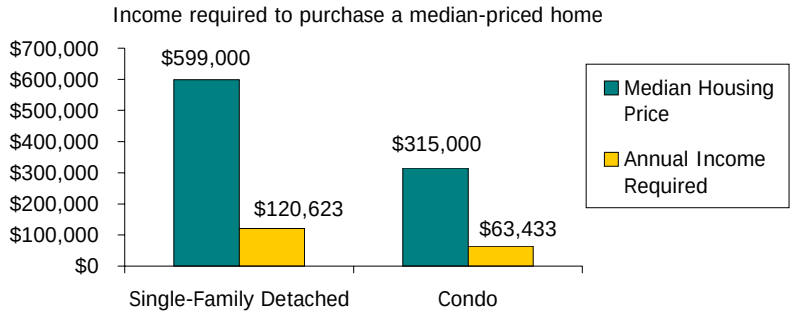
d) Increase funding for renewable energy projects by 20 percent by 2005 from the 2000 level.

C. HOUSING

➢ Background and trends

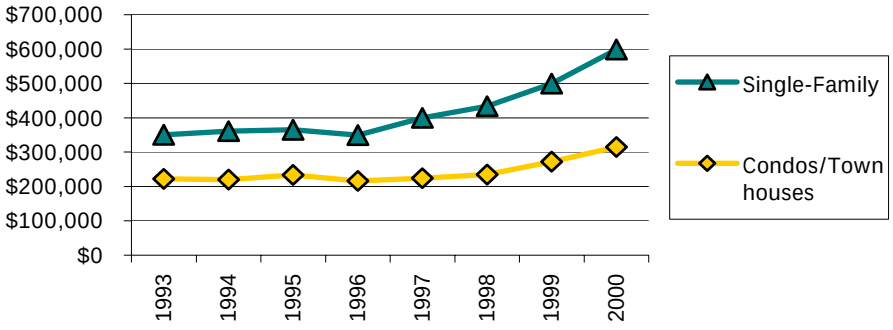
The cost of buying and renting housing in Marin County is continuing to rise. Families and individuals are paying larger shares of their income for housing or are unable to afford to live in Marin. The median sales price for a single-family house increased from $350,840 in 1993 to $599,000 in 2000. The median price for a condominium increased from $237,794 to $315,000 in the same period. It would take an annual income of $120,623 to buy the median-priced single-family house and an income of $63,433 to buy the median-priced condominium (Figures III-14 and III-15).

Figure III-14
Housing Affordability, 2000



Source: 2001 Marin Economic Commission

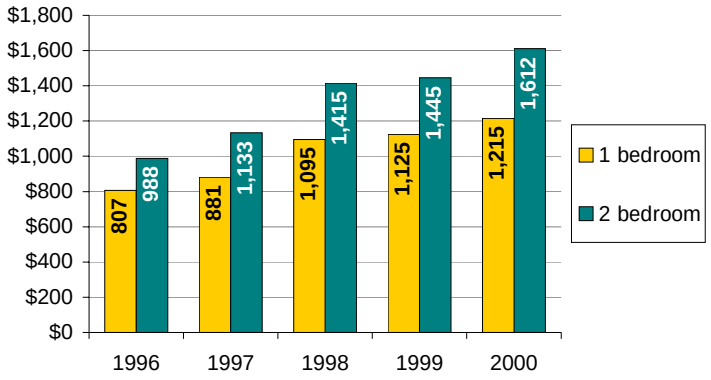
Figure III-15
Housing Median Sale Price



Source: Marin County Assessor

Rents continued to rise from an average of $807 for a one-bedroom apartment in 1996 to $1,215 in 2000 (Figure III-16), while the continued low rental vacancy rate makes finding housing difficult. Relatively few housing units were built between 1994 and 2000. Of the 2,592 that were developed, 1,908 were single-family detached units, 179 were condominiums or townhouses, and 866 were apartments.

Figure III-16
Marin County Average Rent

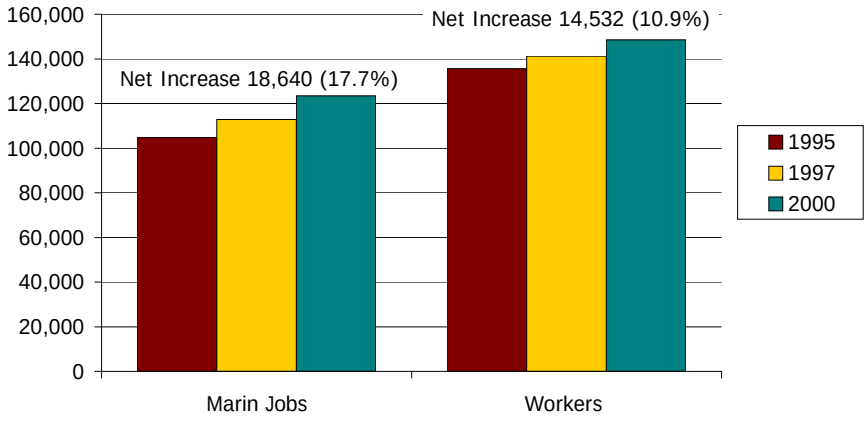


Source: 2001 Marin Economic Commission

People holding many types of jobs cannot afford to buy or rent housing in Marin. The 2001 annual median income for a family of four in Marin County was $80,100. Many jobs provide far less income than this. Very low income jobs paying less than $28,050 per year include cashier, restaurant cook, and retail salesperson. Many clerical and maintenance types of jobs in government agencies are in the category of low income jobs, paying a maximum of $44,850 per year. Moderate income jobs paying a maximum of $67,300 per year include nurse practitioner, pharmacist, firefighter, and police officer. Only people with incomes at the high end of the moderate category could afford to buy a median priced condominium. None could afford the median priced single-family house.

The number of jobs and workers in Marin is greater than the number of housing units where workers can live. While the number of workers in Marin has increased since 1995, the number of jobs created in the county has increased even more. There were 135,557 workers in Marin in 1995 and 148,515 by 2000, while the number of jobs increased from 104,870 to 123,510 in the same period. When applied to the number of housing units in the county, there were 1.32 jobs per housing unit in 1995, increasing to 1.37 in 1997 and to 1.41 in 2000 (Figure III-17).

Figure III-17
Marin Jobs-Workers Balance



Source: 2001 Marin Economic Commission

The construction of housing contributes to environmental problems such as waste generation, air pollution, and water use. According to the Alameda County Green Building Guidelines, 12.91 tons of waste are typically created from the construction of a new 2,000-square foot home. The U.S. Environmental Protection Agency reports that the air in new homes can be 10 times more polluted than outdoor air because of the materials used in construction. Several planning jurisdictions worldwide contribute to water conservation by requiring roof catchment water supply as a condition for approval for new construction. Boulder, Colorado, makes green building a condition for approval.

1. Increasing the Supply of New Housing

➢ Issues

The shortage and cost of housing make it difficult for people who work in Marin to live near their jobs.

a) The lack of affordable workforce housing causes employers and employees to leave the county.

b) There is linkage between the lack of housing and transportation congestion.

c) Housing need is created by increased employment, including in schools and government offices. If employers help provide housing for their workers, this will help to address housing and traffic issues.

d) A legal mechanism needs to be identified to providing housing for people who work in the community need to be identified, with preferences for local workers to buy or rent affordable units.

e) There is a connection between business and housing. Resources need to be leveraged, and there needs to be cooperation between business and the community. Businesses need to be involved in the planning process.

f) The rental vacancy rate is so low that rental housing is hard to find.

g) Increases in development density are strongly resisted.

h) There is a need to find ways to increase support for development of more housing.

A variety of techniques will be needed to identify and develop sites for housing.

a) The supply of affordable housing, money, and available land needs to be increased. The community needs to be mobilized for change.

b) Lower density development of large homes continues because of the profitability and market for this type of development although higher density development uses fewer resources such as water for landscaping and energy because of the shared building walls.

c) New development needs to be transit oriented, pedestrian oriented, and accessible by bike.

d) Changing land zoned for commercial to residential use would reduce land costs.

e) Commercial areas need to be better utilized: They have transit proximity, opportunities for retrofitting shopping centers, and air rights over parking.

f) Existing communities can become denser. Permitted densities of development can be increased in order to increase the supply of housing. Development does not have to be allowed to spread into existing open space and agricultural lands, although density increases are strongly resisted.

g) Zoning for sales tax revenue reduces the availability of land for housing.

h) Transfer of development rights from flood-prone areas to areas with urban development potential needs to be considered.

i) Poor quality building sites increase the cost of development.

j) There is a need for an effective land-banking program.

k) Neighborhoods, business groups, schools, churches, and community organizations can be activated to identify housing sites.

l) Surplus school sites can be evaluated for teacher housing. Also, church lands are underused and could become affordable housing sites.

m) Areas can be identified where housing would add to the desired liveliness of an area.

n) San Quentin is a potential opportunity site for affordable housing.

o) The recommendations for the St. Vincent's and Silveira lands need to be integrated into the Countywide Plan.

Overcoming obstacles to the development of second units would contribute to the housing supply at relatively low cost and ease of development.

a) Restrictive covenants forbidding second units in some older areas could be invalidated and second units could be allowed in new development.

b) Existing illegal second units could be legalized; permits could be expedited; connection fees could be reduced; waivers on height and floor-area ratio could be allowed.

c) Neighborhood opposition to second units and code enforcement against them need to be addressed. The cost of second units is increasing, and it is becoming more difficult to get approvals for them.

d) Regulations could be developed that are sensitive and neighborhood-specific for parking and design to make sure that second units fit in.

e) The reluctance of people to build second units needs to be addressed by identification of areas, techniques for building a second unit, and parking options. Low-interest loans for affordable second units could be provided.

➢ Strategies

Use land efficiently to meet housing needs and implement smart-growth principles.

a) Maintain a diverse population by promoting a variety of choices in housing.

b) Develop new affordable housing strategies to strengthen the link between jobs and housing. Adopt a jobs-housing linkage program.

c) Complete a study showing the nexus between commercial and industrial development and the need for housing for the workforce.

d) Identify existing employee housing opportunities. Specify that employer-provided housing focus on line staff.

e) Prepare land use plans to facilitate infill housing.

f) Prevent the loss of units through downzoning actions by transferring development rights to sites for affordable housing projects near jobs and transit. Purchase Transferred Development Rights (TDR) to increase housing density at selected sites.

g) Encourage transit-oriented development by identifying and designating sites, and establishing development standards.

h) Zone and provide appropriate standards for efficiency/SRO units.

i) Provide for live/work opportunities.

j) Amend multifamily General Plan policies and zoning regulations. Amend single-family zoning regulations to require minimum as well as maximum densities.

k) Review and update parking standards.

l) Incorporate child care centers and Safe Routes to Schools standards into new developments.

m) Develop vacant or underutilized school property for housing.

n) Encourage mixed-use development that includes housing in currently nonresidential areas by preparing a white paper on mixed-use housing development feasibility, conducting a survey of potential mixed-use sites, and establishing mixed-use development standards.

o) Create incentives for the development of long-term affordable housing. Enact density bonus zoning and other incentives.

p) Prepare a white paper on ways to facilitate smaller affordable housing projects. Conduct a detailed feasibility study of affordable housing sites. Evaluate an "Affordable Housing Overlay Zone" zoning designation and sites suitable for such a designation.

q) Facilitate development at key housing opportunity sites. Expedite environmental review for designated housing opportunity sites.

r) Strengthen residential inclusionary requirements and establish inclusionary housing regulations.

s) Modify the second-unit development standards and permit process to make it easier to develop second units. Establish a clearinghouse for second-unit technical assistance. Consider an amnesty program for unpermitted second units. Require resale inspections—assist second units in becoming legal.

➢ Sample indicators

a) Measure the median sales price of homes in Marin (Marin County Assessor).

b) Measure affordability levels of homes in Marin (Marin County Housing Authority).

c) Track the number of new units constructed in Marin (Marin County Community Development Agency).

d) Track the jobs-housing ratio (Marin County Economic Commission).

➢ Sample targets

a) Meet the regional fair-share allocation for construction of 229 very low, low and moderate income units in Marin County by 2006.

b) Increase by 20 percent by 2020 the number of Marin County workers living in the County who hold very low, low and moderate income jobs.

2. Government Programs to Encourage Housing Development

➢ Issues

Planning and zoning programs and incentives have a role in facilitating affordable housing.

a) There needs to be more collaboration on city and County plans to avoid conflicts. All towns and cities need to cooperate in providing a fair share of affordable housing. Multijurisdictional planning efforts could be encouraged.

b) A set of resources could be provided to help small jurisdictions streamline their process and to focus on affordable housing.

c) Incentives for developing affordable housing are needed, such as density and floor-area-ratio bonuses, shared parking, third-floor height allowances, no restrictions on residential density within a building envelope, and single-room-occupancy facilities.

d) Residential infill on underdeveloped residential sites can be encouraged. Infill projects can receive density bonuses.

e) Affordable housing for farm workers is needed. High housing costs make recruitment of workers difficult and contribute to a decreased quality of life for workforce families.

f) There is a conflict between the Association of Bay Area Governments' (ABAG's) housing allocation and some policies in the Countywide Plan that discourage affordable housing. For example, underutilized sites can be redesignated to allow additional housing.

g) Prezoning to allow multiuse and affordable housing could be considered. Overlay zones for mixed use and affordable housing can be established.

h) Blanket overlay zones are problematic; instead, amend the zoning districts accordingly.

i) Setbacks need to be relaxed and clustering allowed. Off-street parking requirements can be reduced for multifamily housing development.

j) The environmental review process might create a barrier to affordable housing development.

k) Models for housing development such as programs and standards used in Davis could be considered.

l) Incentives for meeting and penalties for not meeting housing goals need to be established.

m) The percentage of inclusionary units required in new projects needs to be increased.

n) On-site or offsite housing is more effective than fees for mitigating the impacts of new commercial development.

o) Cooperatives and cohousing could be considered as possible affordable housing types.

p) Free or low cost land is useful, but subsidies are still needed for affordability.

q) One way to overcome neighborhood opposition is by providing examples of well-designed affordable housing. Design is the key to community acceptance.

Housing developers, funding sources, and financing are essential factors in building affordable housing.

a) Local government agencies need to identify reputable developers and work with them to develop affordable housing.

b) The public needs to recognize that a developer requires flexibility to fit a project into a community and to make it feasible. There needs to be recognition that developers would prefer to invest equity in the community rather than have to pay extra taxes or fees.

c) Mixed-income housing projects need to be considered so that a variety of funding sources and financing can be used.

d) Ways to make rentals available and affordable need to be explored. There is a need for a community bank to provide loans for higher density housing.

e) Apartment owners are reluctant to accept Section 8 clients. They need education on this subject.

f) A real estate transfer tax for affordable housing could be established. Tax-exempt financing and bonding potential by redevelopment agencies and cities need to be considered.

g) Although homeowners receive a large subsidy through mortgage interest and property tax deductions, there is some public opposition to subsidizing affordable housing.

h) Mixed-use projects need to tap into increasingly greater funding sources.

i) Government and developers need to coordinate with banks and utilize their obligations under the Community Reinvestment Act.

j) The update process for the Housing Element of the Countywide Plan provides an opportunity to set in motion a countywide housing trust fund and options for funding sources.

➢ Strategies

Work together to achieve housing goals.

a) Work with housing advocates.

b) Establish procedures for neighborhood meetings. Prepare and update public information materials.

c) Conduct community outreach. Provide public education on affordable housing opportunities and incentives for first-time home buyers.

d) Collaborate to implement an interjurisdictional strategic action plan for housing. Undertake coordinated lobbying efforts.

Build local government capacity to respond to housing needs.

a) Increase local government effectiveness in implementing housing programs. Provide briefings for elected and appointed officials on alternative housing types.

b) Conduct staff training. Designate staff to develop local funding sources. Establish a permanent “affordable housing strategist” position. Establish a Housing Assistance Team (HAT).

c) Leverage funding opportunities. Establish a housing trust fund ordinance and operating procedures. Seek additional local sources of funding. Coordinate funding among development proposals.

d) Utilize Redevelopment Agency powers.

e) Streamline the permit application process to allow for affordable housing for farm workers. Consider waiving or lowering permit fees as an incentive for the construction of farm worker housing.

f) Provide green building technical assistance for affordable housing.

g) Establish a housing-data clearinghouse. Conduct an annual Countywide Plan Housing Element review.

h) Mandate fee waivers or discounts for deed-restricted units as is done in San Rafael.

i) Eliminate time limits on deed-restricted units.

j) Zone appropriately so that sites are eligible for funding (many sources exclude projects that require General Plan or zoning amendments).

k) Promote more consistent fee schedules among jurisdictions.

l) Provide a land-transfer-for-units option with priority on getting sites.

m) Use available funding to maximize the number of affordable units.

n) Establish an open, public policy for allocation of Housing Trust Fund monies.

o) Integrate inclusionary units into projects instead of allowing payment of an in-lieu fee. Base inclusionary requirements on the size of market rate units.

p) Create incentives for the provision of more than the minimum number of affordable inclusionary units.

➢ Sample indicators

a) Measure the amount of local public money provided for affordable housing and its utilization for housing developments (Community Development Agency, Marin County Housing Authority, Marin County Community Development Block Grant).

b) Measure the implementation of programs in the Countywide Plan's Housing Element.

c) Measure the number of inclusionary units built in the county (Marin County Community Development Agency, Marin County Cities and Towns).

➢ Sample targets

a) Increase the amount of local funding and the number of units of affordable housing by 20 percent by 2006 over the 2002 level.

b) Implement programs in the Housing Element according to the schedule specified in the Element.

c) Increase by 10 percent the number of inclusionary units by 2006 over the number approved in 2002.

3. Utilization of Existing Housing Stock

➢ Issues

The existing housing stock provides opportunities to increase the supply of affordable housing.

a) For a variety of reasons, many "empty nest" households continue to occupy housing units that are well suited to families with children and with adults in the workforce.

b) There is a need to stimulate turnover of large houses occupied by empty nest households by encouraging the production of smaller units, and of assisted-living and residential care facilities targeted to the senior population.

c) The San Mateo County shared-housing program could be used as a model for providing opportunities for shared housing in Marin.

d) Large homes sizes result in fewer affordable units.

e) There is a need to discourage demolition of housing that is in good shape and conversion of housing to nonresidential use unless the housing is to be replaced by an equal or greater number of housing units. A housing conservation plan needs to be developed to protect existing housing.

f) Existing housing needs to be acquired and made affordable. Large homes could be converted to multifamily housing.

g) The number of projects to which affordability (inclusionary) requirements apply, and the amount of the requirements, are not sufficient to meet the affordable housing need.

➢ Strategies

Maintain and enhance existing housing and blend well-designed new housing into existing neighborhoods and communities.

a) Provide housing that is well designed. Adopt criteria for use in design review to clarify the design review process. Consider creating a shared architect or designer position.

b) Protect and enhance existing affordable housing.

c) Protect "at-risk" units.

d) Link code enforcement with public information programs. Assist in maximizing use of rehabilitation loan programs.

e) Acquire rental properties for affordable housing.

f) Review the Condominium Conversion Ordinance.

g) Use mediation to resolve landlord-tenant issues.

h) Investigate and encourage home-sharing and tenant-matching opportunities.

i) Provide for child care in housing developments.

j) Modify the Second Unit Development Standards and Permit process. Establish a clearinghouse for second-unit technical assistance.

k) Consider an amnesty program for nonpermitted second units.

l) Analyze how incorporating uniform design standards or processes affects the function of design review boards. Look at ways to reduce the cost of the design review process.

m) Address nonconforming uses and their reconstruction potential—there is a great potential for loss of units because of this.

n) Incorporate Safe Routes to Schools criteria with new housing development.

o) Keep on-site wastewater treatment limitations in mind.

p) Maintain parking-requirements where street widths are narrow, on-street parking is minimal, and public transit is not close by.

Provide housing for special-needs populations.

a) Establish zoning for emergency shelters and transitional-housing facilities.

b) Modify residential care facility zoning to facilitate provision of such care facilities.

c) Ensure good neighbor relations involving emergency shelters and residential care facilities.

d) Review and consider revising zoning regulations for farm worker and ranch hand housing if necessary.

e) Provide housing for government employees.

➢ Sample indicators

a) Measure the number of new second units and rent levels (Marin County Community Development Agency).

b) Measure the number of homeless people assisted through the Continuum of Care program (Marin County Housing Authority).

c) Inventory and track farm worker housing to ensure that all vacant farm worker housing is being fully utilized (Marin County Department of Agriculture, Weights and Measures).

➢ Sample targets

a) Add 50 second units by 2006 over the level in 2002.

b) The number of individuals provided assistance in obtaining shelter and other services will increase by 10 percent in 2010 over 2000 levels.

(See also IV. The Economy, Equity and Culture, A. The Economy, Workforce Housing, and C. Social Equity and Public Health, Housing.)

D. COMMUNITY DESIGN

1. Community Structure and Character

➢ Background and trends

Marin County's built environment and natural landscape are historically in harmony. The heritage of Marin County's built environment is one of villages, towns, and cities that are in harmony with the surrounding natural and agricultural landscape. Marin's housing was historically concentrated in its downtowns—the centers of commercial, cultural, and civic activity—and in adjoining, walkable neighborhoods. These places, and the images and lifestyles associated with them, remain among Marin's most treasured and valuable assets.

Marin County is experiencing outward pressure for suburban development. With the growth of the population and economy in the Bay Area metropolis in the past 50 years, and the pervasive influence of automobile access, Marin's urban and rural areas have been subject to the same outward pressure for suburban development as other rural edges of the Bay Area. Unlike most rural counties, however, Marin has aggressively sought to protect its irreplaceable natural and agricultural assets from being overrun by low density, low quality development.

Most new growth has been automobile oriented. Much of the housing built in the last 30 years has been relatively low density, single family houses that are not within easywalking distance of shops, schools, or parks. And any new office and retail developments are in the form of low density, single-use buildings, each surrounded by its own parking lot. This type of automobile oriented development has consumed larger amounts of land to serve a smaller number of residents and generates an automobile trip for most activities of daily life. With the high cost of land, and growing concern about traffic and air quality, there is a need for a more sustainable urban form that is disciplined by the needs of the pedestrian.

➢ Issues

More sustainable community development patterns would better utilize our limited amounts of land and other nonrenewable resources.

a) The cost of land is increasing. There is a need for more efficient use and reuse of existing developable lands.

b) Land is increasingly used to serve automobiles.

c) There is increasing dialogue on mixed-use neighborhoods, especially in downtown areas.

d) There are interjurisdictional barriers to the sustainable design of communities.

e) There is a direct relationship between the design of new development and the preservation of resources.

New and redeveloping neighborhoods could be made compact and walkable, and could include a range of housing types, with schools, parks, and neighborhood shops within a ½-mile walking distance. The majority of the population would be concentrated within a ¼-mile radius, as is shown in the traditional neighborhood diagram on the previous page.

a) Existing communities can become denser through increased permitted densities of development, including allowance for second units, thus preserving existing open spaces and agricultural lands.

b) Design guidelines can be used to code a variety of housing types and sizes, including mixed income neighborhoods near transit.

c) Existing discontinuous bicycle and pedestrian routes hamper the ability to walk and bike to work and other destinations. Gated communities can hamper connections and walkability.

d) An intra-Marin bus system could reduce automobile use, with a plan for bus routes within a quarter mile of locations where 90 percent of the population lives.

➢ Strategies

Incorporate principles of the new urbanism into the Countywide Plan, zoning code and community plans.

a) Identify areas near transit nodes that would be appropriate for higher density, transit-oriented development. Create incentives for development in these areas.

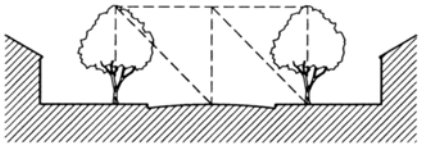
b) Include and designate mixed-use zones and higher density residential zones.

c) Permit second units in all residential zones.

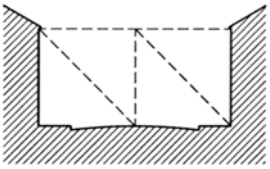
d) Encourage mixed-use development in commercial areas within the City-Centered Corridor.

e) Update community plans with community-specific standards and guidelines to ensure that new development retains the essential characteristics that make each community unique.

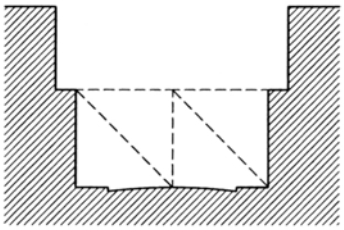
Figure III-18
Spatial Enclosures



Spatial enclosure by tree canopy



Spatial enclosure by building height



Spatial enclosure by recess line

- **Spatial Enclosure:** the defining elements of a public space provided by facades with disciplined tree planting as an alternative. Trees aligned for spatial enclosure are necessary on thoroughfares that exceed the maximum height-to-width ratios.

Source: 2002 Fisher & Hall Uban Design

Incorporate clear development standards and design guidelines into the zoning code and subdivision standards, including the following elements.

a) Build streets in an interconnected grid or modified grid to provide route choices and dispersion of traffic.

b) Design buildings with similar uses to front the street, facing one another. Use changes should occur at the rear property line.

c) Design buildings so that heights are similar on a given street frontage and be proportional in height to the width of the street, at a height-to-width ratio of no more than 1:3, as shown in the Spatial Enclosure diagram at the right.

d) Provide on-street parking where feasible to serve as a buffer between pedestrians on the sidewalk and moving traffic except in certain cases where steep terrain would require excessive grading. In this case, parking on one side, or opportunistic parking lanes where terrain permits, are good options.

e) Design parking structures so that the street levels have uses other than parking.

f) Produce a map showing walking distances from existing housing to services. Overlay with half-mile radii circles—the distance that most people will comfortably walk—to determine the number of residences that are not within walking distance of services.

Plan and design new development with respect for its natural surroundings.

a) Design compact mixed-use communities to accommodate the needs of the human population in discrete areas, leaving the undeveloped countryside alone. (See the diagram comparing towns in the landscape to suburban sprawl, on the following page.)

b) Review hillside grading standards in terms of amount removed or reused on-site and of revegetation requirements. Require grading to follow a smooth contour; avoid sharp cuts and fills, and long, linear slopes that have uniform grade.

c) Use local building materials to the extent possible to create a local sense of place.

d) Provide and protect scenic corridors and significant viewsheds from scenic roads, hiking trails, and public places throughout the county.

e) Do not allow building near visually prominent ridgelines when a choice of building location is available. Building rooflines must be located below the ridgeline so that views to the hillside retain the natural ridgeline.

f) Require that roof forms and rooflines of hillside buildings be broken into a series of smaller building components to reflect irregular forms of the surrounding natural features. Require roof colors to be earth tones.

g) Require that hillside buildings be cut into the hillside to reduce visual bulk. Excavate underground or use below-grade rooms to reduce effective bulk and provide energy efficient and environmentally desirable spaces.

h) Encourage sloping lot design, such as split-level building terraces, to reduce building pad size. Building forms should be stepped to conform to the site topography.

i) Reassess and reduce to a minimum the maximum amount of flat yard area in hillside development. Reassess clustering policies for hillside development and clarify, with 90 percent open space and 10 percent development, what is acceptable in each use.

j) Do not allow continuous building masses that create a “wall” effect and inhibit views should not be allowed. Do not allow large expanses of wall in a single plane on downhill elevations on hillside lots.

k) Improve the quality of stormwater runoff with sensitive site design.

l) Use irregular plant spacing to achieve a natural appearance on graded slopes.

m) Clarify under what circumstances eucalyptus trees are protected.

Figure III-19
Cities and Towns Made of Neighborhoods

Source: 2002 Fisher & Hall Urban Design

This diagram shows the same amount of development in compact towns and villages, top, and evenly spread suburban sprawl, bottom. The compact development provides a larger net amount of undisturbed open space. ©DPZ & Co. Reproduced with permission.

Remove interjurisdictional barriers to the sustainable design of communities.

a) Work with each of the cities and the Congestion Management Agency to develop a comprehensive master plan. The goal of this master plan would be to maximize the amount of transit-served development, and ensure that new development and redevelopment is transit-servable.

b) Work with each of the cities to maintain a coherent urban boundaries to retain a pattern of compact towns and villages in the Marin countryside.

➢ Sample indicators

a) The rate of growth of the human population in relation to the rate of growth of urbanized land (Marin County Community Development Agency).

b) The density of new development overall, and compared with the averages from 1980 to 2000 (Marin County Community Development Agency).

➢ Sample targets

a) Increase residential densities of new development in Marin County by 20 percent by 2020 over the prior 20-year period.

b) Twenty percent more residences will be within a quarter mile of services and transit by 2020.

c) Update and code all of the community plans to include sustainable development and new-urbanism principles and design standards by 2020.

2. Streetscape and Open Space Design

➢ Background and trends

Marin County's roadway system was designed for a smaller population. Historically, Marin's roadway system was made up of two-lane highways winding through the countryside, narrow country lanes lined with rural houses, tree-lined neighborhood streets, and busy commercial streets in the towns. Streets and roads that carried small amounts of low speed traffic often had no sidewalks because it was comfortable to walk along the edge of the roadway, while busier streets almost always had comfortable sidewalks for pedestrians. Parking was allowed on both sides of most streets, such that a row of parked cars often separated the pedestrian from moving traffic.

Streets constructed in recent years have been designed and detailed to maximize the level of service for automobiles, and the level of service for pedestrians and bicycles has suffered. As the population increased in recent decades, wider streets were constructed to carry more traffic at higher speeds. These streets included collector streets and arterial streets, in addition to four-lane highways and freeways. These streets were built with and without sidewalks, and parking was often prohibited in the interest of allowing more traffic to flow more freely. This brought fast-moving traffic very close to pedestrians on the sidewalk or shoulder of the road. A result was that people who could afford a car would generally not choose to be a pedestrian on streets with fast-moving traffic.

Garages and other service functions historically were located away from the street. While the houses in the older neighborhoods generally had garages that were set back behind the house, the streetscapes of the newer neighborhoods often were dominated by garages. As land became more valuable and lots became smaller, the percentage of the lot frontage devoted to parking and the garage increased substantially.

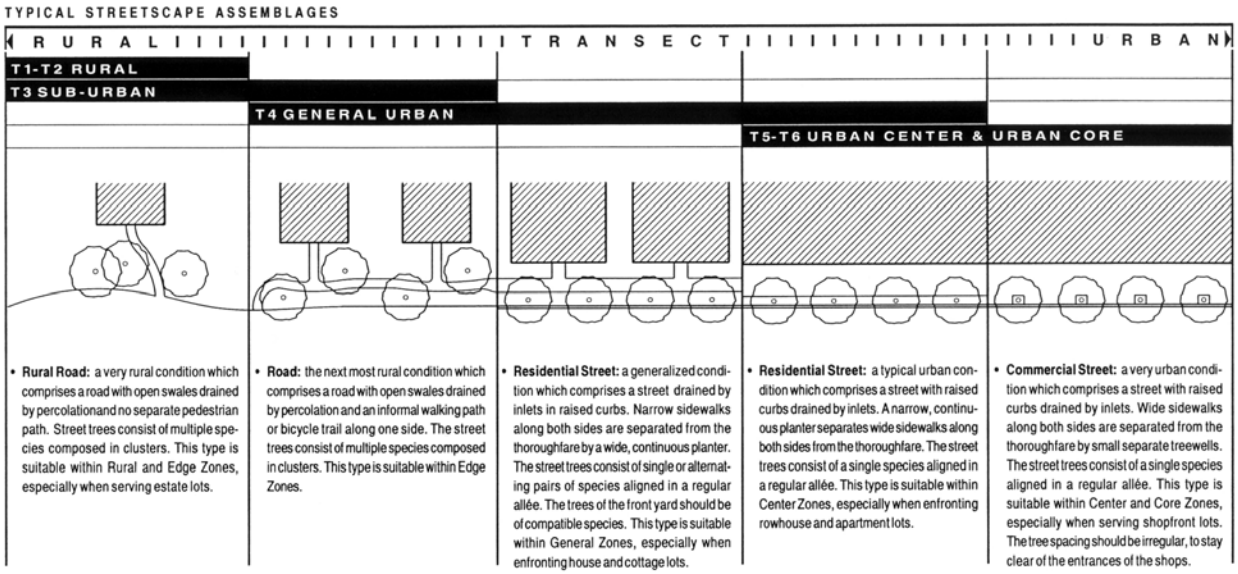
As local governments' ability to raise funds for construction and maintenance has been significantly reduced in recent years, the quality of public space design and maintenance has also been reduced. With the passage of Proposition 13, local governments' ability to raise funds for the construction and maintenance of streets and parks was significantly reduced. To maximize the traffic-carrying capacity of the streets for the lowest cost, street standards were produced that often removed the parking lanes, sidewalks, street trees, and planting strips. To maximize the acreage of parkland that could be provided for a limited amount of money, standards were developed for the building of larger, more widely spaced parks rather than small neighborhood parks within walking distance of new homes. This made the parks more economical to maintain but required that most children be driven to them to play. The responsibility for funding and constructing new streets and parks was largely shifted from local government to developers and builders. The developers generally supported the trend toward bare-bones streets and parks, since they saw those as "off-site" costs that did not add value to their "product," and hence sought to minimize their investment in public spaces and infrastructure.

There is a nationwide trend toward traditional neighborhood development that is reversing the trend toward auto-dominated public spaces. A strong focus of this movement is the design of public spaces to accommodate pedestrians and bicyclists comfortably while allowing cars to move through, generally at lower speeds (Figure III-20). A key to avoiding congestion is to design street systems that connect neighborhoods together with an open network of many smaller streets, rather than relying on a single collector or arterial street for this function. The result is that not one street is burdened with a large amount of traffic, and thus the streets are not easily overloaded.

The blocks within a traditional neighborhood street network are relatively small, so that children and other pedestrians can easily move in any direction through the neighborhood. The streets have relatively narrow pavements and comfortable sidewalks, and are spatially defined by street trees and by houses set facing the street. Houses often have front porches or stoops, with the garages tucked back. The fronts of the houses—free of garages—can be pulled up close to the street, creating a strong neighborly feeling.

The destinations to which one can walk in such neighborhoods include small shops, offices, apartments, and transit stops along a larger street at the neighborhood edge; a small green or playground near the quiet center of the neighborhood; bicycle and jogging trails along an open space at a neighborhood edge; and neighborhood schools located where several neighborhoods meet.

Figure III-20
Typical Streetscape Assemblages (I)



Source: 2002 Fisher & Hall Urban Design

A diagram showing the character of the street based upon the zone in which it is located. From *The Lexicon of the New Urbanism.* ©DPZ & Co. Reproduced with permission.

The key to an efficient and convenient transit system is getting people to leave their home on foot or on a bicycle. Once people are in a car, they will probably drive to their final destination. If they are willing to switch to transit from the car, parking facilities are needed at the transit stop, which are either very costly to provide in structures, or consume large amounts of valuable land for surface parking at terminal locations where the land could be used for higher density mixed-use development.

➢ Issues

Neighborhood streetscapes—including streets, front yards, and building facades—should be designed in a coordinated way that makes them comfortable to walk along.

a) Land is predominantly used to serve automobiles.

b) Design principles and development patterns can be developed to create pedestrian and bicycling opportunities within the community.

Street design can balance the needs of the pedestrian and the bicyclist with those of the motorist. Moderating the motorists' speed is an important factor.

a) New development can consider bike and pedestrian paths as basic infrastructure.

b) Improvements to existing streets can be pedestrian and bicycle oriented.

The design of streets and roads can be functionally and aesthetically appropriate to the neighborhood.

a) In the rural areas of West Marin, and in lower density neighborhoods on the edges of towns and cities in the City-Centered Corridor, roadways can be more rural in appearance.

b) Most residential streets should have sidewalks or separate pathways so that walking is pleasant and safe. An exception to this could be rural roads with little traffic where it might be fine to walk along the edge of the road or on the road.

c) Downtown streets, such as those in San Anselmo and Fairfax, need to have plenty of on-street parking so that customers will use the front doors of businesses.

Parks, squares, greens, and plazas can provide safe and useful public spaces within a neighborhood when they are appropriately sited and carefully designed.

a) Public spaces that are faced by buildings inhabited at all times of day ensure that they are safe and secure.

b) Small play areas within walking distance of residences allow children to play and socialize without being driven there by an adult.

c) Public plazas and squares can serve as local gathering places, making them ideal locations for small-scale local businesses such as cafes, bakeries, and service businesses.

➢ Strategies

Prepare both countywide and community-specific standards for pedestrian oriented streets that honor the principles of sustainability and new urbanism.

a) Make sure that streetscape improvements and standards are pedestrian and bicycle oriented.

b) Establish a system that measures Level of Service for pedestrians and for bicycles. In directing infrastructure investment, adopt minimum standards for these that supersede standards for automobile traffic.

c) Consider users of public spaces to be from a wide range of ages.

d) Provide or require the provision of pedestrian amenities such as fountains, benches, tables, kiosks, landscaping, and courtyards in key facility locations.

e) Encourage single-family homes to have porches at the front and garages to the back of the site.

f) Restrict the use of solid fences and walls over four feet in height along public streets due to the negative impact on the streetscape.

g) Street trees should be planted to provide continuous shade and green.

h) Design buildings to provide defensible space. Higher density residential areas should have doors and windows facing the street at frequent intervals. Commercial areas should avoid dead spaces such as blank walls.

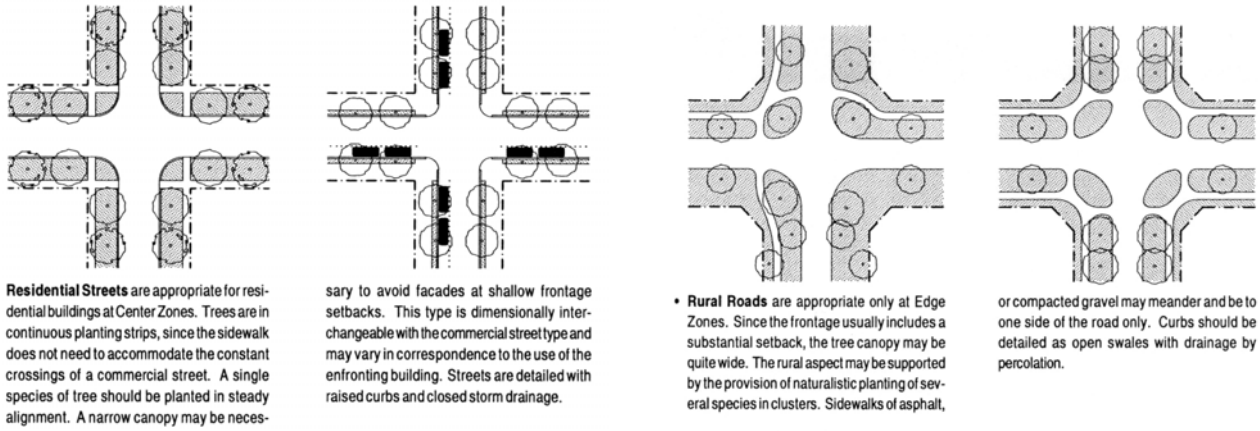
Integrate street and road design standards with the overall community design, reinforcing the rural or urban character of the place they serve (Figure III-21).

a) Develop typical and special streetscape standards for the three corridor areas and Community Plan boundary areas.

b) Modify hillside roadway standards to require minimum widths to maintain the rural feel of the hillsides. Use narrower street widths to reduce grading impacts.

c) Inventory the character of the streets and roads in terms of width of sidewalks, presence and spacing of street trees, height-to-width ratio of "outdoor room," height of streetlights, number and spacing of benches, and distances between doors facing the public street. Base community-specific standards on this inventory.

Figure III-21
Sample Street-type Diagrams



• **Residential Streets** are appropriate for residential buildings at Center Zones. Trees are in continuous planting strips, since the sidewalk does not need to accommodate the constant crossings of a commercial street. A single species of tree should be planted in steady alignment. A narrow canopy may be necessary to avoid facades at shallow frontage setbacks. This type is dimensionally interchangeable with the commercial street type and may vary in correspondence to the use of the enfronting building. Streets are detailed with raised curbs and closed storm drainage.

• **Rural Roads** are appropriate only at Edge Zones. Since the frontage usually includes a substantial setback, the tree canopy may be quite wide. The rural aspect may be supported by the provision of naturalistic planting of several species in clusters. Sidewalks of asphalt, or compacted gravel may meander and be to one side of the road only. Curbs should be detailed as open swales with drainage by percolation.

Sample street-type diagrams that show how the design is based upon overall character of the adjacent development. From *The Lexicon of the New Urbanism*. ©DPZ & Co. Reproduced with permission.

Source: 2002 Fisher & Hall Urban Design

Incorporate clear, high quality development standards and design guidelines for public parks and plazas. The following elements should be addressed.

a) Design public plazas and community parks to be fronted by building facades and circumscribed by thoroughfares.

b) To maximize their use and security, locate parks and plazas next to other destinations.

c) Take care that open spaces have visual supervision from fronting buildings.

d) Avoid dense, visually impenetrable planting since it creates the opportunity for crime.

➢ Sample indicators

a) Percentage of residences within ½ to ¼ mile of a playground ((Marin County Community Development Agency).

b) Number of miles of new sidewalk constructed on streets that previously had none (Department of Public Works).

c) Ratio of pedestrians per day to cars per day, and ratio of bikes per day to cars per day (Metropolitan Transportation Commission).

d) Average driving speed on residential streets.

e) Average percentage of empty seats on buses and ferries (Golden Gate Bridge, Highway and Transportation District).

➢ Sample targets

a) Ensure that by 2020, 50 percent of local streets (not including collector and arterial roads) have more pedestrians and bicyclists per day than cars.

b) Ensure that 10 percent of the gaps in street trees in the City-Centered corridor will be planted with new street trees by 2020.

c) Increase the amount of new residential development with front porches, shallower setbacks, and garages behind the house to 75 percent by 2020.

d) Increase the number of new parks and plazas enfronted by building facades and surrounded by thoroughfares to 80 percent by 2020.

3. Building and Site Design

➢ Background and trends

The dominant model of development in Marin County comes from the early 20th century and is based on a network of walkable streets and small blocks. In each community this basis pattern was configured and detailed in a unique way that gave each place its own distinctive local character. The dominant indigenous urban design and architecture of Marin is based on American town planning practices of the early 20th century. This design is characterized by relatively small-scale buildings fronting onto small neighborhood streets. In West Marin, the character of the buildings and the way they are sited on their lots was historically relatively rural, with larger lots, mostly one-story buildings with larger setbacks, and relatively informal landscaping. In the City-Centered Corridor, the historic tendency was to a more urban character, with taller buildings set closer to the street, and more formal arrangements of trees and other landscaping.

The current model of development in Marin County is not community-specific. Current zoning tends to require that building and site design within a given zone be the same regardless of location in the county. The community plans attempt to counter this tendency by including community-specific standards and guidelines that customize buildings to their community.

There is a trend toward new urbanism designs. There is a strong nationwide trend toward higher density mixed-use infill development, particularly near transit nodes. This is a sustainable way to provide needed housing and neighborhood-serving commercial uses. There is also a nationwide trend toward new urbanism, a pattern of development based on the walkable neighborhood. This pattern provides a range of housing types, a range of neighborhood-scale commercial uses, and a range of civic amenities such as schools and parks, all within a walkable radius of approximately ¼ mile.

When lower density new development occurs on natural terrain, it should fit the terrain as much as possible to minimize grading and reshaping. Low density housing development, particularly on steep hillside sites, may be damaging to the natural terrain. Marin is committed to developing and enforcing building and site design standards that minimize reshaping of the natural terrain and harmonize the built elements with their natural surroundings.

➢ Issues

Green building techniques include the use of energy efficient and recycled materials, reduce the use of nonrenewable resources, and reduce the discharge of waste into the environment.

a) Green building and biological treatment of sewage can be encouraged through government policies.

b) Buildings consume 65 percent of the electricity and 35 percent of the total energy generated in the United States (U.S. Green Building Council). Fly ash can be used in concrete to replace a portion of cement. This reduces the amount of carbon-dioxide emissions and waste from coal-fired power plants, and increases sheer strength over time.

c) Buildings use 40 percent of raw stone, gravel, and sand and 25 percent of virgin wood in the United States (U.S. Green Building Council). Buildings use 25 percent of water consumed in the United States.

d) Green building could be required as a condition for residential remodeling and new construction approval by utilizing a rating system.

e) Sustainable building materials and solar and wind power could be used in housing. Incentives could be provided for green building and other standards for high quality housing.

f) A whole-systems approach to building homes should be considered (site runoff to landscaping, orientation of building to sun, reused building materials).

g) Sustainable housing can be provided, using energy efficiency, water conservation, sustainable materials, attention to indoor air quality, and renewable energy.

h) Restricting new housing to the City-Centered Corridor helps preserve rural areas.

Marin's varying community types could benefit from unique landscape design standards and guidelines.

a) Native landscaping could enhance the sense of place in each of Marin's unique communities.

b) Gardens could be sited in urban areas, including rooftop gardens and community gardens.

➢ Strategies

Adopt parking lot design standards that require parking to be screened from public view and designed in an environmentally responsible way.

a) Develop underground and parking structure standards.

b) Encourage the use of pervious surfaces for drainage swales, driveways, walkways, and parking lots. Use hybrid parking surfaces to reduce impervious surfaces.

c) Create a parking grove standard with permeable stall design, a grid of trees, and bollards to delineate parking spaces.

Focus site development standards on the siting of buildings for access by pedestrians and bicyclists. Cars should be accommodated but should not dominate.

a) Make sure streetscape improvements and standards are pedestrian and bicycle oriented.

Develop unique landscape design standards and guidelines for each of Marin's various community types.

a) Encourage gardens in urban areas, including rooftop gardens and community gardens.

b) Select streets to add trees and landscaping.

c) Use irregular plant spacing to achieve a natural appearance on graded slopes.

d) Use landscaping as a tool to promote and provide food, habitat, and water. Incorporate the elements of good ecological design into the design review process.

e) Include native landscaping as part of lot coverage.

Reevaluate parking standards so that they do not unintentionally decrease the density of infill projects or discourage the use of transit.

a) Allow shared, tandem, and elevator car parking, and other flexible parking arrangements for mixed-use or affordable housing projects.

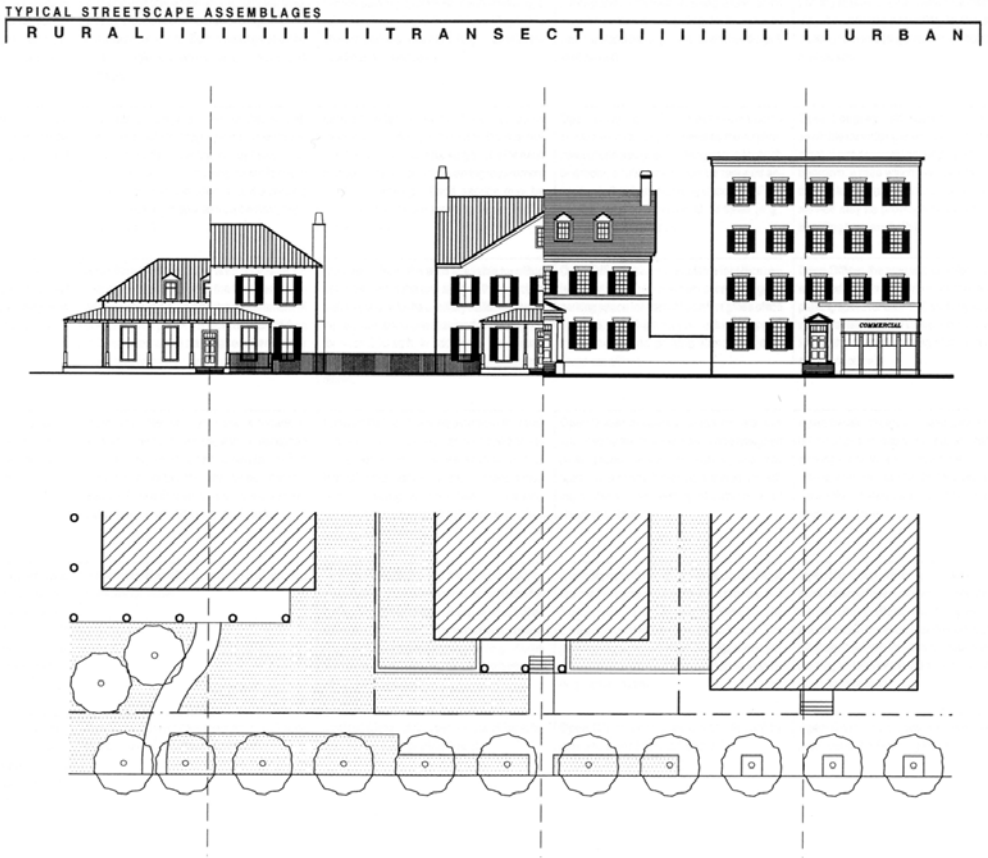
b) Reassess parking requirements related to transit uses.

c) Increase the compact parking ratio for affordable housing projects.

Include customized building and site design standards in community plans to ensure that the unique character of each community is preserved.

a) Ensure that infill development makes incremental changes from the existing character of a surrounding area.

Figure III-22
Typical Streetscape Assemblages (II)



Source: 2002 Fisher & Hall Urban Design

Building types that represent a change along a continuum from rural to suburban to urban. From *The Lexicon of the New Urbanism.* ©DPZ & Co. Reproduced with permission.

b) Complete countywide and community-specific design guidelines for all types of development in order to achieve high quality site design. Consider separating these into corridor areas.

c) Update each Community Plan to address similar topics and standards in order to clearly articulate requirements and streamline review of development applications.

d) Community plans need to concentrate on design issues unique to their areas (see the "Typical Streetscape Assemblages" diagram, above).

e) Require excellence in building and site design.

Develop design standards and guidelines for new development that ensure it will be compatible with the historic character of its community.

a) Develop policies and design guidelines for large-home construction in existing, established areas so that the integration of new buildings is more compatible and less intrusive.

b) Develop policies and design guidelines discouraging the establishment of gated residential communities.

c) Assure ridgeline protection by developing better-defined ridgeline graphics, articulated criteria, protection of specific viewsheds, and hillside design guidelines.

d) Prepare detailed standards for architectural review for multifamily and mixed-use development to include such items as bulk, building materials, reflectivity of glass, color, landscape treatment of front yards, and driveway paving.

e) Develop an interjurisdictional approach to sustainable design of communities. Encourage residential infill on underdeveloped residential sites. Allow density bonuses for infill projects.

Develop design standards, guidelines, and technical assistance for the design of environmentally responsible green building.

a) Require solar orientation as a condition for approval.

b) Encourage and facilitate the use of products with no or low volatile organic compounds (VOC) and the use of local, ecologically sound building materials in construction.

c) Promote the use of recycled and salvaged building materials. Prepare a construction and demolition waste ordinance that requires building projects to recycle 50 percent of waste or develop a recycling plan.

d) Promote the weatherization of all homes in Marin.

e) Encourage the replacement of wood stoves with pellet stoves or other EPA approved stoves.

f) Promote straw bale construction and other natural building technologies, such as: clay, adobe, rammed earth, and presá.

g) Require using the Leadership in Energy and Environmental Design (LEED) rating system for new and remodeled commercial and industrial facilities. Require an LEED Silver rating.

h) Promote the use of renewable energy in buildings.

i) Provide free green building technical assistance to commercial project applicants. Actively seek projects for which the County can provide technical assistance.

j) Use biofilters for vegetated slopes, channels, and parking areas to allow runoff to move slowly over vegetation.

k) Promote water conservation programs and require native, low water consuming vegetation in new or renovation projects.

l) Encourage the use of edible landscape materials.

m) Increase the use of Integrated Pest Management (IPM) by promoting IPM to agencies and the public; encouraging plant nurseries to use and promote IPM; and continuing and expanding the programs established by the IPM Commission to reduce or avoid pesticides, herbicides, biocides, and other chemicals on County projects.

n) Require green building as a condition for approval for new market rate projects and significant renovations. A checklist developed in conjunction with building professionals will determine which projects get approved.

o) Provide free green building technical assistance to affordable housing applicants. Actively pursue funding to assist the ability of affordable housing projects to use energy efficient and green building materials.

p) Create a green building training program for building professionals in partnership with the Builders Exchange.

➢ Sample indicators

a) The average annual energy use per residence, in relation to a 1990 baseline (Pacific Gas & Electric).

b) The average annual water use per residence, in relation to a 1990 baseline (Marin Municipal Water District, North Marin Water District).

c) The percentage of green building materials used, in relation to a 1990 baseline.

d) The rate of increase in impervious paved surfaces in relation to the rate of increase in population.

➢ Sample targets

a) Reduce the amount of resources consumed for housing needs by 25 percent by 2020.

b) Ensure that 10 percent of all new or remodeled buildings use green building design and materials by 2010 and 25 percent by 2020.

c) Ensure that 30 percent of new dwellings and 50 percent of new commercial space is built within ¼ mile of an existing or planned transit stop by 2020.

d) Sixty percent of new housing is constructed in walkable neighborhoods with a mix of owner occupied and rental residences, in a wide range of household sizes, types, and income levels.

e) Ensure that the children and parents of Marin residents are able to find suitable housing in the same neighborhood.

f) Seventy-five percent of new residences are built within walking distance of an elementary school by 2015.

4. Infill and Redevelopment

➢ Background and trends

Recent new development in Marin County has been relatively low in density. The bulk of new development in Marin County in the past 40 years has been composed of relatively low density suburban housing tracts, shopping malls, and office and industrial parks. Most buildings are one and two stories in height and provided with a large supply of surface parking.

In order to improve transit services and relieve traffic congestion, nodes of higher intensity mixed-use development are needed. One of Marin County's main goals over the past 30 years has been to improve the transit services available to its residents. Traffic congestion and its impacts on the urban and natural environments are a major concern. Yet convenient and cost-efficient transit systems have not yet proved to be a viable alternative to driving a private automobile. This is due in large part to the lack of centers with a population density that will support transit service at sufficiently frequent intervals to make transit a reasonably convenient and attractive alterative to driving.

➢ Issues

Infill development should be located, sited, and designed for a long life cycle, and for long-term flexibility and adaptability of building use.

a) Current needs ought to be considered in the context of respecting Marin's history without being solely bound to its tradition.

b) Commercial areas need to be better utilized: They have transit proximity, opportunities for retrofitting shopping centers, and air rights over parking.

New development should be in the form of infill whenever possible and should be compatible with the unique design character of Marin.

a) Housing development must be infill; transit and pedestrian oriented; and near jobs, shopping, and recreation.

b) Neighborhood identity should be clearly identified and preserved. The County should require compatibility with existing residential development.

c) Design guidelines should be developed that focus on mixed-use and reuse development.

➢ Strategies

Mixed-use infill development should be encouraged in appropriate transit-served locations.

a) Encourage mixed-use development of residential over office and commercial.

b) Match jobs and housing in quantity and location.

c) Target commercial parking lots for redevelopment.

d) Focus on transit-oriented development.

e) Identify countywide opportunity areas for infill and mixed use development, and work with Marin towns and cities to prepare specific plans for their improvement.

Develop standards for increased density, mixed-use, transit oriented development near

transit nodes.

a) Develop design guidelines that focus on mixed-use and reuse development.

b) Define flexible-use building types for mixed-use neighborhood center zones, which can be adapted to new uses over time with minimal internal remodeling, avoiding the need for expensive and energy intensive demolition and reconstruction.

c) Establish zoning for attached single-family homes, or townhouses, which not only occupy less land per dwelling but also expose less exterior surface area to the weather, reducing heating and cooling needs.

d) Amend commercial and office zoning districts to allow mixed-use development.

e) Rezone commercial areas to allow for mixed-use infill development in or above parking lots.

f) Include provisions for increasing building height to accommodate parking structures with housing.

Develop design standards and guidelines for increased density, mixed-use, transit-oriented infill building types.

a) Clearly articulate design standards for commercial, industrial, mixed-use, and residential development in order to achieve high quality site designs and to streamline applications for development.

b) Develop design guidelines that focus on mixed-use and reuse development.

➢ Sample indicators

a) The square footage of remodeling and renovation permits as a percentage of total construction permits (Marin County Community Development Agency).

b) The percentage of building area entitled on previously built sites as a percentage of total new building area entitled (Marin County Community Development Agency).

c) The public subsidy per passenger mile of bus route, compared with 1990 levels, adjusted for inflation (Golden Gate Bridge, Highway and Transportation District, Metropolitan Transportation Commission).

d) The average square footage per residence, compared with 1990 averages. This could be divided to measure the averages for residences more and less than ¼ mile from a transit stop (Marin County Community Development Agency).

➢ Sample targets

a) Ensure that 30 percent of new dwellings and 50 percent of new commercial space are built on previously developed sites by 2020.

b) Increase transit ridership by 40 percent by 2020, relative to 2000 levels.

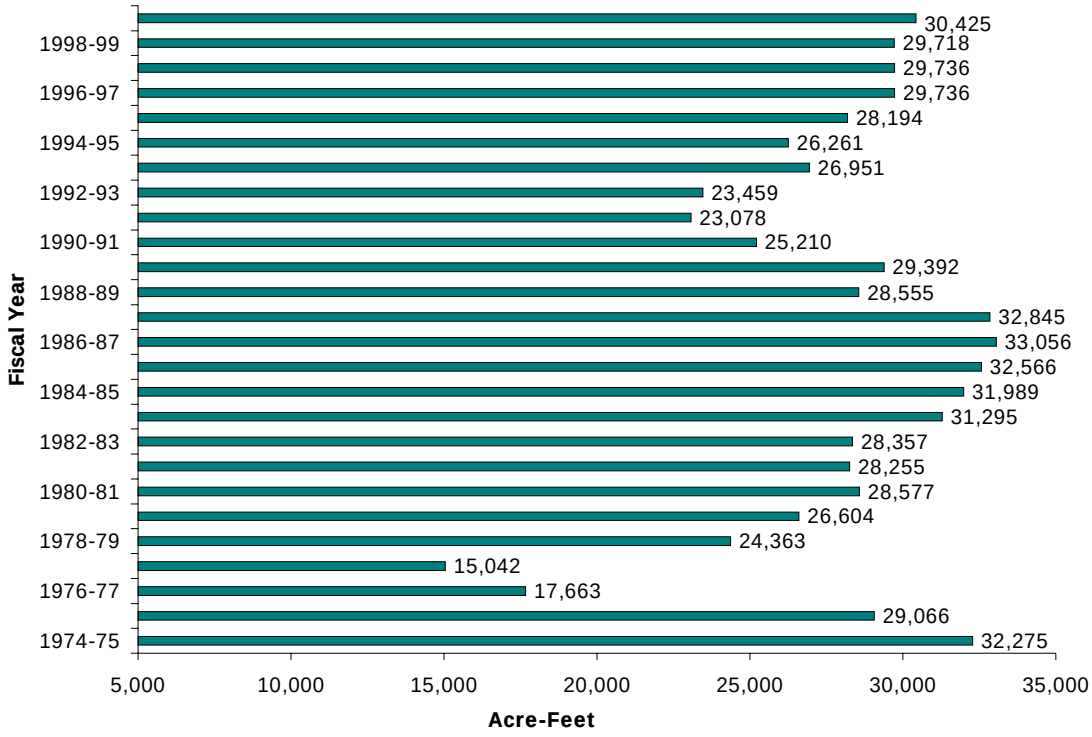
E. COMMUNITY FACILITIES

1. Water Supply

➢ Background and trends

The Marin Municipal Water District is anticipating increased water demand over the next 20 years. Thanks to aggressive conservation programs adopted during the last drought, the Marin Municipal Water District's (MMWD) annual water production has remained relatively stable over time. Demand has remained below peak 1987 levels, despite an estimated 15 percent increase in population. Nevertheless, MMWD demand has been steadily rising for the past several years (Figure III-23).

Figure III-23
Marin Municipal Water District: Annual Water Production



Source: 2001 Huffman

III

The Marin Municipal Water District reports that 5,400 acre-feet per year of additional water supply will be required over the next 20 years (Figure III-24).

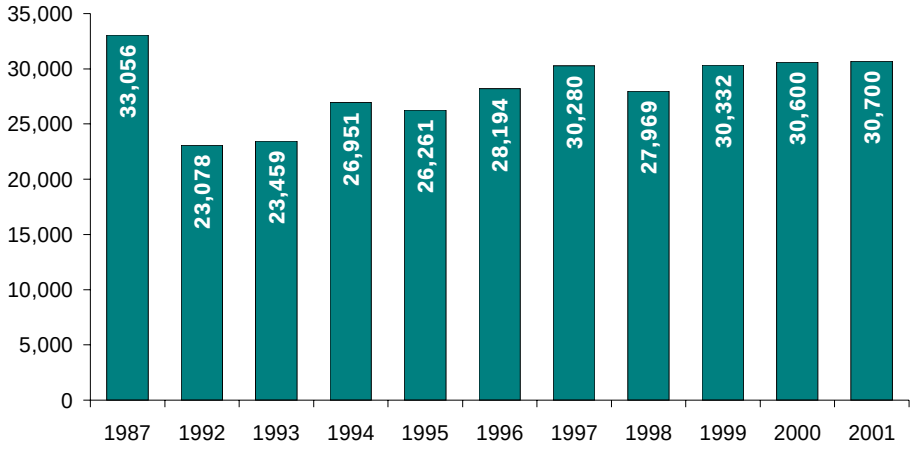
Figure III-24
Marin Municipal Water District:
Water Demand Projections for 2020

Supply	Acre-Feet/Year
Current operational yield	28,600
Current demand estimate	32,500
Projected increase in demand by 2020	2,160
Projected reduction in North Marin pipeline capacity	2,300
Amount required through additional conservation, recycling, and supply	8,360

Source: 2001 Huffman

From 1992 to 2000, per capita water consumption has increased dramatically, from just over 4,600 ccf in 1992 to more than 5,400 ccf in 2000 (1 ccf = 100 cubic feet, or 748 gallons). (It should be noted that 1992 was a drought year.) Demand for water recently began to exceed MMWD's operational yield of 28,600 acre-feet per year "operational yield" is the amount of water MMWD can reliably deliver over time without overdrafting its reservoirs and while meeting service level goals relating to the depth and frequency of rationing) (Figure III-25).

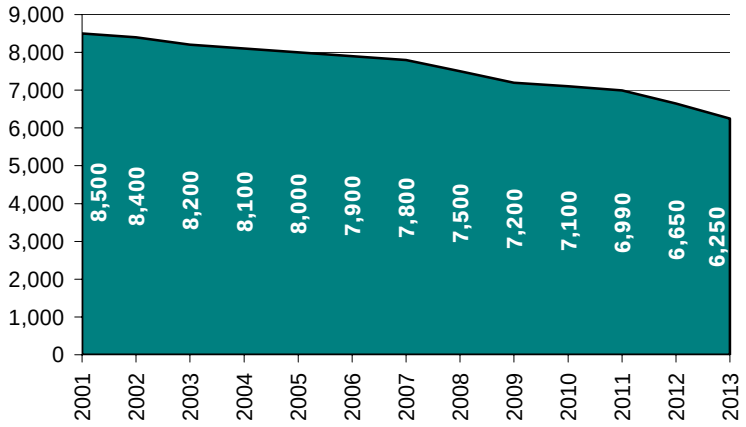
Figure III-25
Demand for Water in Marin: Acre-Feet of Water Used



Source: 2001 Huffman

Per capita demand has been increasing at an even greater rate despite strong conservation measures. MMWD's share of the delivery capacity of the Northern Marin pipeline is expected to decrease from 8,500 acre feet in 2001 to 6,250 acre feet in 2013 (Figure III-26).

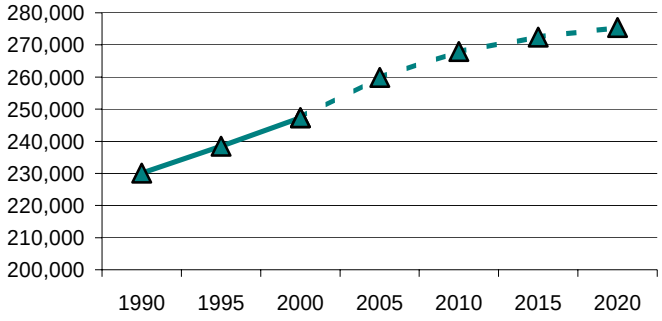
Figure III-26
Marin Municipal Water District's Delivery Capacity



Source: 2001 Huffman

The population of Marin County is expected to increase to nearly 275,000 over the next 20 years, according to ABAG (Figure III-27).

Figure III-27
Marin County Population, 1990–2020



Source: U.S. Census Bureau

Water supply conditions vary in different parts of the county. The North Marin Water District estimates that an additional 8.7 million gallons per day of peak-month service capacity will be needed by 2025. In West Marin, the Bolinas Public Water Utility District (BPUD) has a moratorium on new water service connections because demand is equal to capacity and there are chronic shortages in the dry season.

➢ Issues

Careful water supply planning is needed, and the constraints need to be examined.

a) Development is not congruent with the available water supply, and tension is mounting around this issue.

b) Historically, water planning has been determined by estimating demand and providing supply, versus focusing efforts on demand reduction programs.

c) There is potential for more efficiency in water districts and more potential for cooperation between water districts and sanitation districts.

d) County government is not sufficiently involved in water planning.

e) Data is lacking on how much water is consumed by various land uses.

f) There is a lack of information and education on water sources, the energy used to create supply, and environmental impacts. Information could be provided at water taps in public facilities.

There is debate over new sources of water supply—desalination or a pipeline bringing water from the Russian River.

a) Desalination technology costs are decreasing and coming close to the cost of delivered water. The Russian River pipeline option is estimated by MMWD to cost $1,000 to $1,500 per acre-foot, while desalination is estimated to cost $1,200 to $1,800 per acre-foot. There are factors skewing unit-cost comparison.

b) There is limited flexibility for Russian River deliveries in that the Sonoma County Water Agency contract regulates timing and amount of water access.

c) The operational flexibility of desalination is questionable.

d) Voters approved the Russian River pipeline in 1992, but it has not been constructed due to increased concerns about reliability, environmental issues, and costs.

e) Desalination is attractive because it is drought proof and provides high quality water. However, desalination uses considerable amounts of energy and generates brine, which must be disposed of.

f) Unit costs may skew the comparison between desalination and the Russian River pipeline because desalination is more operationally flexible. For the pipeline, MMWD's contract with Sonoma County contains "off-peak" and "take or pay" provisions, which in many years result in purchases of water that is not needed. A desalination plant, however, can be turned up or down as needed.

g) Russian River water is of excellent quality but draws water from outlying areas and watersheds beyond that of the river. In the summer months, most of the Russian River's flows are actually diversions from the Eel River.

Water conservation measures could reduce the need for additional water supply.

a) Increasing conservation is difficult but still more cost effective than making major infrastructure improvements, which include the Russian River pipeline and desalination.

b) Change-out programs (replacing high flow toilets with low flow ones) and other conservation programs are generally more cost effective than capital projects.

c) Water conservation measures need to be implemented by all community types, including high income communities.

d) The water rate structure for the North Marin Water District should be tiered to encourage conservation.

e) The County could continue to set an example by expanding water conservation at all of its facilities.

f) The recent rise in water consumption can be attributed primarily to outdoor landscaping water use.

West Marin communities have a limited water supply and unique water issues.

a) For West Marin residents served by coastal wells, saltwater intrusion on the coast may be limiting the availability of drinking water.

b) Stream water turbidity caused by heavy winter storms is an issue for the Bolinas Community Public Utility District, since suspended particles and debris can overload the capacity of the treatment plant to purify the stream water.

c) The Inverness Public Utility District (PUD) has no reservoirs for long-term storage. The water system is dependent for its supply on the daily flows in the springs in the watershed. In late summer and fall the amount of water available in the springs sometimes gets very close to equaling the water system's demand. There is no more surface water available in the District's watershed.

d) Water demand is increasing in Inverness because large houses are being built or remodeled and landscaped. Many irrigation systems are on automatic timers and use more water than houses with more natural drought-tolerant landscaping. Water use during the dry season has increased 3.2 percent over the past decade.

e) The Muir Beach Community Services District (CSD) is concerned with delivering water to residents through a water-delivery system that is more than four decades old in some places and suffers from deferred maintenance.

Other issues include groundwater and other ways to conserve and reuse water.

a) Individual diversion of groundwater and streams can result in creating fish migration barriers.

b) Potable reuse could help meet some of our demand for water, but the concept is politically unpopular.

c) There are conflicting regulations about graywater use among Marin County agencies, the North Marin Water District, and the Marin Municipal Water District.

d) People would invest in graywater systems for their homes if there were additional financial incentives.

e) Further information is needed on composting toilets and other experimental types of facilities.

f) A minimum development standard for on-site water retention is lacking.

g) New developments are not being designed to capture rainwater because of existing regulations, and programs do not encourage this practice.

➢ Strategies

Increase water-conservation measures.

a) Study the impacts of increased development and higher densities on water demand.

b) Develop measures to reduce Marin County's dependence on fresh water sources, especially diversions from environmentally sensitive rivers and streams.

c) Support the Marin Municipal Water District's tiered water rate structures to encourage water conservation.

d) Urge the North Marin District to adopt the California Urban Water Conservation Council Best Management Practice of tiered billing rates to encourage water conservation.

e) Develop a model water conservation program to be implemented at all County buildings (such as the Civic Center), landscaped areas, and parks. This model program could be used as an example for other jurisdictions.

f) Institute a water conservation program for all County facilities. Install zero-flow urinals and low-flow toilets, sinks, and showers. Continue to use recycled water in the chiller of the Civic Center and encourage the use of recycled water in other County facilities, use drought-resistant landscaping for all County facilities and public roadway landscaping, and use little to no potable water for landscaping.

g) Require compliance with the County's water-conservation measures, such as requirements for use of native plants in landscaping and water-conserving fixtures in buildings.

h) Develop public information fact sheets with water consumption rates for various land uses, water conservation suggestions, the amount of energy that was used to create the water supply, and the environmental impacts.

i) Require drought-tolerant landscaping on all new development and re-landscaping projects over a certain size to reduce the amount of water used for irrigation.

j) Conserve water both to decrease use of a scarce resource and to reduce the consumption of energy for water distribution.

k) Encourage farms to create water retention ponds for on-site agricultural use.

l) Encourage the use of recycled water for landscaping on public and private land.

m) Encourage and support water conservation and efficiency programs implemented by the Marin Municipal Water District and North Marin Water District.

Evaluate and consider implementing a variety of techniques for conserving and reusing water.

a) Evaluate the benefits and costs of desalination as a water source, including measures to reduce the environmental impacts of desalination, such as renewable energy generation and blending of brine discharge with existing wastewater outfalls.

b) Encourage use of rainwater catchments. Evaluate the use of small-scale portable graywater converter systems as a possible water source for landscaping. Reevaluate graywater regulations and modify them as necessary to encourage its use.

c) Provide financial incentives to encourage people to invest in graywater systems for their homes.

d) Provide information on composting toilets and other experimental types of facilities.

e) Create development standards for capturing rainwater for irrigation.

f) Require homes over 5,000 square feet to reuse 25 percent of their own water through catchments and/or water recycling.

g) Upgrade the water delivery systems in West Marin to reduce the incidence of saltwater intrusion and leakage.

h) Study efficiency and cost effectiveness of rainwater harvesting systems, infiltration, and recharging patterns of groundwater aquifers to assess the most feasible water sources.

i) Conduct a groundwater study of groundwater availability and water quality of the Tomales Bay watershed, including the Walker, Lagunitas, Stemple, and Olema Creek watersheds, and the aquifer bordering the Petaluma River.

➢ Sample indicators

a) Monitor MMWD and NMWD reservoir levels (Marin Municipal Water District and North Marin Water District).

b) Measure the amount of water supplied by the Russian River (Marin Municipal Water District and North Marin Water District).

c) Track the rate of water consumption by County government and countywide (Marin Municipal Water District and North Marin Water District).

d) Track recycled water use (Marin Municipal Water District and North Marin Water District).

e) Measure water use per capita (Marin Municipal Water District and North Marin Water District).

➢ Sample targets

a) Increase water-conservation measures in use by regulated industries by 10 percent by 2010 over 2000 levels.

b) Increase water catchments by 25 percent by 2010 over 2000 levels.

2. Sanitary Districts and Sanitary Waste Disposal

➢ Background and trends

Sanitary districts throughout the county have to address the need for expanded capacity and upgrading of facilities. The Las Gallinas Sanitary District and the Novato Sanitation District will need to expand in order to serve the large parcels that are anticipated to develop within the next 10 years. Sanitary District #5 (Tiburon Area) will reach its capacity by 2003.

The Southern Marin Sewerage Agency assumed ownership of a five-mile trunk sewer system from member agencies. This system requires upgrading to prevent sewer system overflows and backups. The estimated cost is $1,800,000, and the project should be completed in 2003.

The Ross Valley Sanitary District #1 has some areas that are served by septic systems. Property owners are connecting to the sewer service as required. An assessment district may be an option if a majority of the property owners agree.

The Seafirth treatment plant, located between Corte Madera and Tiburon, is privately owned by 100 property owners. The plant has operating problems, and the residents are interested in annexing to a public treatment facility.

The Bolinas Community Public Utility District (BCPUD) is currently operating at capacity in non–dry weather months; therefore, there is a moratorium on new connects to the system.

➢ Issues

Issues of concern to sanitary districts include releasing sewage into the bay, upgrading and improving facilities, funding upgrades and maintenance during a time when electricity costs are rising, and trying to keep customer rates down.

a) Concerns of the Las Gallinas Valley Sanitary District include sewage violations by the district; heavy metal deposits, such as mercury, zinc, and copper, which are building up in the District's treatment plant; the need to improve management of natural and financial resources; funding the upgrading of aging pipes and other equipment; improving communication with the public; and dealing with methane gas on District lands.

b) The Sausalito/Marin City Sanitary District will be required to upgrade two additional pump stations, replace two pump stations with gravity sewers, rehabilitate the Marin City collection system, and install a new sludge dewatering facility at the treatment plant. These improvements will not increase the system's capacity but will allow it to handle present peak flow conditions more safely.

c) The Bolinas Community Public Utility District (BCPUD) needs to upgrade its system to increase capacity at an estimated cost of $1.2 million.

d) There is a need for the County to develop new septic regulations.

➢ Strategies

Encourage sanitary districts to support and participate in water conservation programs.

a) Include consideration of volumetric billing and partnering with water districts to reduce the volume of wastewater that must be treated.

b) Strongly urge the County to support the use of treated wastewater for irrigation by using wastewater to irrigate County-owned properties and encouraging wastewater irrigation at other public and private facilities.

Reduce the toxic impacts of sewage treatment.

a) Develop policies and programs that encourage biological treatment of sewage.

b) Encourage the sanitary districts to reduce the number of sewage violations.

c) Encourage the sanitary districts to reduce the accumulation of heavy metal deposits, such as mercury, zinc, and copper, in their treatment plants.

➢ Sample indicators

a) Measure levels of heavy metals, such as mercury, zinc, and copper, in wastewater (Marin County Department of Public Works).

b) Measure the amount of wastewater that is recycled and reused (Marin County Department of Public Works).

➢ Sample targets

a) Reduce heavy metal deposits at sewage treatment plants by 20 percent by 2020.

b) Increase the amount of wastewater that is treated and recycled by each sanitary district by 20 percent by 2020.

3. Public Utility Districts and Community Services Districts

➢ Background and trends

Special districts that provide water and other facilities have a variety of supply concerns. In terms of water supply versus water demand, certain West Marin districts periodically experience water supply shortages during peak-use periods and drought conditions. For example, the Inverness Public Utility District's available water volume can range from a high of 2 million gallons per day in winter during heavy rainfall periods to a low of 69,000 gallons per day, which occurred during August 1994, following the 1993-94 drought (Marin Countywide Plan Community Facilities Technical Report, 2001).

The Bolinas Community Public Utility District (BCPUD) has had to impose building moratoriums on new water service connections due to lack of adequate water storage capacity. The first moratorium was enacted in 1971. The BCPUD currently has a moratorium in new water service connections due to chronic water shortages during the dry season (Marin Countywide Plan Community Facilities Technical Report, 2001).

➢ Issues

Special districts are faced with resource and maintenance issues.

a) The Inverness Community Plan needs to consider how the community is going to address its water needs in an era of increasing demand for limited resources.

b) The Bel Marin Keys Community Services District is concerned about how to deal with the unincorporated waterfront community's silted lagoons and deteriorating lock system, and how to fund planned improvements to waterways.

➢ Strategies

Address supply and maintenance issues.

a) Work with the Inverness PUD on updating the Inverness Community Plan to identify ways to address the demand for resources.

b) Encourage Bel Marin Keys to identify strategies for addressing waterfront silting and improvement cost demands.

➢ Sample indicators

a) Monitor annual water production in acre-feet per year for each district (Sanitary Districts, Marin County Department of Public Works).

b) Monitor average daily demand of the peak month (in million gallons per day [mgd]) for each district (Sanitary Districts, Marin County Department of Public Works).

➢ Sample targets

a) Increase the installation of water conservation devices by 25 percent by 2010 and 50 percent by 2020.

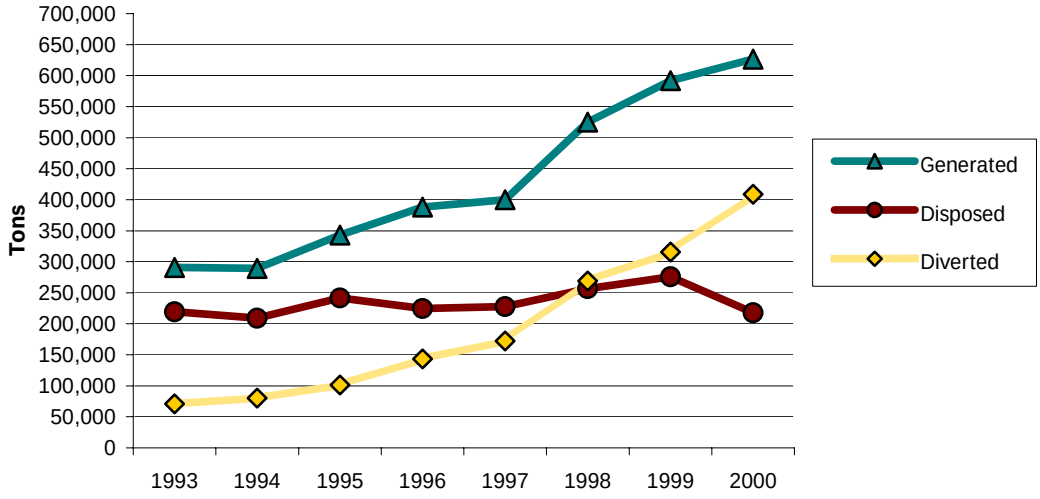
b) Water demand will not increase by 2010 over 2000 levels.

4. Solid Waste

➢ Background and trends

Marin County's solid waste generation is increasing, but diversion from landfills is also high. There are approximately 30 known solid waste sites in Marin County, including a solid waste landfill, a composting facility, a materials recovery facility, and a large-volume transfer and processing facility (Snyder and Smith Associates). Marin County has significantly increased the percentage of solid waste diverted from landfills. Only 24.4 percent of all waste was diverted from landfills in 1993, compared with 65.2 percent by 2000. During the same period, however, waste generation increased 115.7 percent, from 290,519 tons to 626,696 tons (Figure III-28).

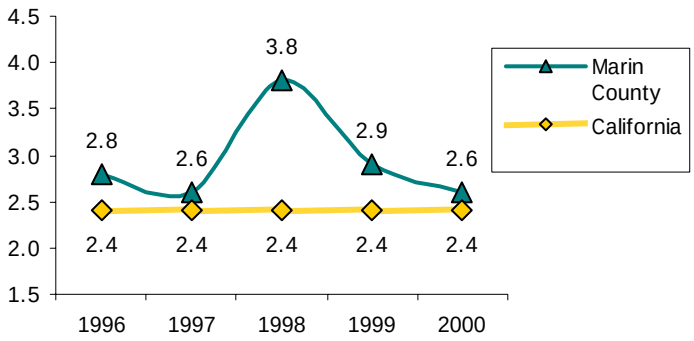
Figure III-28
Waste Generation: Disposal and Diversion Rates



Source: Marin County Hazardous and Solid Waste Management Authority

Residential disposal rates have varied but are above the state average. While the average resident disposed of 2.4 pounds of waste per day in California, in Marin the amount varied from a low of 2.6 pounds in 1997 and 2000 to a peak of 3.8 pounds in 1998 (Figure III-29).

Figure III-29
Residential Disposal Rates
Per Resident, Per Pound



Source: Integrated Waste Management Board

Hazardous waste disposal regulations are changing. The State of California is attempting to reduce overlap and redundancy within the hazardous materials regulations and enforcement efforts. The state is promoting site-specific health-based risk analysis cleanup standards versus broad, conservative regulation standard and a tiered permitting process, which indicates an interest in public health and the environment.

➢ Issues

Despite very high recycling, Marin County can do more to reduce waste.

a) Marin County's Regional Integrated Waste Management Plan needs to be implemented.

b) Rules for diverting construction waste from landfills exist in some communities but not in Marin.

c) Since there is no landfill or transfer station in West Marin, residents must drive to the Redwood landfill in Novato to dispose of refuse. Because of the lack of an easily-accessible disposal site, there is considerable illegal dumping of trash.

➢ Strategies

Pursue additional efforts to reduce waste.

a) Create a construction and demolition waste ordinance to divert construction waste from landfills.

b) Continue to impose aggressive recycling, resource recovery activities, and composting efforts to reduce the amount of waste diverted to landfill.

c) Enact educational programs to inform residents about recycling and composting programs.

d) Develop an education program and a Web site about diversion of construction waste from landfills to other sites within the county.

e) Explore the feasibility of establishing a transfer station in West Marin.

➢ Sample indicators

a) Annually measure the diversion rate of waste from the Redwood Landfill in accordance with the California Integrated Waste Management Act of 1989 (California Integrated Waste Management Board).

b) Measure the percentage of reduction in landfill solid waste volumes (California Integrated Waste Management Board).

➢ Sample targets

a) Recycle at least 50 percent of Marin County construction waste by 2005.

b) Increase the waste stream diversion rate to 75 percent by 2020.

5. Emergency Preparedness

➢ Background and trends

Disasters are increasingly complex. The scope of disasters continues to broaden. No longer does emergency response focus solely on life-safety or property and environmental protection. A focus on efficiency has led to increased dependence on technology to communicate and manage personnel and equipment during an emergency response. There are fewer government resources. Government in California is growing at one-half the rate of the population. The government resources available in a disaster are now relatively fewer and less available than in the past.

Threats to life, property, and the environment in Marin County are increasing in variety and frequency, such as earthquakes, fires, floods, and diseases. There is significant evidence that earthquake activity is increasing in the Bay Area. The chance of a major earthquake (6.7 on the Richter scale) hitting the Bay Area before 2030 is estimated at greater than 70 percent.

Global warming is expected to cause an increase in weather severity and rising sea levels. Rising sea levels will cause increased localized flooding in low-lying coastal areas and will increase coastal erosion. Expected and predicted impacts from global warming and the resulting rise of sea levels on coastal areas include increased coastal erosion, increased saltwater intrusion, increased flooding in low-lying areas, and liquefaction of soils.

➢ Issues

Emergencies can be caused by a variety of events.

a) There are threats of drought based on increasing population versus decreasing water supplies. Environmental restrictions being placed on the Eel and Russian rivers will impact Marin's ability to draw water from these sources.

b) There are threats from wildfires. Controlled burns are not keeping pace with the growth of vegetation. Heavy vegetation combined with the housing patterns in Marin creates a significant fire hazard. Sudden Oak Death will exacerbate this problem.

c) Recent evidence indicates that the most significant threat from tsunami comes not from an earthquake in Japan, Alaska, or Chile, but instead from an underwater landslide or earthquake just off the California coast; the resulting tsunami could hit the coastline within 20 to 30 minutes.

d) There are potential threats, including nuclear and biological threats from terrorists.

e) Perhaps the greatest threat to life in Marin is that posed by a public health crisis. An outbreak of a communicable illness, such as drug-resistant tuberculosis or pandemic influenza, would pose a grave challenge to the local medical institutions.

Government agencies have to face many challenges to be able to respond effectively to emergencies.

a) Emergency response requires an increasingly sophisticated and coordinated effort on the part of local and state government agencies, as well as community groups and nonprofits. The effects and response to a disaster can last years. Jurisdictions in Marin County need to train exhaustively for emergency preparedness.

b) Technology is vulnerable to disruption from natural events as well as criminal attack. Manual back-up systems must remain in place.

c) Increasingly, local governments are required to develop plans and procedures that address other disaster-related issues, including sheltering special-needs populations, complying with the Americans with Disabilities Act, mitigating economic losses including tourism, and addressing the mental and emotional needs of victims and responders. Some jurisdictions address emergency preparedness in their general plans.

d) With a relative reduction in resources and increased complexity, local communities are increasingly reliant upon outside assistance following a disaster. No longer can a community take care of itself—emergency response must focus on bringing resources from outside the affected area. This interdependence places a great premium on the ability to communicate and manage people and equipment during a crisis.

e) City, County and special district employees are increasingly living outside Marin County. A recent survey of County employees showed that 44 percent live outside the county. This will have a major impact on the ability of local governments to respond during a disaster—especially if access routes like Highway 101 or 37 are closed down.

f) Government resources that can be brought to bear in a disaster are becoming relatively fewer and less available. Additionally, the federal military agencies have closed almost all of their Northern California installations in the last 10 years, and the National Guard has lost 50 percent of its strength. Governments have moved fully out of the civil-defense structure seen from 1949 through 1989. There are no warehouses full of disaster supplies, and either few or no community response teams.

g) A contingency plan is needed for critical lifelines (power, water) if they are unavailable.

h) Building a north-south bikeway parallel to Highway 101 creates a new transit corridor that could serve emergency vehicles if the highway is blocked.

i) Marin cities do not have an emergency manager on staff. The preference of the Office of Emergency Services (OES) is for each city to have at least an emergency manager on staff on a part-time basis.

j) Increased interdependence and reliance on outside counties and agencies for assistance, supplies, and other resources is a challenge. The County does not have enough resources on hand to be able to cover needs. In the event of a disaster, it is a challenge to quickly identify the resources needed, which requires significant coordination and management among OES staff, both internally and external to outside agencies. This could result in a delay in getting resources to the area.

k) The County could take an active role in hazard mitigation by focusing on prevention and minimizing their effects.

l) The County does not have adequate storage or warehousing facilities for emergency vehicles and equipment.

m) Marin County has not received national or international certifications that verify the community's level of readiness for a particular type of disaster. Examples of such certifications include the National Fire Protection Association's 1600 Standard on Disaster/Emergency Management and Business Continuity Program (NFPA 1600), and the National Weather Service's StormReady and TsunamiReady Programs.

n) The County Emergency Operations Center is too small, and a new one needs to be constructed, as well as an alternative center.

o) In an emergency, all the local agencies (municipal, fire, and water) require a reliable method for speaking with one another.

Local residents and communities need to be prepared for emergencies.

a) Most neighborhoods are not prepared for disasters. Most families do not have a food and water contingency plan for emergencies. Marin County residents must expect to be on their own for at least 72 hours following a major event.

b) Better exit plans are needed for hillside residents if their primary access is blocked. Bicycling and walking may be the only practical transportation means in some areas during an emergency.

c) Planning for special needs populations during emergencies is being promoted in communities.

➢ Strategies

Improve government ability to respond to emergencies.

a) Support the Office of Emergency Services (OES) efforts to oversee emergency response that identifies and coordinates all potential allies during an emergency, such as nonprofits, hospitals, and schools.

b) Support the OES Emergency response plan that identifies potential threats and the appropriate responses.

c) Build the new OES Emergency Operations Center, which will support the management of response activities during a disaster.

d) Continue to train Marin County staff in emergency procedures and the emergency response plan.

e) Complete the north-south bike route with design features that will accommodate emergency vehicles if the highway becomes impassable.

f) Encourage jurisdictions to create an emergency response plan if one does not already exist in their master plan.

g) Integrate into the County Space Plan the minimum requirements for the County Emergency Operations Center expansion needs.

h) Ensure that the Marin Emergency Radio Authority (MERA) project is completed.

Educate the public about emergency preparedness.

a) Establish an "Emergency Preparedness Awareness Week" for an annual public education campaign about what families should do to prepare for potential emergencies. Educational programs in schools could also occur during this week.

b) Encourage residents to have 72 hours of water, food, and other supplies available; to plan multiple exit routes from both the house and the neighborhood; to prepare for situations when roads are not passable by car traffic; and to undertake other preparatory actions.

c) Encourage the installation of automatic natural gas shut-off valves in residential and nonresidential buildings and have neighborhood emergency-response groups educate others about the location of natural gas shutoff valves and prepare neighborhood emergency plans.

d) Encourage residents to go through the Community Emergency Response Training (CERT) so that they can serve as civilian volunteers during an emergency.

e) Support affordable housing for emergency response personnel so that they are able to purchase a house within the county if they desire to do so.

f) Develop a contingency plan for special needs populations, which might include identification of their location and special need and an identification of reaction requirement given the emergency.

g) Prepare an education program for businesses and families for emergency preparedness, which might include evacuation plans, and on-site storing of adequate water and food.

➢ Sample indicators

a) Number of disaster readiness or training certifications received by County departments (Office of Emergency Services).

b) Percentage of County employees trained through the Emergency/Disaster Operations and Introduction to Standardized Emergency Management System (SEMS) training (Office of Emergency Services).

c) Percentage of communities with 1 percent of their population trained in Community Emergency Response Training (CERT) (Office of Emergency Services).

➢ Sample targets

a) Complete the Office of Emergency Services' Emergency Operations Center by 2008.

b) Train 95 percent of County employees in the Emergency/Disaster Operations and Introduction to Standardized Emergency Management System (SEMS) training.

c) Train 1 percent of the population of every community in Community Emergency Response Training (CERT).

6. Fire Protection

(See also II. Natural Systems, B. Environmental Hazards, 4. Fire Hazards.)

➢ Background and trends

Efforts are being made to reduce fire hazards around buildings. New development in the outskirts of cities but in the unincorporated areas require a fuels management plan and an automatic sprinkler system in buildings. Vegetation management programs are being promoted; this includes clearing flammable vegetation away from structures.

➢ Issues

Fire protection agencies are facing the need to upgrade equipment and personnel.

a) The comprehensive plan for the Novato service area calls for a fire station with a paramedic engine company in the southern portion of the fire district.

b) Water pressure in some hillside areas is not adequate for fire protection.

c) Many areas of the county are located a great distance away from or are difficult to get to from fire stations.

d) The current fireboat used by the Sausalito Fire Department to protect the waterfront has limited access in certain tidal conditions, in shallow water, and where there is debris on the bottom of the bay.

e) The 1999 Fire Flow and Seismic Improvement Master Plan from the Marin Municipal Water District established priorities for water distribution in the Tiburon Peninsula where fire flow was low. The 3000 to 4000 block of Paradise Drive was not included in this plan for update.

f) The Bolinas Fire Protection District has a station that is seismically inadequate and too small to meet its current need.

g) The West Marin Fire District counts on volunteers to become as highly trained as firefighters in paid departments, but the number of volunteers is quickly becoming depleted due to the age of the population and a change to more of a weekend vacation population.

h) Inverness has several engines and utility vehicles that are 20 or more years old and that need replacement, but fiscal considerations have constrained the replacement.

➢ Strategies

Use personnel effectively for fire protection and emergencies.

a) To better serve Marin's aging population, encourage Novato, like San Rafael, to require that firefighters be certified Emergency Medical Technicians as a condition of employment.

b) Continue to maintain adequate response times by continuing to use mutual aid for fire protection.

c) Promote the value of fire volunteering to the younger people in West Marin.

Consider fire protection needs in building and development policies.

a) Continue to encourage more urban development in the City-Centered Corridor to maintain development in the areas serviced by public utilities.

b) Aggressively promote vegetation clearing from structures as a fire management technique.

c) Continue to support the Fire District's requirement for on-site water retention for parcels located in areas with inadequate water flow.

Provide necessary facilities and equipment.

a) Encourage a Sausalito Fire Department committee to finalize specifications and recommend purchase of a new fireboat for the Sausalito waterfront floating homes.

b) Encourage the Marin Municipal Water District to consider adding to its Fire Flow and Seismic Improvement Master Plan improvements required for the 3000–4000 block of Paradise Drive.

c) Encourage the Bolinas Fire Protection District, along with other public and private sources, to continue to seek funding for its station-rebuilding project.

d) Encourage Inverness to seek public or private funds for the replacement of its engine and utility vehicles, which are each more than 20 years old.

7. Police Protection

➢ Background and trends

Police agencies are broadening their functions and using volunteers to supplement paid staff. Police officers are now bridging the gap in social services by working with mental health patients and Health and Human Services. Volunteers to supplement sworn officers for specialized duties (airplane crew, patrol boat staff, mounted deputies, specialized event patrol) continues to be used extensively for the Marin County Sheriff's Department.

➢ Issues

a) If Marin City were to be annexed to Sausalito, additional police officers and equipment would be needed, and additional space is not available at the existing facility.

➢ Strategies

Meet staffing and facility needs.

a) Continue to provide the social benefits of alternative health services instead of jail for people with mental health problems who are nonviolent.

b) If Marin City is annexed to Sausalito, revisit their need for additional officers or building space.

c) As the population ages and the use of volunteers does not subside, the Marin County Sheriff's Department needs to continue to recruit volunteers to replace those retiring.

8. Schools

➢ Background and trends

Current trends in school-age population may not continue. The increase in elementary school children in the mid-1990s caused some school districts to reopen closed schools and expand existing facilities. Since 1985 the following school districts have experienced a steady increase in average daily attendance: Dixie, Kentfield, Larkspur, Ross Valley, San Rafael Elementary, and Novato Unified.

In Marin County the proportion of the population composed of children 17 years old or younger is expected to decrease by 27 percent. The decrease in the number of children may bring about the closure of schools and may reduce the demand for child-care services.

➢ Issues

There is uncertainty about the merger of two school districts in San Rafael.

a) Depending upon a decision of the California State Board of Education, voters may consider the unifying of the San Rafael Elementary and the San Rafael High School Districts in 2003. Many are concerned that less money per student will be allocated to the unified district. Also, the future existence of the continuation school is unknown; and the Santa Venetia students currently going to Terra Linda High School may or may not continue to go there.

b) Decreased State funding may substantially impact Marin school districts.

➢ Strategies

Provide adequate facilities and assess future needs.

a) Seek additional funding sources for capital improvements to school facilities.

b) Conduct a study to reassess whether the development fees currently collected with building permits adequately meet the school facilities' needs.

c) Find multiple uses for schools to meet other community needs.

d) Encourage the County to create smaller neighborhood schools throughout the county so that children can safely walk or bike to school.

e) If the California State Board of Education agrees to the unification of the San Rafael Elementary and San Rafael High School districts, encourage the community to consider all the impacts when voting in 2003.

f) Encourage the school district to continue to follow trends in numbers of school-age children and assess facility needs.

➢ Sample indicator

a) Measure enrollment figures against the maximum design capacity of each school (Marin County Office of Education).

➢ Sample target

a) Ensure that by 2020, enrollment within 90 percent of the school districts will not exceed design capacities for their schools.

9. Libraries

➢ Background and trends

The Marin County Free Library (MCFL) system currently serves roughly one million visits per year. This has remained relatively unchanged since fiscal year 1996–97, when the population in the MCFL service area was 132,310. In fiscal year 2000–01, the service area population was 136,875. It is expected that future visits to the library system will increase as the demographics of the county evolve.

In particular, the number of visits from immigrant and elderly populations is expected to grow (Marin County Grand Jury).

The MCFL circulates approximately 1¼ million volumes and processes more than 150,000 reference requests per year. Reference requests have been steadily declining, dropping from 235,085 in fiscal year 1996–97 to 154,776 in 2000–01. It is speculated that the decreasing trend in the number of reference requests reflects increasing use of the Internet.

The MCFL sponsors a variety of special programs and outreach services. In 2001, the MCFL was involved in more than 300 adult programs reaching nearly 2,700 attendees. In addition, more than 28,000 participants attended 1,000 children's programs. Other services offered included a bookmobile program, a Books on Wheels program for homebound patrons, the Tender Loving Care service to convalescent homes, and the Marin Literacy program, to name a few (2001–2002 Marin County Grand Jury Report).

➢ Issues

Libraries need adequate facilities and staff.

a) Adequate library facilities and services are required to meet the needs of people of all ages in all parts of Marin.

b) It will continue to be a challenge for libraries to keep up with changing technologies and funding constraints.

c) In the coming years, a large percentage of librarians will retire, and there are a limited number of new librarians coming into the system. The high cost of living compared with the salaries of librarians may make it difficult to find committed and knowledgeable librarians to work in Marin.

d) Many of the Marin County branch libraries are not large enough to meet minimum standards. The library staff will need to evaluate space requirements and try to meet the needs of the branch libraries.

e) A report from the Grand Jury in 1997 focused on the poor condition of many Marin County public libraries.

A variety of services are needed for a diverse population.

a) As the population in Marin increases, library use will likely increase.

b) Libraries provide an opportunity for low income individuals to have access to digital information. Librarians can help people navigate the Internet and gain access to information.

c) If the demand by older people increases, the materials may have to be more age appropriate, with more large-print books and books on tape.

d) Outreach to the community will become more important for libraries. With the reduction in school libraries, children are not exposed to library services and will need to be educated about the availability of library resources.

e) Changing demographics provide challenges for libraries. There is a need to provide services to the elderly, to reach out to younger patrons, and to provide bilingual and literacy services.

f) Public libraries are a key institution for helping immigrants to become assimilated into the mainstream culture.

➢ Strategies

Provide needed library facilities.

a) Continue to seek additional revenue sources to fund library operations.

b) Upgrade library technology and increase communication capacity for computer access for each library. Ensure that more of the library resources are available in digital format. Evaluate space requirements for branch libraries, and develop a program to meet identified needs.

c) Find multiple uses for libraries to meet other community needs.

d) Install a reliable, fast computer network that electronically links all the libraries.

e) Improve transportation options, such as bike and pedestrian pathways, that link libraries to their communities.

Address the needs of a diverse population for library programs and services.

a) Periodically evaluate Marin's demographics in order to provide improved library services. Ensure that library services match the demand of the populations they serve.

b) Develop better ways to serve the library needs of the county's special populations, such as children, young adults, the elderly, the handicapped, and residents who are not native English speakers. Ensure that adequate literacy, bilingual services and bilingual technological services are available in all libraries.

c) Expand outreach efforts to the community.

➢ Sample indicators

a) Measure the number of library resources available in digital format (Marin County Free Library).

➢ Sample targets

a) Increase the number of library resources available in digital format by 20 percent by 2010 (Marin County Free Library).

10. Hospitals

➢ Issues

a) Marin County was identified in the Statewide Health Facilities and Services Plan (1985) as having a significant excess of acute care hospital beds.

b) Marin General is considering retrofitting two of three wings by 2008, or building a new hospital by 2013.

➢ Strategies

a) Given the aging population, it is recommended that any decrease in acute care hospital beds be carefully considered.

b) If Marin General decides to retrofit its two wings, it should coordinate with other area hospitals to prepare contingency plans for service.

11. Telecommunications

➢ Issue

a) High-speed computer access is critical to data network deployment for economic development.

➢ Strategy

a) Integrate the strategies in the Marin Telecommunications study into the policies of the Countywide Plan.

(For discussion of the digital divide issue related to telecommunications, see IV. The Economy, Equity, and Culture, C. Social Equity and Public Health, 4. Education.)

F. COMMUNITY DEVELOPMENT

➢ Background and key trends

The Countywide Plan incorporates sound environmental and planning principles that have guided Marin County for 30 years. The Plan designates the 606 square miles of land and water composing Marin County as an environmental unit consisting of regions called *corridors,* with specific geographical and environmental characteristics and natural boundaries formed by north- and south-running ridges. In the first Countywide Plan, adopted in 1973, and in subsequent updates, three environmental corridors were designated:

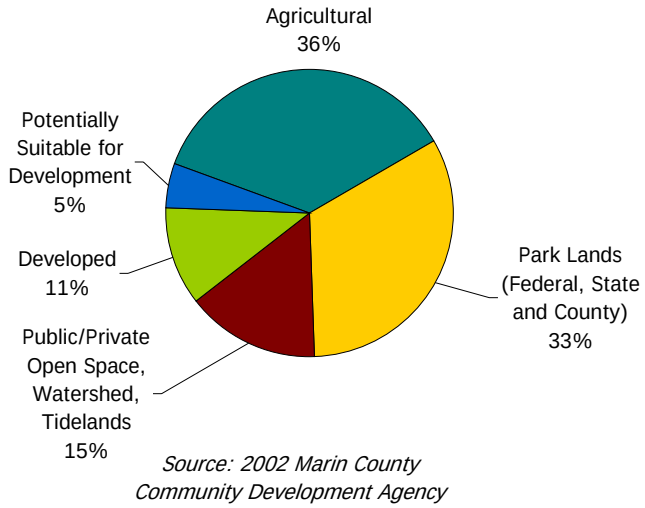
- The Coastal Recreation Corridor, adjacent to the Pacific Ocean, is designated for federal parklands, recreational uses, agriculture, and the preservation of existing small coastal communities.
- The Inland Rural Corridor in the central and northwestern part of the county is designated for agriculture and compatible uses, and for preservation of existing small communities.
- The City-Centered Corridor along Highway 101 in the eastern part of the county near San Francisco and San Pablo Bay is designated for urban development and for protection of environmental resources. This corridor is divided into six planning areas based on watersheds.

One modification proposed in this update of the Plan is the designation of a fourth environmental corridor encompassing the lands along the shoreline of San Francisco and San Pablo Bay. The designation as a Bayfront Corridor would provide heightened recognition of the unique environmental characteristics of this area and the need to protect its important resources. The area consists of marshes, tidelands, and diked lands that were once wetlands or part of the bay.

Resource areas are also designated in the Countywide Plan. They include stream and creekside areas, the Bayfront Conservation Zone, and the coastal zone, which is protected by a detailed plan for coastal conservation called the Local Coastal Plan.

More than three-fourths of Marin County's land is protected from development, and population growth is low. Only 11 percent of Marin County's land area has been developed. The majority of this land is within cities. Most of the 5 percent of land potentially available for development is also in cities. Nearly 85 percent of the county consists of parks, open space, watersheds, tidelands, and agricultural lands (Figure III-30).

Figure III-30
How Marin Lands Are Used



Source: 2002 Marin County Community Development Agency

Countywide population growth between 1990 and 2000 averaged ¾ percent per year. The population in cities grew from 165,997 to 178,554, while the population in unincorporated areas increased from 64,099 to 68,735. Countywide population was 230,096 in 1990 and 247,289 in 2000 (1990 and 2000 Census).

Countywide planning requires coordination with cities and regional agencies. The Countywide Plan is not created in a vacuum. Coordination is needed with agencies such as ABAG in regional planning efforts and the Regional Water Quality Control Board in developing policies that will result in clean water flowing from creeks into the bay and ocean. State and federal agencies like the California Coastal Commission and the National Park Service are also consulted.

Local agencies and various County departments participate in the planning process. The Local Agency Formation Commission (LAFCO) is an agency that plans for the provision of urban services, and the future service areas and boundaries of cities. Its policies and boundaries are incorporated into the Plan. A Countywide Planning Agency was created by a joint powers agreement among all the cities and towns and the County, with one of its functions being to review and comment on the Countywide Plan and the general plans of the cities and towns. It can play an important role in the update of the Plan.

Planning policies and zoning are used to carry out the goals of the Countywide Plan. Since many of the mapped boundaries and policies in the Countywide Plan were established 30 years ago, there may be reasons to review them carefully and consider revisions. A careful study of the relationship between land use designations in the Countywide Plan and zoning on specific parcels would indicate whether the intention of the Plan is being expressed in the zoning.

LAFCO is reviewing spheres of influence for cities and service agencies in the City-Centered Corridor. Any changes made to these boundaries will be considered in the course of the Countywide Plan update and will ultimately be incorporated into the Plan.

Community plans provide specific direction for communities in the unincorporated area of the county. Most unincorporated communities have a community plan, which provides specific direction for land use, transportation, community facilities, building design, and environmental issues. Some of these plans have been updated recently in a format that is consistent with the Countywide Plan.

1. Coordination within the County and with Regional Agencies

➢ Issues

Sound regional planning requires coordination and consistency among general plans of neighboring counties, cities and towns in Marin, federal and state management agencies, and the Countywide Plan.

a) Data and policies in various plans need to be consistent and compatible.

b) A broader view of planning to encompass public health, social services, and other quality of life issues is needed.

c) Land use planning needs to be coordinated with LAFCO and with agencies providing water and sewerage.

The Countywide Planning Agency was created to coordinate planning among the cities and the County, and can be used for a variety of planning functions.

a) With representation from all the cities and the County, the Countywide Planning Agency can address many planning issues of concern to all jurisdictions.

➢ Strategies

Coordinate with all relevant agencies in updating the Countywide Plan.

a) Coordinate with the National Park Service on land use planning for property adjacent to or within park boundaries.

b) Continue to work with the Local Agency Formation Commission on its special studies to determine changes in boundary areas.

c) Work with ABAG in the development of a regional plan.

d) During the periodic review of the Countywide Plan, also conduct a review of the general plans of participating jurisdictions to coordinate growth projects, traffic level of service, housing policies, and environmental quality policies and programs.

e) Have the County continue to take an active role in participating with other organizations' planning efforts (for example, health agencies, social agencies, and transit) to encourage the understanding of the relationship between land use planning and quality of life.

f) Have the County analyze the cumulative impacts of development applications on water availability.

Utilize the Countywide Planning Agency for a variety of the following planning functions.

a) Take a greater role in the coordination and implementation of land use and transportation planning efforts.

b) Conduct a biennial review of the general plans of participating jurisdictions to coordinate growth projections, traffic level of service standards and mitigations, housing policies and programs, environmental quality policies and programs, and policies and programs dealing with provision of community facilities and services.

c) Work closely with the Planning and Public Works departments regarding smart infill standards and designs.

d) Cooperatively implement capital improvements, transportation services, or modifications to land use designations to maintain the levels of service with the Planning and Public Works departments.

e) Develop a program to coordinate the pace of development in all jurisdictions with the provision of transportation system capacity.

f) Evaluate expanding the functions of the Countywide Planning Agency to include such activities as waste management planning and airport land use planning. The design and implementation of a countywide revenue-sharing program, review of major development projects, and the relationship of jobs and affordable housing should also be considered.

g) Analyze the impacts of development applications on public services and facilities by requiring a fiscal-impact analysis that examines the costs and benefits of the proposed development. The analysis should include possible financing methods if it shows that new or expanded facilities are needed to serve the proposed development.

h) Have the County and the cities, through the Countywide Planning Agency, report on a regular basis to the appropriate agencies on development activities and growth projections, and should coordinate with water and sanitary districts in the provision of water and sanitary facilities.

i) Have the County and the cities contribute semiannually to the County land use and transportation database to monitor, track, and map Marin County growth.

j) Have the districts provide the Countywide Planning Agency with regular reports on facility development and capacity of existing facilities.

➢ Sample indicators

a) Coordination by the County with all relevant agencies.

b) Increased functions for the Countywide Planning Agency.

➢ Sample targets

a) The County will contact 100 percent of the affected local, state, and federal agencies during the 2004 Countywide Plan update.

b) The Countywide Planning Agency will add at least two new planning review functions between 2003 and 2010.

2. Planning and Zoning Policies

➢ Issues

Planning policies and zoning may need revision.

a) Zoning designations may not be consistent with Countywide Plan land use designations.

b) There are many categories of zoning, which makes it difficult to interpret and understand the County Development Code.

Transfer of development rights may offer opportunities for environmental protection and smart infill.

a) Analysis of appropriate locations for transfer would provide information about the viability of such a program.

Effective policies and implementation can ensure protection of environmental resource areas.

a) The Bayfront Conservation Zone is one of the sensitive resource areas that need protection.

Countywide Plan and zoning policies and implementation can help provide protection from environmental hazards.

a) Zoning and procedures can provide protection from flood hazards.

b) The County Community Development Agency needs to continue to consult with fire officials to provide adequate protection from fire hazards.

➢ Strategies

Review and consider revising planning policies if necessary.

a) Develop planning relationships between planning corridors, watershed boundaries, and planning areas.

b) Reassess the seven planning-area boundaries for boundary appropriateness.

c) Conduct a review of the zoning ordinance to determine whether zoning categories and regulations clearly reflect the intention of the land use designations of the Community Development Element of the Countywide Plan, express the relationship between land use and population density, and outline appropriate uses and procedures.

d) During the development review process, encourage telecommuting in proposed commercial office projects and in residential areas.

Review and revise zoning designations and the zoning map for consistency with the Countywide Plan and simplification of designations.

a) Revise zoning designations where proposed land use is different from existing zoning in the unincorporated portions of the county. Zoning shall be consistent with Countywide Plan land use in unincorporated areas.

b) Revise the zoning ordinance text to explain commercial uses and the application of floor area ratios (FARs).

c) Revise zoning designations to simplify designations.

d) Review zoning designations where proposed land use is different from existing zoning in the unincorporated portions of the county.

e) Modify the Coastal Plan to be consistent with current issues and trends in the coastal area.

Use Transfer of Development Rights to protect environmental and agricultural resources and encourage moderate density mixed-use development in the City-Centered Corridor.

a) Transfer development rights (TDRs) from West Marin to the City-Centered Corridor around transit nodes, and increase densities around the nodes.

b) Have the County and the cities consider a program that would enable development rights on bay-front, ridge, and upland greenbelt lands to be transferred to existing communities designated as high intensity centers.

Provide for protection of environmental resource areas in the Bayfront Conservation Zone.

a) Minimize the development impact of earth disturbance, erosion, and water pollution in the Bayfront Conservation Zone.

b) Encourage use of shoreline areas with sound ecological and safety considerations.

c) Encourage public access easements to facilitate public use and enjoyment of the bay-front lands, along with protection of wildlife habitat.

d) Encourage recreational uses such as fishing, boating, hunting, picnicking, hiking, nature study, and wildlife preserves as an appropriate means of providing public education on the value of shoreline preservation.

e) Evaluate the survival of built elements, such as overhead utilities, that detract from the shoreline and marsh landscape.

Provide for protection from environmental hazards.

a) Discourage development in areas that have high natural-resource value or that pose a significant hazard to life or property.

b) Continue to implement the regulations of Marin County Code Title 23.09 (Floodplain Management), which establishes Coastal High Hazard Zones with special location and construction standards for all land uses subject to inundation by a tsunami.

c) Coordinate between the Marin County Community Development Agency and the County Fire Marshal in mapping fire hazard areas subject to wildland fire risk. Make these maps available to planners and the public for use in reviewing projects and applying building standards that reduce the risk of fire.

d) Include recommendations made by fire authorities as conditions of approval for discretionary planning permits when the Community Development Agency staff determines that these recommendations are necessary for safety reasons.

e) Specify requirements for referrals of discretionary planning permits to County fire officials in the County Code.

f) Allow development in areas identified as having extreme fire hazard only where adequate water for fire suppression is or can be made available and where dual emergency evacuation is possible.

g) Have the Community Development Agency and fire officials work together to evaluate the adequacy of standards for water-supply and road access to subdivisions.

h) Amend the Marin County Code to establish uniform standards for clearance from structures, landscaping, and fire resistant building materials (particularly pole construction) for all new construction in fire hazard areas. Removal of exotic flammable vegetation should be encouraged.

i) Periodically conduct review of the Marin County Code by the Community Development Agency, Department of Public Works, and fire officials to ensure conformance with the latest Uniform Codes.

j) Have the Community Development Agency work with fire officials to bring the Marin County Code into conformance with State Responsibility Area construction and fire safety standards.

➢ Sample indicators

a) Implementation of Countywide Plan programs.

➢ Sample targets

a) Development Code and zoning map revisions will be adopted concurrently or within one year of the Countywide Plan.

b) Fifty percent of the programs identified in the Countywide Plan will be implemented within five years after adoption and 90 percent within 10 years.

3. Planning for Unincorporated Communities

➢ Issues

A community plan is a miniature Countywide Plan for each unincorporated community.

a) Community plans need to be regularly updated to remain relevant and consistent with the Countywide Plan.

b) Community plans are most useful and easy to use if they follow a consistent format.

➢ Strategies

Periodically revise the community plans according to a schedule and with current information consistent with the Countywide Plan.

a) Prepare a schedule for revision of community plans.

b) Address community plans in defined general plan topics and issues important to a particular community.

c) Modify the community plans to correspond to the Countywide Plan elements.

d) Coordinate between Marin County and the National Park Service during review of development applications for property adjacent to or within park boundaries.

➢ Sample indicators

a) List of community plans with most recent date of adoption and schedule for revision, with the oldest plans scheduled to be revised first (Marin County Community Development Agency).

➢ Sample targets

a) All community plans will be reviewed and updated as needed at least every 10 years.

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Economy, Equity and Culture

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IV. The Economy, Equity, and Culture

The Economy, Equity and Culture Element focuses on how people live, work, and interact with each other in Marin County. While each section will be explored separately, the subjects relate to and impact each other in many ways. Marin's economy is relatively strong but its vitality is challenged by transportation and affordable housing constraints and there is limited commercial space for large businesses to grow. Additional economic opportunities and secure, well-paying jobs will be needed to support the local economy.

Social equity issues in Marin are evident in many facets of community life. The demand for child care consistently exceeds the licensed supply, and low income families experience the brunt of the child-care crunch. In terms of community involvement, the overall participation level in the County is substantial, but the diversity of the general population is not reflected in governmental commissions, councils, and advisory groups. While diversity is increasing in Marin, integration is limited, and diversity levels are still far below the state and the region. Educational institutions and programs are successful in Marin, especially when compared with the state overall. However, educational inequities based on income, geography, and race still exist. Also, in some cases low income communities and communities of color in Marin may be disproportionately exposed to toxins in the air, soil, water and food.

The lack of affordable housing, in addition to impacting the local economy, disproportionately burdens low income individuals, minority communities, and immigrant families. A lack of affordable housing also poses a barrier to recruiting and retaining workers in many social service and health care jobs, including, teachers, nurses, police and fire personnel and child-care workers.

In terms of public health and safety, Marin County residents are healthy overall and participate in many preventive health measures. There are, however, some health concerns that face Marin's population including high rates of cancer and other health problems. Marin has a strong public safety record, with crime rates remaining consistently lower than in the rest of California, but there is a need to address the high number of local abuse and physical violence cases.

Transportation and workforce issues are closely linked to social equity in Marin. Because the local transportation system is designed primarily for cars, those without a car are more likely to experience difficulty moving around the community to jobs, medical services or cultural opportunities. Also, there is a shortage of entry-level workers in the county and this could be addressed by additional workforce training and a focus on fair compensation.

Finally, Marin is a culturally rich community that places importance on exposing the community to and involving the community in artistic expression, both modern and historical. The arts industry is a strong contributor to the Marin economy.

A. ECONOMY

➢ Background and trends

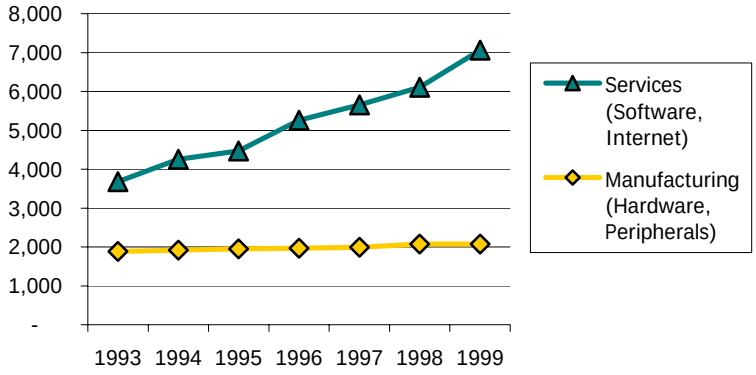
While Marin County generally maintains a prosperous economy, acute housing and transportation problems have not been resolved. In the last decade Marin County has enjoyed a relatively healthy and varied economy. Many businesses have taken root and grown successfully here, providing multiple benefits to community members. Some such businesses have grown so large, however, that they have had difficulty finding adequate space, and in some cases have moved out of the county. The lack of space available for future economic development, increasing labor costs, traffic congestion, and a shortage of affordable housing have all impacted business viability in Marin, as has the recent downturn in the economy. In addition, some sectors, such as agriculture, have not participated in the economic boom that has buoyed other sectors of the economy.

Among the key economic trends in the county, Marin's high cost of living poses a profound barrier to the future viability of our economy. The high cost of living diminishes the purchasing power of individual households while inflating the cost of home ownership, especially for low income households. The growing gap between the rich and poor in Marin has made it more difficult to attract low-cost labor. In addition, employers have difficulty hiring entry-level employees with adequate verbal, written communication and arithmetic skills. Many service jobs in Marin County are low paying, and many of these jobs are going to immigrants. For workers who are non-English speaking, language poses a barrier.

Job growth in Marin continues in many sectors. The number of jobs in Marin grew from just under 110,000 in 1990 to more than 120,000 in 2000. This number is projected to increase to 150,000 by 2020. Industries that experienced growth in employment between 1998 and 1999 include: information construction (19 percent); management of companies and enterprises (12 percent); administrative, support, waste management, and remediation (11 percent); finance and insurance (9 percent); education services (8 percent); transportation and warehousing (5 percent); wholesale trade (4 percent); motion picture production (4 percent); services (3 percent); miscellaneous services (3 percent); real estate, rental and leasing (2 percent); professional, scientific, and technical services (2 percent); retail trade (2 percent); and accommodation and food services (2 percent). In addition to growth in these sectors, home-based businesses have been steadily increasing in the county. Home-based businesses accounted for 27 percent of all businesses in Marin in 2001, an increase from 23 percent in 1999 (Marin Economic Commission).

Some sectors have experienced a decrease in employment. Industries in which employment decreased include manufacturing (–11 percent) and health care and social assistance (–4.4 percent). The arts, entertainment, and recreation industry saw no significant change in employment (Marin Economic Commission). In the late 1990s, software, multimedia, and Internet businesses were among the fastest growing employment sectors in Marin. Wages in this sector were relatively high. The number of service jobs in this sector grew from fewer than 4,000 in 1993 to 7,000 in 1999, while high-technology manufacturing jobs remained steady at about 2,000 (Figure IV-1) (Marin Profile 2001). Recently this trend has changed as high-technology employment has decreased across the Bay Area.

Figure IV-1
High Technology Employment

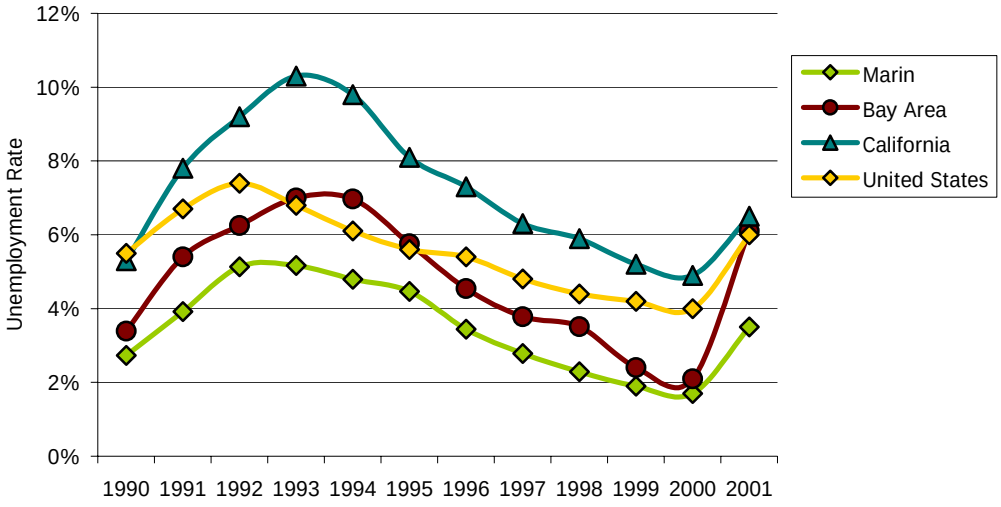


Source: 2001 Marin Economic Commission

The unemployment rate in Marin is generally low. The unemployment rate reached its highest point of 5.2 percent during the recession of 1992 and dropped to 1.7 percent in 2000 (Figure IV-2). Unemployment increased to 2.7 percent in September 2001. Since 1998 the number of cases enrolled in the CalWORKS program has decreased 35 percent, from 986 cases to 643 (as of December 2001), primarily due to the program's focus on putting parents into the workforce. The number of people

statewide receiving financial aid for unemployment has fallen to roughly 1.4 million from 2.3 million four years ago (Marin County Department of Health and Human Services).

Figure IV-2
Unemployment Rate, 1990–2001



Source: 2002 Employment Development Department

➢ Issues

(See also II. Natural Systems, D. Food and Agriculture.)

Marin's economic vitality needs to be enhanced.

a) Existing businesses need additional support to address the shortage of community and residential space, traffic congestion, and other key issues.

b) Compatible businesses need to be recruited to the county, and new local enterprises need to be supported.

c) There is a need for increased economic development in some geographic areas, such as in the Canal community and Marin City.

There is a need for a more equal relationship between jobs and housing.

a) More workforce housing is needed near job centers, and employment centers are needed near existing housing. It is becoming more difficult to bring in labor from Sonoma County because Sonoma's wages are rising and housing costs in Sonoma County are lower than in Marin.

b) In addition to the ongoing need for affordable housing for workers and families, a growth in the service industry has added to the need for very-low income and entry-level housing.

c) Marin has a high percentage of residents whose income is derived from sources other than jobs such as investments. There is a need to look at how this impacts Marin's economy.

The cost of moving goods and people is high due to traffic congestion.

a) Employers must pay high salaries to compensate for the high cost of housing and traffic congestion. It is difficult for employers to retain employees because of high levels of traffic congestion combined with limited affordable housing and the low unemployment rate.

b) Time spent in traffic results in a loss of productivity and increased fuel costs. There is a need for development patterns that support public transit and improve transportation options.

c) Traffic congestion results in indirect costs, such as air pollution, impacting community health and the environment.

d) While the trend in the increase in home-based businesses is generally beneficial economically and in terms of reducing commuting, one potential downside is that some traffic may be more redistributed and focused in specific neighborhoods and in local city centers.

Some businesses are relocating from Marin to other counties.

a) The impact of business relocation on number of jobs, level of wages, and other factors is not clear.

b) There is a need to identify which businesses are relocating from Marin to other counties and why.

The county needs to maintain and manage its tourism industry.

a) Tourism plays a significant role in Marin's economy. The number of bed-and-breakfast facilities and commercial uses serving tourism is increasing. In addition, there is an increasing demand for parking, camping, hotel, and motel accommodations.

b) The events of September 11, 2001, the California energy crisis, and the economic downturn have had an effect on the number of tourists visiting Marin.

c) Sustainable tourism in Marin needs to be supported by encouraging visitors to patronize locally owned businesses.

Marin's agricultural economy needs support to remain economically viable.

a) The necessary input of resources and output of sales for agriculture to be self-sufficient needs to be defined.

b) The wages of agricultural workers are not adequate to cover the county's high cost of living.

Interest in green businesses is increasing and needs support.

a) The County's Green Business Program needs to further refine standards and indicators to better identify green businesses. There needs to be ongoing cooperation between government and businesses for this to occur.

b) An expedited approval process is needed for projects that meet a published list of criteria and standards for green businesses.

c) The County does not currently have a set of milestones or a timeline for making County procurement more sustainable—for example, buying more recycled products, minimizing packaging and virgin materials, and using renewable resources whenever possible for fuel, energy, and paper.

Marin's high cost of living threatens the county's economic vitality.

a) The wages of many Marin workers are not adequate to cover the county's high cost of living. A high cost of living reduces households' purchasing power.

b) People are increasingly spending beyond their means and having to deal with debt.

c) Most young people living in the county are working in low-paying jobs and need support for housing and education.

More job training is needed.

a) Cooperative government, school, and business partnerships are needed to initiate local workforce job training, business education, and entrepreneurial skill building.

b) Some workers who are hired do not meet minimum language, training, or skill requirements needed for a given job.

c) Job training in schools and for adults is needed so that local companies can hire from within the community.

➢ Strategies

Vibrant, viable, and sustainable economy

Identify and support the types of businesses that comprise a vibrant, viable, and sustainable economy.

a) Retain and reinvent community resources. Identify criteria for businesses that should be targeted for development in and attraction to Marin County. Undertake a business expansion, retention, and attraction study.

b) Evaluate the prospects for a business mentoring and incubation program to be undertaken in cooperation with the private sector.

c) Foster a diverse but balanced mix of economic uses and expand the fiber optic network to attract high-tech businesses.

d) Decrease the import of products from outside the county. Foster development of a closed-loop system for Marin's economy, capturing and recycling both resources and dollars.

e) Provide increased employment opportunities that match the skills of the Marin County workforce by identifying the occupations of workers who commute to jobs outside Marin County and evaluating the possibility of attracting industries with such occupations to locate in Marin County.

Ensure that sites suitable for economic development are available, and make information about those sites available to businesses that may be considering a Marin County location.

a) Prepare an inventory of existing commercial space, vacant sites that are zoned for nonresidential use, and underdeveloped sites that could be redeveloped with more intensive nonresidential use. If possible, create an integrated searchable database for this information in conjunction with the cities of Marin County.

b) In conjunction with the cities of Marin County, study the potential to increase permitted intensities of nonresidential use, in order to create greater redevelopment potential on underdeveloped and underutilized sites near transit stops.

c) Study the economic development potential of identified economic development sites, and formulate and adopt strategies to attract businesses to those sites.

d) Encourage the provision of jobs near transit stops and along transit corridors by identifying and eliminating barriers to development on sites that would be suitable for employment-related and mixed-use development, with a view toward increasing the overall density/intensity of development. Suitable sites would be, at a minimum, currently designated for housing and outside of sensitive habitats. Allow employment-related and mixed-use development by right (but not requirement) on identified sites.

e) At the same time, identify and evaluate sites near transit stops or along transit corridors that are currently designated for housing but that are not suitable for employment-related or mixed-use development, and protect those sites from additional uses.

Support the agricultural economy.

a) Provide assistance to facilitate the processing of applications for uses related to production agriculture and to help county farmers comply with environmental regulations.

b) Develop criteria and standards to permit related accessory uses and agriculture-related tourism on agricultural lands. Support agricultural conservation easements.

c) Develop and adopt buying programs to support local agricultural production (for example, require government agencies to adopt a “Marin First” purchasing protocol for agricultural products).

d) Explore opportunities to diversify/intensify agricultural use of agricultural lands and to enhance the viability of the agricultural business sector.

e) Increase the supply of housing for agricultural workers and address child-care and education needs related to agricultural operations.

f) Institute a media campaign and public education on the benefits of local agriculture.

Recognize and support tourism as a significant contributor to the Marin County economy, while reducing adverse effects that visitor activity may have on the environment.

a) Study the County’s approval process for visitor accommodations, and modify the process if necessary to reduce uncertainty. Modifications could include, for example, clarifications to the zoning ordinance and preapplication review to identify issues that might arise during the approval process.

b) Provide cost-effective public transit for visitors, and maximize its use by visitors.

c) Maintain contact with various tourist attractions to address needs of that industry sector.

Continue and expand support for the development of green businesses.

a) Disseminate adopted standards and indicators that identify what a green business is.

b) Define levels of performance for future green business certifications. Facilitate the development application, review, and approval process for green businesses.

c) Establish a program for making County procurement more sustainable. Set goals, milestones, and a timeline for reaching that target, which include more recycled products and fewer virgin materials, locally grown food, reduced packaging, and use of renewable resources for fuel, energy, and paper whenever possible.

d) Formulate and adopt a strategy for conforming Marin County operations to green business principles and practices.

e) Encourage the cities of Marin County and other public agencies to establish programs for more sustainable procurement. Encourage the cities of Marin County and other public agencies to conform their operations to green business principles and practices.

Ensure the availability of adequate and appropriate infrastructure to serve the businesses of Marin County's future.

a) Monitor the condition and adequacy of infrastructure systems, and identify potential constraints, to ensure that sufficient capacity is available to meet the needs of existing and planned business operations.

b) Identify strategies to ensure that Marin County maximizes the effective capacity of its infrastructure systems and resources.

c) Identify and adopt strategies to encourage and facilitate the development of an advanced electronic communications infrastructure to provide digital connectivity.

Promote corporate responsibility.

a) Evaluate publicly supported economic development programs, investments, and subsidies for their long-term benefits and impacts on the whole community, not on short-term job or revenue increases.

b) Ensure that public investments should support environmental and social goals. Prioritize infrastructure and supportive services that promote the vitality of all local enterprises instead of individual firms.

c) Encourage businesses to contribute to the communities and regions where they operate, protecting the natural environment and providing workers with opportunities for upward mobility.

Improve job readiness of unemployed and underemployed residents of Marin County.

a) Continue to disseminate an inventory of workforce skills programs, updating that inventory as necessary. Publish this inventory in English, Spanish, and other languages spoken by a critical mass of Marin County residents.

b) Investigate additional means for the County to facilitate connections and communications between the private sector and the educational/workforce training sector to improve workforce preparedness and lifelong learning.

c) Encourage cooperation between the public and private sectors to provide job training and job placement services to unemployed and underemployed Marin County residents.

d) Increase workforce preparedness of unemployed and underemployed Marin County workers by implementing the policies and programs of the Land Use Element and Housing Element of the Countywide Plan to ensure the availability of housing for Marin County workers.

Address the high cost of living in Marin and reduce poverty.

a) Conduct an analysis of the impacts of adding high-end versus low-end jobs. Discourage new businesses that primarily create low-paying jobs.

b) Ensure that any business working with the County of Marin has a closed-loop system, such as hiring local people, paying living wages, having adequate health benefits, and providing child care and education opportunities to employees.

c) Promote jobs that match the skills of existing residents and Improve the skills of low income individuals, addressing the needs of immigrants and of families moving off welfare.

Workforce housing

(See also III. The Built Environment, C. Housing.)

Increase the supply of housing affordable to workforce households in Marin County.

a) Encourage the provision of housing near transit stops and along transit corridors by identifying and eliminating barriers to development on sites that would be suitable for residential and mixed-use development, with a view toward increasing the overall density/intensity of development on these sites. Suitable sites would be, at a minimum, currently designated for employment-related uses and outside of sensitive habitats.

b) Encourage the construction of new residential units at higher densities than may currently exist on sites near jobs or transit.

c) Remove economic and financial obstacles that inhibit smaller families that occupy large housing units from moving into smaller units.

d) Publicize the availability of residential property tax relief consistent with Proposition 60.

e) Recruit high-paying employment into Marin.

Ensure the availability of sites for employment and housing close to each other, consistent with the health and safety of Marin County residents.

a) Encourage businesses to locate on sites that are served by transit.

b) Encourage the provision of housing for the workers to be employed in all new commercial development.

c) Commit County resources to increasing the number of housing units affordable to workforce households.

d) Implement policies and programs of the Housing Element of the Countywide Plan that provide for development of workforce housing, affordable housing, and higher density housing in an effort to increase the supply of units affordable to workforce households with members who are employed in Marin County.

Transportation

(See also III. The Built Environment, A. Transportation.)

Support efforts to improve the county's transportation system.

a) Maintain a highly accessible public transportation system.

b) Improve transit service for home-work trips within the county by improving service between residential areas and business concentrations.

c) Provide intra-city shuttle service for home-school, home-shopping, and other nonwork-related trips.

Encourage patterns of land development that support public transit as a way to reduce traffic congestion during commute hours.

a) Encourage businesses to locate on sites that are served by transit by increasing the maximum floor-area ratio permitted on those sites.

b) Establish a minimum density for residential development near transit nodes.

c) Reduce parking requirements for new and existing buildings that participate in subsidy programs for transit riders and new buildings located near transit hubs.

Encourage use of public transit and other alternatives to single-occupant vehicles by Marin county workers as a way to reduce traffic congestion during commute hours.

a) Identify incentives that would encourage employers to participate in subsidy programs for transit ridership and other alternative travel modes for their employees. Continue subsidy programs, such as Golden Gate Transit Ride Value bus tickets, to encourage transit ridership by County employees.

b) Implement bikeway improvements and continue free bike tune-ups for County employees who commute by bicycle.

c) Continue programs for County government employees such as at-cost fuel purchase and preferential parking incentives for registered carpools, ride-matching service for carpools, and guaranteed ride home to encourage carpooling.

d) Identify incentives that would encourage private sector and other (non-County) public sector employers to participate in subsidy programs for carpools, similar to or exceeding those currently used for County government workers (Program 3.3.5), for their employees.

e) Identify conditions under which new employment-related developments should be required to adopt Transportation Demand Management (TDM) programs, and require adoption of such programs when the identified conditions are met.

f) Encourage telecommuting, home-based work, and home-based businesses as a way to reduce the need for work-based trips during commute hours.

g) Implement the policies and programs of the Transportation Element of the Countywide Plan to ensure the adequacy and appropriateness of the transportation system to support the economy of Marin County.

h) Promote programs that provide transportation passes or incentives to businesses to address traffic congestion and Provide worker education on transit use.

Institutional framework

a) Exert strong leadership to achieve cooperation among County departments and, as feasible, between the County and other agencies, to provide a reliable process for approval (or disapproval) of businesses that meet the criteria established for targeted business expansion, retention, and attraction.

b) Create a one-stop preapplication review system for early review of potential projects by County departments. Create a fast-track review and approval system for minor projects (such as interior tenant improvements). Assign “approval process navigators” to shepherd applications for development of targeted industries and workforce housing.

c) Establish a regular project review meeting schedule that includes attendance by all agencies involved in the development-permit review and approval process.

d) Work with other agencies involved in the development-permit review and approval process to identify and agree on additional strategies to facilitate economic development that is consistent with the General Plan.

e) Conduct a multi-jurisdictional analysis and study of job demand and fiscal needs, address the fiscal viability of governments and local agencies.

f) Focus CEQA review on true environmental impacts and avoid NIMBY ("Not in my backyard") statements.

Ensure that information about the Marin County economy is available to all County decisionmakers.

a) Maintain a full-time economic policy analyst on County staff to support the work of the Marin Economic Commission.

b) Use the powers and staff of the County Redevelopment Agency to pursue redevelopment of underutilized sites.

c) Establish a plan, strategy, and timeline for implementation of the programs in this element.

➢ Sample indicators

a) Rate of employment by industry (Bureau of the Census).

b) Unemployment rate (California Employment Development Department).

c) Nonresidential vacancy rate (Orion Partners).

d) Nonresidential construction and renovation (Marin County Community Development Agency).

e) Taxable sales (Board of Equalization).

f) Annual Gross Regional Product (Bay Area Council).

g) Annual Genuine Progress Indicator (Redefining Progress).

h) Value of agriculture production (Marin County Department of Agriculture).

i) Number of businesses certified by the Green Business Program (Marin County Community Development Agency).

j) Number of new living-wage jobs (California Employment Development Department).

k) Number of workers with jobs earning less than living wage (percentage of the workforce) and without benefits (U.S. Census Bureau).

l) Number of new small businesses, including data by ethnicity and gender (U.S. Small Business Administration).

➢ Sample targets

a) Implement a jobs-housing linkage program by 2004.

b) Implement telecommuting and live-work programs, such that at least 30 percent of all workers will not need to commute by 2010.

c) Increase the Gross Regional Product 10 percent by 2020.

d) Increase the Genuine Progress Indicator 10 percent by 2020.

e) Maintain or increase gross agricultural sales annually.

f) Increase the percentage of Marin Green Business membership by at least 20 percent per year between 2002 and 2010.

g) Increase the number of living-wage jobs by 20 percent in 2020.

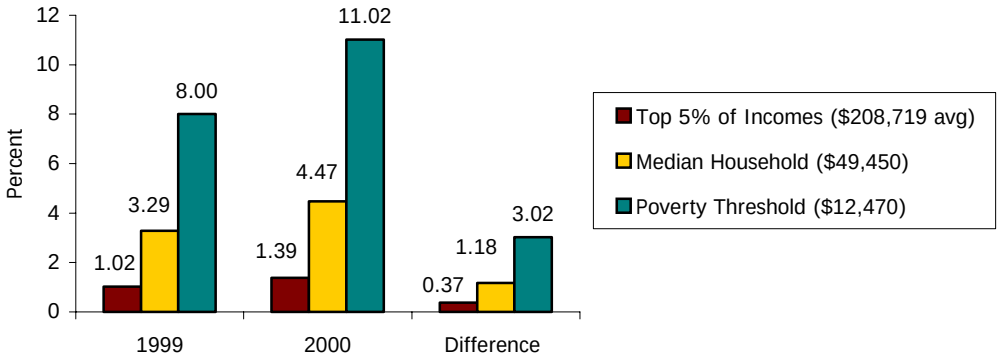
B. ENERGY

➢ Background and trends

The energy supply in Marin County has been impacted by the fallout from deregulation, the subsequent "energy crisis," and the current uncertainty of future fuel supplies. The increase in energy costs has put a strain on all businesses, but particularly small businesses because of the proportional cost increase. In addition, higher energy costs have disproportionately impacted low income families.

The cost of energy particularly impacts low income households. The percentage of income that low income households spend on energy is significantly higher than that of median and high income households, and is increasing (Figure IV-3). Low income households are less able to invest in energy-saving appliances and renovations due to the up-front costs.

Figure IV-3
Percentage of Household Income Spent on Energy



Source: 2000 Alliance to Save Energy

➢ Issues

(See also III. The Built Environment, B. Energy.)

The uncertainty of energy costs impacts businesses and households, particularly small businesses and low income households.

a) Increased energy costs affect the economy by impacting business costs and consumer spending power. Low income individuals and families are disproportionately impacted by uncertain energy costs.

b) Renters find themselves in a tough position between wanting to make energy-saving improvements and not wanting to invest in a home or apartment they do not own. Landlords are resistant to energy-saving retrofits because the renters pay the energy bills.

There is a need for increased renewable energy production in Marin.

a) Increasing the localized production and distribution of energy would help stabilize the energy market.

b) Increased renewable energy generation would reduce air pollution, including carbon emissions but more economic incentives are needed to encourage renewable energy installations.

➢ Strategies

a) Create an energy office, joint powers authority, or regional energy agency that will address the energy needs of 11 cities and the county.

b) Provide energy efficiency analyses, interventions, projects, and consulting to government, nonprofit organizations and businesses.

c) Invest in renewable energy generation facilities, such as solar, wind, wave power, and hydroelectric (on existing dams).

d) Research ways to use renewable energy in affordable housing. Promote programs, such as PG&E's CARE and Energy Partners programs, that provide free weatherization services and reduced energy rates to qualified low income individuals and families.

e) Offer free energy efficiency consulting assistance to low income families, nonprofits, and other social service agencies through County Planning.

f) Include funding and preferences for renewable/energy efficiency features in publicly assisted building projects and economic development efforts.

➢ Sample indicators

a) The percentage of income Marin residents use to purchase energy (County of Marin).

b) The percentage of income that low income residents spend on energy (California Energy Commission and the U.S. Department of Commerce).

c) Energy consumption per capita, per fuel type, and by sector (California Energy Commission).

d) The number of households assisted through County energy programs (County of Marin).

e) The annual energy cost per capita (U.S. Department of Commerce).

f) The percentage of the County budget dedicated to purchasing energy (County of Marin).

➢ Sample targets

a) Increase by 10 percent the amount of energy assistance going to low income residents from 2000 to 2010.

b) Twenty percent of all persons receiving building permits utilize a County energy or Green Building Program by 2010.

c) Thirty percent of Marin's energy is produced using renewable sources by 2020.

C. SOCIAL EQUITY AND PUBLIC HEALTH

Equity is defined as freedom from bias or favoritism. Marin's ability to maintain social equity and public health is key to maintaining a strong foundation for a healthy, vibrant, and sustainable community. While Marin has experienced some success in many areas, including community participation, education, and public safety, other areas such as child care, housing, and public health are in need of considerable attention. High test scores in schools and low crime rates in our neighborhoods are counterbalanced by alarming cancer rates, lack of diversity and a growing gap between rich and poor.

This section will explore many of the social equity and public health trends in Marin and suggest strategies for addressing the issues faced today. Included below are the following sections: child care, community participation, cultural and ethnic diversity, education, environmental justice, housing, public health, public safety, transportation, and workforce training and compensation. More specific information on housing and transportation can be found in Chapter III of this report.

1. Child Care

➢ Background and trends

In Marin County the demand for child care consistently exceeds the licensed supply. Low income families experience the brunt of the child-care crunch, an issue exacerbated by the weakened economy, which has precipitated cuts in subsidized child care for those who need it most. In addition, there are not adequate affordable sites on which to locate or develop child-care facilities. Furthermore, the combination of low wages paid to child-care workers and the high cost of living in Marin County make finding and retaining qualified staff a challenge.

Child-care demand greatly outweighs supply. While the licensed child-care supply has increased significantly over the last decade, estimated demand for care continues to exceed available licensed supply for both infant and school-age care (Figure IV-4). Between 1990 and 1999, licensed child-care supply increased by approximately 39 percent from about 8,202 to 9,144 spaces. This increase varied by age group, with the estimated infant-care supply increasing by 57 percent, preschool care by 2 percent, and school-age care by 17 percent (Marin County Child Care Commission).

Figure IV-4
Marin's Child-Care Demand vs. Licensed Supply—October 1999

Age of Child	Total Demand (estimated by number of children in working families)	Total Supply*	Difference	Number of Children per Licensed Slot
Under 3 years	4,759	1,102	3,657	4.3
3 to 5 years	4,759	5,288	–529	Less than 1
6 to 13 years	15,714	2,754	12,960	5.7
TOTAL	25,232	9,144	16,088	2.7

Source: 2002 Marin County Child Care Commission

An estimated 25,232 children under 14 live in working families (that is, families with two working parents or a single working parent) and are likely to need care for their children. Of these, there are an estimated 4,759 children under 3 competing for 1,102 licensed infant spaces. Estimated demand of school-age children also exceeds supply with 15,714 competing for 2,754 licensed spaces (Marin County Childcare Commission).

More financial subsidies are needed for child care. While financial subsidies for child care have increased slightly over the last few years through the Head Start and CalWORKS programs, these

subsidies do not completely cover the income-eligible population. More than 300 children are enrolled in the Head Start program, while 250 additional children are waiting to enroll.

➢ Issues

An increased supply of affordable child-care options is needed.

a) Parent fees do not cover the full costs of child care. This is particularly true for infant care, which has a high staff-to-child ratio. When subsidies are provided, they do not cover the full cost of care. Providers are reimbursed approximately 55 percent of the actual cost of infant care. Fees paid by middle- and upper-income families cover only an estimated 70 to 80 percent of costs. Subsidized infant care covers 8 percent of income-eligible infants. Subsidized preschool care covers 59 percent of income-eligible preschoolers.

b) There is a lack of child-care funding for low income families. With a weaker economy, cuts in federal and state funding for the CalWORKS program and other programs for child-care assistance may occur.

c) The need for child care is expected to grow as the local labor-force base expands to include more women, and implementation of welfare reform continues. Projected job growth in the lower paying service and retail trade sectors will increase the need for subsidized and affordable child care.

d) Many employers do not provide or support child care for employees with children.

Additional child-care facilities are needed.

a) High land values, high rents, and a low vacancy rate make leasing and acquiring space for child-care facilities difficult.

b) As class size is lowered in schools, school facilities currently being used for day care are being taken back for classroom use by the schools. This situation is creating a shortage of space for child-care facilities, particularly for centers serving lower income families.

c) There is a severe shortage of funding to support child-care capital projects and to pay for ongoing facility costs. Land use and zoning policies make siting and development of child-care services difficult.

d) Child-care providers have limited real estate skills to navigate the complex and technical facility-development process.

Additional child-care workers are needed to staff child-care facilities.

a) The low wages traditionally paid to child-care workers, coupled with the high cost of housing, make it difficult to hire and retain qualified child-care workers.

b) High turnover rates in child-care facilities have an impact on the quantity and quality of child care.

➢ Strategies

Encourage new sites for child-care facilities through land use policies and zoning.

a) Undertake an assessment of current zoning regulations and definitions pertaining to child care, and propose changes if necessary, particularly to increase the number of zoning designations where child care is a permitted use.

b) Encourage large (up to 14 children) child-care facilities in all residential zones as a permitted use subject to development standards (rather than a conditional use) consistent with state law and local provisions. Grant churches and schools the right to have child care on site as a permitted use

c) Increase floor area ratio (FAR) requirements, and ease parking requirements for employers or developers who include child-care facilities in the design of new housing and commercial establishments.

d) Expedite the permit process for child-care facilities, designate staff to facilitate the permit-application process for proposed child-care centers and adopt a lease-first policy for child-care and after-school programs.

e) Provide real estate assistance (including loan assistance) to child-care providers seeking to site facilities in the county.

f) Conduct a nexus study to determine the quantifiable need for child-care slots created by new commercial or residential units. Use results of the nexus study as the basis for an inclusionary ordinance or lieu fee for all new residential and commercial buildings.

g) Support marketing and media campaigns to promote child-care uses in businesses, commercial shopping center developments, schools, churches, and hospitals.

Expand the supply of affordable child-care options.

a) Provide financial support for child care.

b) Coordinate efforts with the school districts to enhance existing extended-day child-care programs.

c) Provide incentives to employers, such as fast-track permitting, tax credits, tax breaks, and fee reductions, to include on site child care. Provide child care at the Marin County Civic Center for County employees.

d) Promote the Marin Childcare Council's Web site, which allows users to search for child-care information and resource referral.

e) Promote the Special Needs Project and the Early Childhood Mental Health Project to enhance care for children with special needs.

Improve the quality of child care.

a) Support and promote existing training opportunities for licensed and license-exempt child-care providers. Support new and existing caregivers by providing training for providers and parents.

b) Support fair wages for child-care workers by exploring ways to subsidize their wages. Consider the use of Proposition 10 funds or other funds available through the Marin CARES program.

c) Support appropriate legislation and conduct advocacy to legislators to increase the availability and quality of child care.

Increase accessibility of child-care programs.

a) Encourage housing that incorporates on site or shared child-care facilities.

b) Work to ensure that child-care facilities are adequately served by public transportation.

Promote a healthy child-care environment.

a) Prohibit the siting of new alcohol and cigarette sales establishments within one mile of schools and child-care centers.

b) Create incentives for the siting of healthy fresh food (organic where possible) businesses near schools and child-care centers.

➢ Sample indicator

a) Child-care supply and demand by child age group and income categories (Marin County Child Care Commission).

➢ Sample target

a) Child-care supply grows until it is within 10 percent of child-care demand for all age and income categories by 2020.

2. Community Participation

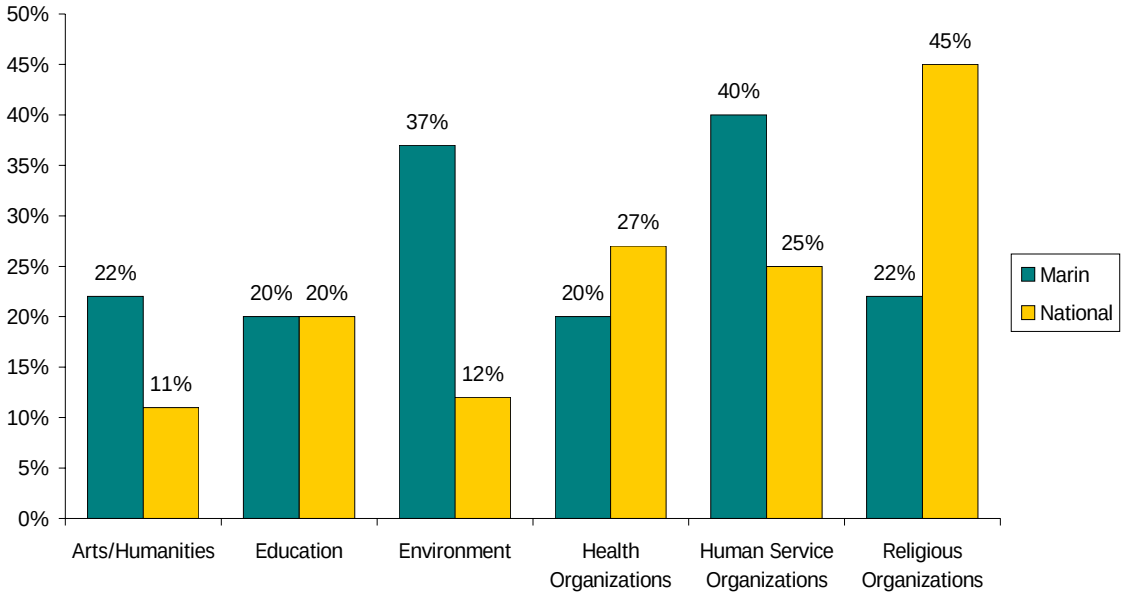
➢ Background and trends

Community participation reflects the interaction between Marin residents and government. A majority of Marin's residents identify themselves as voters, and more than one-third either belong to a neighborhood or community organization or have attended a public meeting during the past year. While the overall participation level in Marin is substantial, the diversity of the general population is not reflected in governmental commissions, councils, and advisory groups. In addition, a disproportionate part of the population does not participate in civic activities such as voting or is not active in the community. In particular, there is not enough ethnically diverse participation in community decisionmaking.

The individual's age and length of residence in Marin appear to affect participation in civic endeavors. Marin County residents generally share a commitment to traditional civic engagement and have backgrounds that include personal community involvement. While 72 percent of all Marin residents say they voted in a local or statewide election during the past year (well above the national and state averages), older (91 percent) and longer-term residents (82 percent) are much more likely to vote than those age 18 to 35 (52 percent) and newer residents (58 percent). Even those age 36 to 53 vote at a significantly lower rate (73 percent) than those who are older (Marin Community Foundation).

Marin residents generally have high rates of giving money and time to help others. Residents have a widespread commitment to giving and volunteering, and historically have done so at rates at or above the national average. A recent survey found that 63 percent of Marin residents did volunteer work when they were young, compared with 52 percent nationally. Fifty-eight percent of residents were active in religious organizations, compared with 46 percent nationally, and 60 percent had parents who were active in the community. Younger and newer residents are less likely to vote than older and longer-term residents (Marin Community Foundation). The majority of Marin residents make some kind of charitable contribution, and do so at rates well above the national average (Figure IV-5). Recently, however, the percentage of county residents indicating that they spend time volunteering dropped slightly below the national average of 56 percent to 52 percent.

Figure IV-5
What Marin Residents Support Compared with National Giving Trends



Source: 2001 Marin Community Foundation

➢ Issues

Community participation is not spread throughout the population.

a) Ethnically diverse participation in governmental advising groups is not proportionate to the ethnic makeup of the general population.

b) An ethnically proportionate part of the population does not participate in civic activities such as voting or is not active in the community. This population often lacks the information and resources needed to fully participate in community decision-making in a meaningful way.

➢ Strategies

Encourage and incorporate opinions of diverse segments of the community in decisionmaking.

a) Hold community meetings at times and in locations that encourage meaningful involvement by the members of the affected communities. Build the capacity of disenfranchised community members to participate through education.

b) Provide concise, understandable notices prior to public meetings. Publicize public meetings in non-English-language newspapers and radio, as well as on the Internet.

c) Identify key community groups in the areas affected by a given meeting to assist with outreach about the meetings. Ask representatives of these groups to attend the meetings.

d) Provide language translation at all public meetings as needed, and provide meeting materials in multiple language formats.

Diversify decisionmaking bodies in Marin.

a) Provide leadership and training programs to encourage community participation. Inform residents on how they can participate.

b) Establish training programs that promote diversity in leadership (using San Rafael's and Novato's Chamber of Commerce leadership training as an example) and provide support to small businesses to allow employees to attend.

c) Support programs that develop leadership in diverse communities.

d) Develop sequenced curriculum for high school juniors and seniors about the County planning process (similar to mock court), teaching planning and conceptualizing.

e) Limit tenure of commissioners to ensure turnover.

➢ Sample indicators

a) Racial, gender, and age diversity on County commissions, boards, and committees (County of Marin).

b) Marin voter turnout (County of Marin Registrar of Voters).

c) County employee and county resident volunteer hours per capita (County of Marin).

➢ Sample targets

a) Racial, gender, and age diversity on County commissions, boards, and committees equals county demographics by 2020.

b) Voter turnout is increased by 10 percent in local and 15 percent in national elections by 2020.

c) Maintain or increase volunteer hours per capita annually.

3. Cultural and Ethnic Diversity

➢ Background and trends

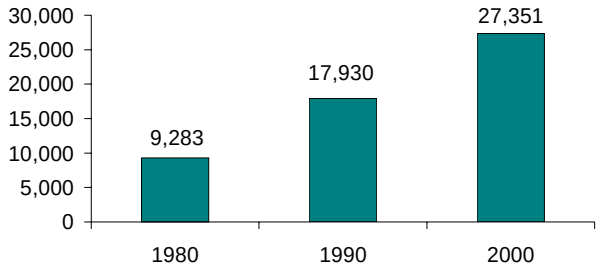
Cultural and ethnic diversity is an area of profound importance in Marin County. The county's population is not very ethnically diverse compared with the state and the region. Currently, Marin is increasing in diversity and its immigrant community is growing, but integration is limited. Communities such as Marin City and the Canal neighborhood in San Rafael are home to a large proportion of the Latino, African American, and Asian populations, while many of Marin's other communities are predominately Caucasian. Some residents believe that racial, ethnic, and cultural diversity is not supported. Also, while Marin's high cost of living results in less income diversity, the lower income residents who do live in Marin are concentrated in certain communities and almost nonexistent in others.

The ethnic diversity of Marin's population is low but is increasing. In 1990, 89 percent of the population was white, and 11 percent was African American, Asian, Pacific Islander, or of other races. People of Latino origin (who may be of any racial group) composed 8 percent of the population. In 2000, the nonwhite population increased to 16 percent and the Latino population to 11 percent (Figure IV-6), while the white population was 84 percent (United States Census Bureau).

There are instances of housing discrimination based on race. Eighteen percent of housing complaints logged in 1999–2000 were based on race or ethnicity. A "Race Audit" conducted in 2000 concluded that a

black person could encounter discrimination or difficulties when finding housing 47 percent of the time (Fair Housing of Marin).

Figure IV-6
Persons of Latino Origin, 1980–2000



Source: 1993- 1999 United States Census Bureau

➢ Issues

Many of Marin's communities lack ethnic diversity.

a) There is an increased concentration of minority communities in some neighborhoods. The cultural and economic vitality of these neighborhoods needs to be supported.

b) People of color have difficulty finding housing due to discrimination.

c) Bilingual and bicultural services are needed where public services are provided.

Immigrant communities face a variety of challenges.

a) New immigrants must face the challenges of meeting basic needs like jobs and housing. Longer-term immigrants may experience cultural gaps. Often, immigrants do not have the support needed to face such challenges.

b) The documentation status of immigrants affects their ability to get education.

c) English as a second language (ESL) classes are overcrowded.

d) Many immigrants do not know how to get health benefits and may not be legally eligible to receive them.

e) The school dropout rate among immigrants is high because immigrants cannot afford to stay in school and need to help earn income for their families.

➢ Strategies

Create diversity in housing.

a) Promote equal opportunity in the housing market for all persons regardless of race, color, religion, ancestry, or other arbitrary factors.

b) Enforce the anti-discrimination ordinance prohibiting discrimination in rental housing and fund the Fair Housing Program to resolve cases of alleged housing discrimination.

c) Design and implement strategies to ensure that agencies contracting with the County have nondiscrimination policies and practices.

d) Increase lending to support diversity in community economies.

e) Create innovative financial mechanisms to promote diverse ownership in Marin's housing stock, especially in areas where infill housing will be encouraged.

Increase the bilingual and bicultural capacity of County services and information.

a) Provide training and classes in understanding and valuing cultural diversity.

b) Provide language training classes to County employees.

c) Provide support and access to information for the immigrant communities as well as linkages to nonimmigrant communities.

d) Increase the salaries of bilingual employees by 5 percent above standard pay scale.

e) Enhance translation services on the County's Web site.

Promote leadership in minority communities.

a) Support documentation of immigrants through programs by the Novato Human Needs Center, the Canal Community Alliance, and Legal Aid of Marin.

b) Recruit leaders from minority communities for County staff positions.

c) Create a mentor program for the County where senior-level staff work with minority or low income youth to educate them about the workplace.

d) Provide support and incentives to small businesses that provide leadership opportunities for minority or low income residents.

e) Allow reduced-fee or free-of-charge use of County facilities for ESL classes.

➢ Sample indicators

a) Marin's ethnic distribution by jurisdiction and compared with the Bay region (U.S. Census Bureau).

b) Ethnic distribution of County staff (County of Marin).

➢ Sample targets

a) Marin's ethnic distribution grows closer to the Bay Area's ethnic distribution.

b) Marin County staff composition reflects the community in ethnicity within a 10 percent margin by 2020.

4. Education

➢ Background and trends

Education is generally strong in Marin, especially when compared with the state overall. The dropout rate is much lower, more dollars are spent per pupil, and standardized test scores are higher than in California at large. Despite these successes, educational inequities based on income, geography, and race exist,

and need to be addressed. Also, a considerable influx of children is placing a burden on the educational system.

In general, the public education system is under pressure to serve more children with limited resources and to increase the services provided. In Marin not all children have access to early education programs, there is a higher dropout rate for immigrants, and more resources are needed for adult education in order to provide lifelong learning opportunities.

Education in Marin ranks higher than in most of California. The high school dropout rate in Marin County is one-fourth the rate of California's and decreased by half between 2000 and 2001. Marin County's average expenditure per pupil exceeds the California average, and the average class size remains below that of California, as does its pupil-to-teacher ratio. Marin County has scored better on Standardized Testing and Reporting (STAR) tests than California for the last four years (Applied Survey Research).

Inequities exist in the educational system based on geography and race. The percentage of Marin students receiving free or reduced-cost meals remains far below the California percentage but has risen recently and is concentrated geographically. In the San Rafael City Elementary and Sausalito Elementary schools, at least half the students received free or reduced-cost meals, 50.0 percent and 56.1 percent, respectively during the 2000–2001 school year (Applied Survey Research).

➢ Issues

The public education system is under pressure to serve more children with limited resources and to increase the types of services provided.

a) Additional support services are needed for adolescents.

b) Parental involvement in schools needs to be encouraged.

There are educational inequities based on income, geography, and race.

a) Not all children have access to early education programs and to a quality education.

b) The graduation rates of immigrants need to be improved.

c) Public after-school programs are needed, particularly for lower income families.

d) Ethnic diversity of teachers should reflect that of students.

Lifelong learning opportunities need to be enhanced.

a) More ESL classes are needed across the county.

b) Classes on financial management would benefit youth and adults.

c) Opportunities for people of all ages to learn about sustainability are needed.

d) Library services could be enhanced.

➢ Strategies

Enhance K–12 education.

a) Continue to require property subdividers to dedicate land or pay fees for school purposes.

b) Support programs to reduce the high school dropout rate of immigrant students.

c) Identify ways to expand and support school curriculum about the principles of sustainability for children and adults at the local and state levels.

Enhance preschool and after-school educational programs.

a) Expand existing preschool and after-school education programs.

b) Work with the school districts to provide appropriate after-school child and youth activities and free after-school tutoring opportunities, especially for children from low income families. Support after-school programs at local community facilities owned or controlled by the County.

c) Encourage cooperation between the County and the school districts to provide high-quality summertime programs at the schools that incorporate traditional summer-school and day-care programs every day after school. Support expansion of summer camp opportunities to children from low income families.

d) Identify ways to provide or support education about finance management, sustainability, and food health for after-school programs.

Promote adult education.

a) Continue programs that provide education about financial management, especially for low income families.

b) Encourage schools to remain open for afternoon and evening use to serve community needs.

c) Increase the number of ESL classes.

d) Promote lifelong learning by offering affordable classes within the communities they target.

Encourage youth, children, and adults to participate in the process of education.

a) Implement a county youth volunteer program that will encourage community involvement, provide training as needed, and match volunteers with projects and activities.

b) Enact a service-oriented program for high school students to work in the community.

c) Utilize the experience and knowledge of Marin's adults, both working and retired, to provide volunteer and mentoring resources.

d) Make computers with Internet access available in underserved areas of Marin.

Strengthen local libraries.

a) Ensure that adequate funding is available to support and maintain the County library in perpetuity.

b) Create a library task force to promote, strengthen, and preserve library services.

c) Market and communicate current library programs.

d) Expand existing library programs through the use of teen and senior volunteers.

e) Offer after-school tutoring and/or homework help at libraries through the use of volunteers.

➢ Sample indicators

a) High school dropout rate by district, school, and ethnicity (Marin County Office of Education and Healthy Marin Partnership).

b) Level of educational attainment (adults 25 and older), by ethnicity (U.S. Census Bureau and Healthy Marin Partnership).

c) Average total educational scores by district (Marin County Office of Education).

d) Student-to-teacher ratios (Marin County Office of Education).

e) Funding per student per district (Marin County Office of Education).

f) Ethnic diversity of teaching staff (Marin County Office of Education).

g) Number of community-driven special courses and seminars offered per year in County facilities (County of Marin).

h) Internet-accessible computers in libraries and other community facilities (Marin County Free Library).

➢ Sample targets

a) High school dropout rate does not vary more than 5 percent by ethnicity by 2020.

b) Educational scores rank 75 percent of national percentile or higher by 2010.

c) Funding per student is at least 10 percent above 2000 levels by 2020 and does not vary along racial or income lines.

5. Environmental Justice

➢ Background and trends

Environmental justice is the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and polices. In some cases in Marin there is disproportionate siting of facilities that use and/or emit toxic substances into the air or groundwater in low income communities and communities of color. In addition, low income communities are less able to afford pesticide-free food, and children in low income families are more likely to be exposed to lead-based paint as well as toxins in the air, soil, and water. Asthma rates for Latino children (13 percent) are higher than for white children (9.6). Asthma rates in Marin for African American adults (21.4 percent) are higher than for white adults (9.1 percent).

Marin's pattern of consumption results in environmental impacts on communities outside of the county. For example, Marin does not have any large-scale power generation facilities, but imports gas and electricity from other cities and countries. Across the bay in Richmond, however, power plants create airborne toxins which may impact the health of their neighborhoods. To add to this inequity the air pollution generated on Marin's roadways and freeways is blown over to the east bay communities by the prevailing wind patterns off the coast.

➢ Issues

There are environmental inequities in Marin based on both race and income level.

a) Low income communities have less access to pesticide-free food.

b) Children from low income families are disproportionately exposed to lead-based paint, as well as toxins in the air, soil, and water.

c) In Marin County, low income families are disproportionately affected by traffic and air pollution impacts from our congested freeway system.

➢ Strategies

Decrease the impact of toxins in all communities, including low income communities and communities of color.

a) Ensure that public documents and notices relating to human health or environmental issues are concise, understandable, and readily accessible to the public, and in multiple languages as needed.

b) Ensure that a range of reasonable alternatives are identified when siting facilities that may adversely affect low income communities or communities of color, and identify sites that would minimize or eliminate environmental impacts on these communities.

c) Decrease the impact of lead and toxins on children in low income families by expanding education, prevention, and treatment programs of Marin's Department of Health and Human Services.

d) Reduce toxic exposure in low income residences and schools by reducing or eliminating the use of toxic pesticides, hazardous cleaning products, and other toxins. Provide education and information on how residents can reduce the use of toxic materials.

e) Substantially reduce or phase out the use of toxic pesticides, hazardous cleaning products and exposure to dangerous materials in Marin.

Increase access to healthy food, air, and soil by low income communities and communities of color.

a) Increase the number of sites available to low income communities and communities of color for community gardens.

b) Provide training in alternatives to toxic pesticides at community gardens in low income communities and communities of color.

c) Work with certified green businesses and members of the Marin Organic label program to donate surplus organic food to food banks and shelters in Marin.

➢ Sample indicators

a) Number of licensed hazardous-waste facilities by zip code (Marin County Department of Public Works).

b) Number of community gardens in low income communities and communities of color (Marin County Community Development Agency).

c) Percentage of organic food provided at food banks and homeless shelters (Marin Community Food Bank).

➢ Sample targets

a) No increase in the number of licensed hazardous-waste facilities that are located in low income communities or communities of color and a 25% decrease in emissions by 2010.

b) Increase the number of community gardens in low income communities or communities of color by 50 percent by 2020.

c) Provide 20 percent organic food in food banks and homeless shelters in Marin.

6. Housing

(See also III. The Built Environment, C. Housing.)

➢ Background and trends

Housing and social equity issues are strongly linked throughout the county. The lack of affordable housing disproportionately burdens low income individuals, minority communities, and immigrant families. Because housing development is profit oriented, it often does not adequately serve low income individuals, families, or seniors.

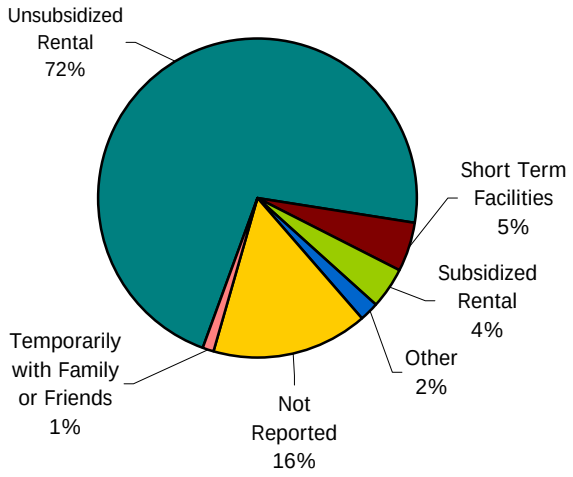
Low income and no-income people, especially seniors and young people, often have to leave the county because of a lack of affordable housing. When affordable housing is provided, the income requirements are often too high to help most low or no-income families. In addition, undocumented residents, who are a significant part of Marin's workforce, do not have access to adequate housing and are denied Section 8 housing certificates, and as a result must often share small rental units with multiple families. A lack of affordable housing also affects the ability to recruit and retain workers in many social service and health care jobs, including professional staff in social service agencies, teachers, child-care workers, staff in long-term care facilities, and nurses.

The lack of affordable housing compounded by transportation congestion creates a significant barrier to equity and economic vitality. The many people employed in Marin who must live outside the county do not participate in local events and do not have a personal stake in Marin communities. In the western part of the county there is a shortage of housing for people in the workforce, including firefighters and other emergency personnel, as many homes are being converted to vacation chalets or bed and breakfast facilities. In other parts of the county, emergency personnel also have difficulty finding affordable housing and thus would need to commute to Marin in case of an emergency, potentially putting our county at risk.

There are significant numbers of homeless individuals and families in Marin. A 1999 census identified 2,698 households, comprising 4,281 individuals, including 1,104 children, that were homeless during 1999. This survey also identified 4,266 households, comprising 11,090 individuals, that were at risk of becoming homeless during 1999. More than half of the households at risk of becoming homeless were working families earning around $947 per month, which is 20 percent of the median income in Marin.

Nearly 10 percent of Marin's population was either homeless or at risk of becoming homeless. Most of the at-risk households live in unsubsidized rental units (Figure IV-7).

Figure IV-7
Living Situation of At-Risk Households, 2000



Source: 2000 Marin Continuum of Housing and Services

➢ Issues

There is a need for more affordable housing for much of Marin's population.

a) The lack of affordable housing affects the ability of employers to recruit and retain workers in many social service and health care jobs, including professional staff in social service agencies, teachers, child-care workers, staff in long-term care facilities, doctors, nurses, and emergency response workers.

b) Low income and no-income people, especially seniors and young people, need to be targeted for housing.

c) There is need for affordable housing and services that are accessible to persons who are physically, emotionally, or developmentally disabled.

d) Families with children and those using Section 8 to pay rent can face discrimination when seeking housing.

➢ Strategies

Utilize housing assistance programs to increase housing opportunities.

a) Provide rental assistance through existing programs. Provide cash aid to assist low income or homeless families with security deposit and moving expenses.

b) Continue to improve the success of the Section 8 program.

c) Provide mortgage assistance.

d) Explore options for rent stabilization.

Encourage housing for special populations.

a) Address shelter needs for special-needs populations, including safe havens for homeless people with severe mental illness.

b) Provide efficient and effective support programs for special needs populations. Provide emergency housing assistance.

c) Create more options for homeless people, including emergency housing, temporary housing, and rental assistance.

d) Advocate for state and federal tax incentives for affordable housing for special populations.

e) Adopt an ordinance prohibiting discrimination based on family composition or source of income for rental units.

f) Comply with state regulations regarding handicapped access to commercial, apartment, and public buildings.

g) Support and promote the use of existing housing for housing and services for special populations.

h) Promote senior networking service programs which allow people to share homes and exchange services so that seniors and the disabled could enjoy living in their homes and be part of their local communities.

Provide services for people who are homeless or living in low income housing.

a) Support and promote housing for seniors, single-parent households, and handicapped persons where there is accessibility to health and social services.

b) Support and promote housing that incorporates on-site or shared health and social services, including medical clinics and child-care facilities.

c) Support and promote existing programs that provide housing and services for special populations including homeless people.

➢ Sample indicators

a) Affordable units in Marin compared with ABAG projected need by jurisdiction (County of Marin).

b) Proportional distribution of new home prices (Healthy Marin Partnership).

c) HUD-defined fair-market rents in Marin by number of bedrooms (Healthy Marin Partnership).

d) Estimated average rents by selected area (Healthy Marin Partnership).

e) Number of Section 8 units occupied annually in Marin (County of Marin).

f) Number of Fair Housing complaints annually (Fair Housing of Marin).

➢ Sample targets

a) Marin's number of affordable units will annually increase so that the ABAG projections are met in each planning period.

b) At least twenty-five percent of new housing units built will be affordable to median-income families by 2020.

c) Increase the number of units available for people with disabilities, emergency shelter, and transitional housing each 20 percent by 2020.

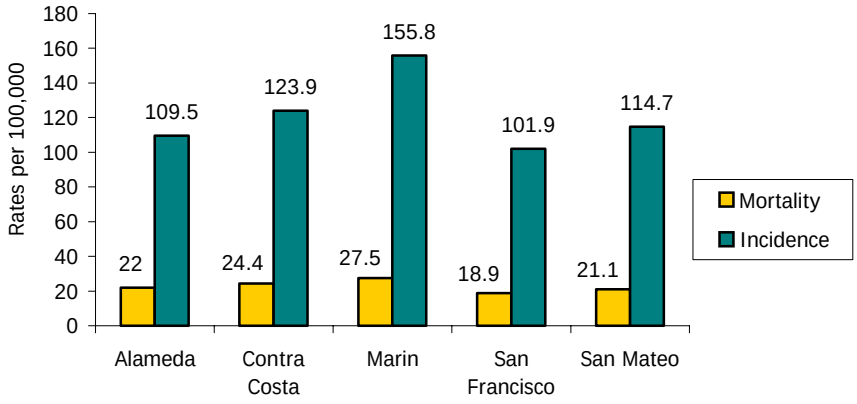
7. Public Health

➢ Background and trends

Overall, Marin County residents are healthy and participate in many preventive health measures. A health and wellness survey of residents indicated that during the past 12 months, more than two-thirds had received a general health exam, and 71 percent said they performed some type of regular physical activity or exercise. Further, the immunization rate for children was 91 percent in 2001 and has been rising. Finally, 70 percent of those surveyed reported that they had visited a doctor and 66 percent had visited a dentist in the last six months (Applied Survey Research).

There are, however, some disturbing health concerns that face Marin's population. The breast cancer rate in Marin is the highest in the United States and one in seven Marin women will be diagnosed with breast cancer in her lifetime. Both the mortality and incidence rates of breast cancer for Marin are the highest in the Bay Area (Figure IV-8). The death rate from breast cancer in Marin is 25 percent higher than rates for other Bay Area counties and other urban areas of California. It went from 23.7 deaths per 100,000 annually in 1995–97 to 21.1 in 1996–98, as compared with the breast cancer rate for California: 18.9 annually in 1995–97 and 18.3 annually in 1996–98 (Futcher).

Figure IV-8
Average Annual Age-Adjusted Invasive Breast Cancer Incidence and Mortality Rates, 1988–1998



Source: 2001 Marin County Department of Health and Human Services

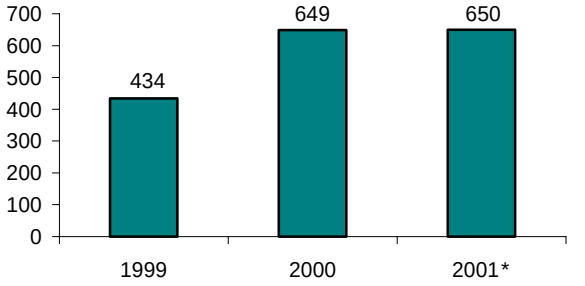
Other cancer rates in Marin are also high. The number of cases of prostate cancer in Marin exceeds the number of breast cancer cases and the prostate cancer rate for white, non-Latino men is the highest in the Bay Area. Bladder cancer and malignant melanoma cases are also comparatively high (Field Research Corporation). Additional public health trends such as relatively high levels of obesity, depression, and suicide, as well as a lack of health insurance for some populations are outlined below.

Obesity rates for adults, seniors, and children are of concern. Obesity rates are high for both adults and children. Fifty-eight percent of adult men are overweight or obese. Forty-nine percent of

seniors are overweight or obese. Thirty-eight percent of boys and 30 percent of girls between the ages of 2 and 17 are overweight or obese (Field Research Corporation).

Health insurance and coverage vary by age, income, and ethnicity.
Age: While only 79 percent of adults between the ages of 18 and 24 are covered by health insurance, more than 90 percent of adults 25 and over and 96 percent of children are insured. An estimated 8 percent of adults over the age of 18 are uninsured in Marin.
Income: Sixty-four percent of adults with a household income under the federal poverty level have health coverage; another 33 percent are on Medicare or Medi-Cal, and 31 percent are on private plans. The number of families enrolled in the Healthy Families program, a health coverage program for children from low income families, has been increasing since 1999 (Figure IV-9) (Applied Survey Research).
Ethnicity: Only 76 percent of Marin Latinos have health insurance coverage, while 94 percent of whites, 90 percent of African Americans, and 93 percent of Asians have coverage (Field Research Corporation).

Figure IV-9
Healthy Families Enrollments: New Enrollments



*Data counts for 2001 not complete at time of survey

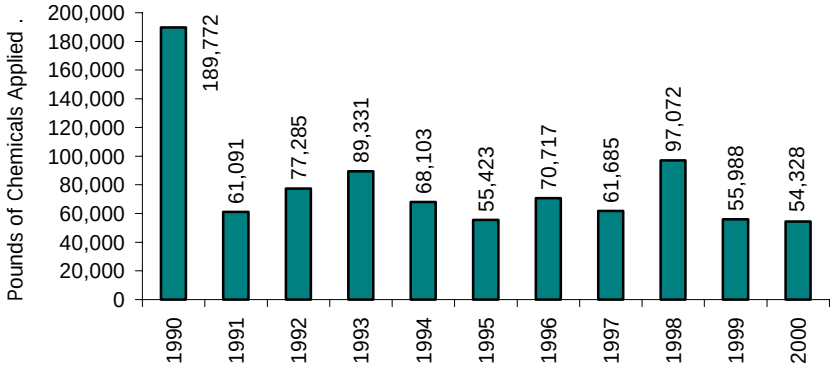
Source: 2001 Applied Survey Research

Seniors are generally healthy, but some face isolation. Nineteen percent of seniors reported a dramatic loss of vision, hearing, mobility, and/or serious illness in the past year; however, 86 percent of seniors feel that in general, their health is good, very good, or excellent. Forty-eight percent of seniors live alone, and 30 percent of those living alone do not see someone else every day (Marin Community Healthy Survey).

Other health trends vary. High blood pressure, cholesterol, and arthritis were the three leading chronic illnesses and conditions among Marin County residents in 2001. The 2001 Marin County Health survey found that 17 percent of Marin residents surveyed consider themselves allergic or sensitive to everyday chemicals, a condition known as Multiple Chemical Sensitivities. The same survey also reported that 17 percent of teenage girls age 12–17 suffer from asthma, and the overall rates of asthma are higher for African American adults in Marin than in the state. Death rates for heart disease, all cancers, stroke, and drugs all decreased slightly between 1993 and 1998 (Figure IV-11).

The quantity of pesticides used in Marin County has decreased over the past decade. Pesticide use has fluctuated between years but has decreased overall since 1990 (Figure IV-10).

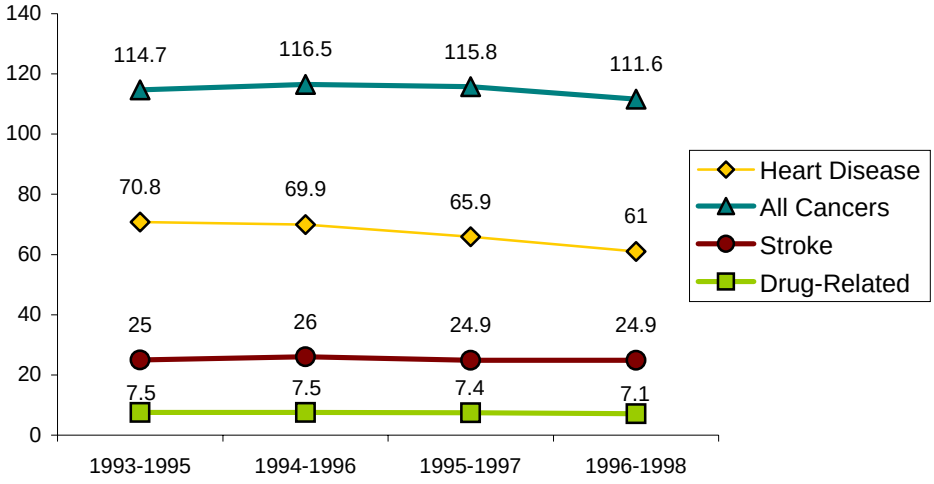
Figure IV-10
Pesticide Use in Marin County*



Source: 2000 California Department of Pesticide Regulation

** Measurement by weight does not indicate toxicity of pesticides. Non- or low-toxicity pesticides may be used in large quantities while more toxic chemicals may represent a small portion of total pesticide weight.*

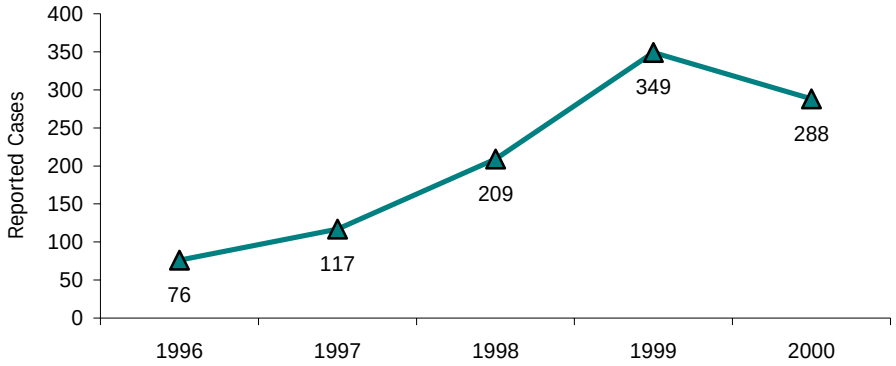
Figure IV-11
Marin County Deaths per 100,000 Population, Age-Adjusted, Three-Year Averages



Source: 2001 Applied Survey Research

While AIDS cases have increased in recent years in Marin, instances of other sexually transmitted diseases have been declining. The incidence of AIDS per 100,000 rose from 1,271 cases reported in 1997 to 1,475 cases reported in 2001, representing a 15.4 percent increase over the four-year period. The number of hepatitis C cases in Marin increased significantly between 1996 and 1999. However, the number of cases dropped between 1999 and 2000 (Figure IV-12). Environmental illnesses including multiple chemical sensitivity, electrical sensitivity, chronic fatigue syndrome and fibromylgia have been more commonly reported in recent surveys (Field Research Corporation).

Figure IV-12
Communicable Disease: Hepatitis C



Source: 2001 Applied Survey Research

Trends in emotional and behavioral health vary. Since 1997, the number of diagnoses for mood disorders such as depression or bipolar disorder has increased from 1,185 in 1997 to 1,421 in 2001 (Applied Survey Research). Marin's suicide rate is slightly higher than the state average. Also, there is a trend away from institutionalizing special needs populations often because funding is available for services but not for housing (National Institute of Mental Health).

Alcohol and drug abuse remains relatively stable. The number of discharges for alcohol-related conditions was 953 in 1996, 1,013 in 1997, and 931 in 1998. The number of discharges for drug-related conditions during the same three years was 541, 538, and 568 (Applied Survey Research).

Teen smoking and drug use are declining. Smoking among Marin teens is declining, and this trend mirrors national smoking trends. Decreases in cigarette smoking were observed for the 8th, 10th, and 12th graders surveyed in Marin, and teen drug abuse appears to be on the decline as well. Alcohol remains the most popular drug with teens, though a slight reduction was reported in 2001 (Associated Press).

➢ Issues

Preventive health care and nutrition need to be promoted.

a) Neighborhoods need to encourage walking, bicycle riding, and exercise to reduce obesity and promote health.

b) There is a lack of nutritious food served in school cafeterias and a lack of education about nutrition. This may contribute to the high obesity rate among children.

c) There may be a correlation between technology, affluence, chemical use, ageing and health issues.

d) Chemicals in our environment may contribute to high cancer rates, learning disabilities, autism and other health impacts in Marin.

e) There are not enough chemical-free buildings or facilities available for public and private use. This is particularly difficult for people with environmental disabilities.

f) There is concern over the placement of cellular antennas and the long-term effects of electromagnetic fields (EMFs) on public health.

Many Marin residents need high-quality free health care.

a) Access to health care is decreasing, especially for low income people. There are too few health care professionals who will serve patients eligible for Healthy Families and Medi-Cal. The Marin Dental Clinic needs to be expanded, especially in West Marin.

b) More culturally diverse health care services are needed.

Targeted health issues need to be addressed.

a) Breast milk monitoring (or "bio-monitoring") may provide a barometer of the health needs and concerns of communities, including but not limited to breast cancer.

b) Marin residents with environmental illnesses or hidden disabilities are unable to access many public buildings and public transportation due to the chemicals in cleaning products, building materials, paint, carpeting, fuel and so on. Public facilities and paths of travel free of chemicals are needed for such residents.

c) Airborne toxins are more likely to impact children than adults due to the surface area of their lungs. These toxins may be increasing the incidence of asthma in children.

d) Toxins in the environment may be contributing to targeted health issues as well as the growing number of cases of chronic fatigue syndrome.

Behavioral health issues need to be addressed.

a) Racism, classism, and sexism contribute to stress-related health problems.

b) The rise in the numbers of mentally ill has created a need for expanded acute clinics and additional psychiatric beds.

c) Because of the lack of programs for individuals with mental illness, these individuals are often brought into the criminal justice system.

d) Homeless people with mental illness need additional outreach and advocacy.

e) Low income families and mentally challenged individuals are often not aware of or are unable to gain access to services and resources that are available in the community.

➢ Strategies

a) Apply the Precautionary Principle, "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken, even if some cause and effect relationships are not fully established scientifically."

b) Enhance the provision of health and social services.

c) Support the Health Council of Marin and other groups responsible for community health promotion. Promote measurable health goals, and work with health-related agencies to monitor their implementation. Encourage coordination between existing social services agencies.

d) Provide incentives, such as co-location of services or rent subsidies, to attract private health and social service agencies.

e) Have a County health advisor available to the public at libraries.

f) More fully utilize main.org to publish a directory of human service agencies and distribute it in the community.

g) Support efforts to inform disabled individuals about the services available to them.

h) Ensure that public, nonprofit, and private facilities providing health or human services be accessible to persons with disabilities.

i) Provide programs to increase the language and cultural skills of health care providers.

Address underlying causes of health issues using prevention and nutrition.

a) Provide educational materials to the community in multiple languages about the relationships between exercise, obesity, walking, and health. Support programs that focus on socialization, recreation, health, and wellness at community centers.

b) Improve indoor air quality by requiring that all new construction or renovation, particularly in school or health care settings, use nontoxic or low-toxicity building materials, and avoid chronic or unsafe exposure to electromagnetic fields.

c) Utilize vacant County property for gardening of fruits and vegetables and support the provision of fresh, healthy, and pesticide-free food in schools and through the Food Bank.

d) Promote the use of alternatives to toxic pesticide use in the county.

e) Require the County government to use alternatives to toxic pesticides in all operations.

f) Promote preventive health care in line with the Child and Adult Preventative Care Guidelines published by the U.S. Public Health Services (1994).

g) Assist in the establishment of more wellness centers to provide preventive health advice, and facilitate greater access to care by linking people to community health services.

h) Promote active living by designing communities to incorporate walking or bicycling into residents' and employees' daily routine. Also, support programs for youth.

Address targeted health issues, including AIDS, high cancer rates, hepatitis C, heart disease, asthma, and environmental illnesses.

a) Pursue sources of private and public funds to address targeted health concerns and support agencies that are addressing targeted health issues.

b) Support adequate state, federal, and private sector funding directed at the cure and treatment of AIDS. Also, participate in organized efforts to educate the public about AIDS and to not allow discrimination against persons with AIDS or AIDS-related conditions.

c) Map the locations of tobacco and alcohol establishments to determine if there is a correlation between the location of stores and the health of nearby residents. Regulate the location and hours of operation of tobacco and alcohol retailers.

d) Continue and expand the programs established by the commission to reduce or avoid pesticides, biocides, herbicides, and other chemicals on County properties and projects.

e) Adopt the California Building Standard Commission's Cleaner Air program to improve access to public facilities for individuals who are environmentally sensitive. Support the evaluation of school environments for indoor air quality.

Make health care accessible to low income families.

a) Continue programs that reach out to low income families for health services, including the Marin Health and Dental Clinic. Support free breakfasts for children in low income families.

b) Promote enrollment in Healthy Families and Provide incentives for health care providers to serve patients in the Healthy Families and Medi-Cal programs.

c) Support measures that would reduce the number of uninsured individuals.

Encourage the provision of health and social services for seniors.

a) Urge public, nonprofit, and private facilities providing health or human services to develop or incorporate facilities and services for older adults.

b) Consider incentives to attract private "senior day-care" services. Support and enhance senior escort services and delivery of meals for low income seniors.

c) Provide opportunities for older adults to volunteer in schools, libraries, and elsewhere using the EASY model or the Elder Volunteer Corps model. Coordinate with local schools and community centers to provide education opportunities targeting seniors.

Reduce environmental hazards through improved guidelines and policies.

(See also II, Natural Systems, B. Environmental Hazards.)

a) Educate city and county councils about lead and other environmental hazards, and explore methods to address such issues through local code enforcement.

b) Convene a committee/interest group involving each of Marin's jurisdictions to hold networking sessions to address environmental health hazards.

c) Drastically reduce or phase out the use of toxic substances in all areas.

d) Consider adopting the City of San Francisco's ordinance implementing the Precautionary Principle.

Address behavioral health issues.

a) Increase the number of psychiatric beds available in Marin.

b) Support and enhance mental health treatment programs.

c) Find a permanent location for a detoxification center.

d) Provide a jail diversion program for the mentally ill.

e) Support treatment for those suffering from major depression.

f) Support forums on racism, classism, and sexism awareness, and events that celebrate diversity.

➢ Sample indicators

a) Rate of breast, prostate, and other cancers compared with national, state, and region rates (Healthy Marin Partnership).

b) Obesity rate and rate of environmental illnesses (Marin County Department of Health and Human Resources).

c) Health and Human Services utilization data, client index, and health survey data (Marin County Department of Health and Human Resources).

d) Health coverage and health insurance by age, income, and ethnicity (Healthy Marin Partnership).

e) Medi-Cal, Medicare, and Healthy Family enrollment data (County of Marin).

f) Pesticide use in County facilities (County of Marin).

➢ Sample targets

a) Rates of breast cancer and prostate cancer decrease by 10 percent by 2020.

b) Obesity rates decline by 10 percent for all age categories by 2020.

c) Reduce incidence of environmental illness by 10% in 2020.

d) Health coverage is available to at least 80 percent of Marin residents of each age, income, and ethnic category by 2020.

e) Enrollment in Healthy Families and number of Healthy Families Providers each increase 50 percent by 2020.

f) Pesticide use in County facilities decreases by 75 percent from the 1997 level by 2004, as set by the County's Integrated Pest Management Ordinance.

8. Public Safety

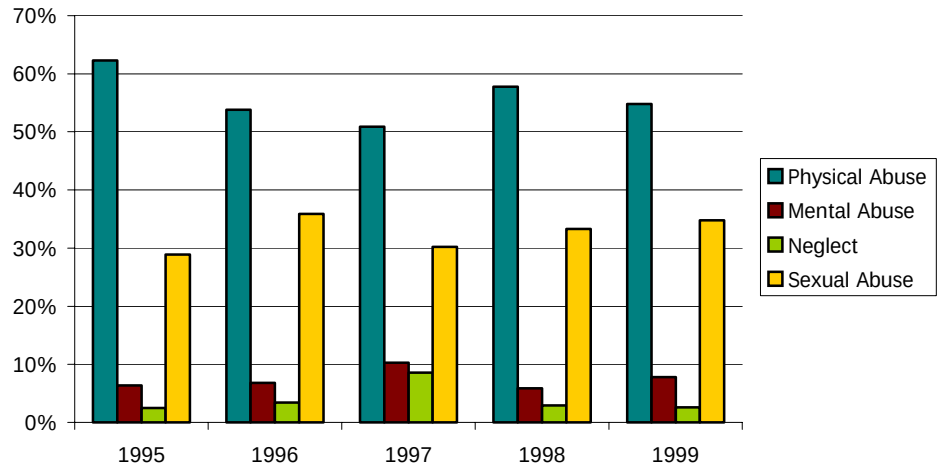
➢ Background and trends

Marin has a strong public safety record, as crime rates have remained consistently lower than in the rest of California for many years. In addition, crime rates for both Marin and the state have been steadily decreasing since 1996, from 7,533 reported crimes in 1996 to 5,902 in 2000.

However, Marin has had a higher percentage of physical abuse cases, including physical child abuse, than the state average since 1998. In addition, the number of youth experiencing violence, the number of violent crimes, and the geographic concentration of hate crimes are all areas of concern in Marin.

Incidence of abuse is high in some areas. Physical abuse cases in Marin are higher than the state average. Physical and sexual abuse cases continue to represent the most common types of abuse of children, followed by mental abuse and neglect. Despite the comparatively high rate, the number of child abuse cases declined 44 percent between 1995 and 2000.

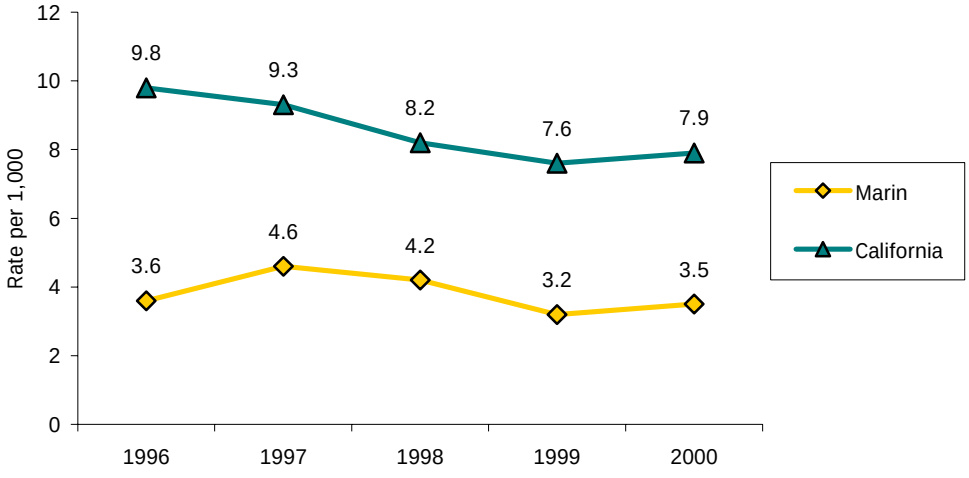
Figure IV-13
Percentage of Child Abuse Cases by Type



Source: 2001 Applied Survey Research

The rate of domestic violence calls in Marin is significantly lower than the rate of domestic violence calls in the state as a whole (Figure IV-14). In addition, the rate of domestic violence calls in Marin decreased slightly from 3.6 in 1996 to 3.5 in 2000.

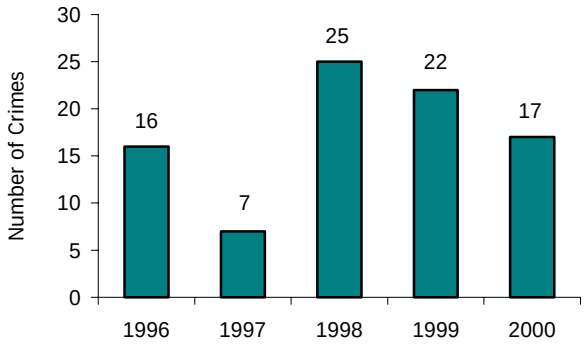
Figure IV-14
Domestic Violence Rate in Marin County



Source: 2001 Applied Survey Research

Hate crimes are less frequent but are concentrated geographically. While the number of reported hate crimes fluctuated between 1996 and 1998, since 1998 the number of reported cases has dropped from 25 to 17, a difference of 47 percent (Figure IV-15). Cities that have reported at least one incident of a hate crime between 1996 and 2000 were Novato (59 offenses), San Rafael (13), Tiburon (2), Fairfax (2), and the unincorporated areas of Marin (11).

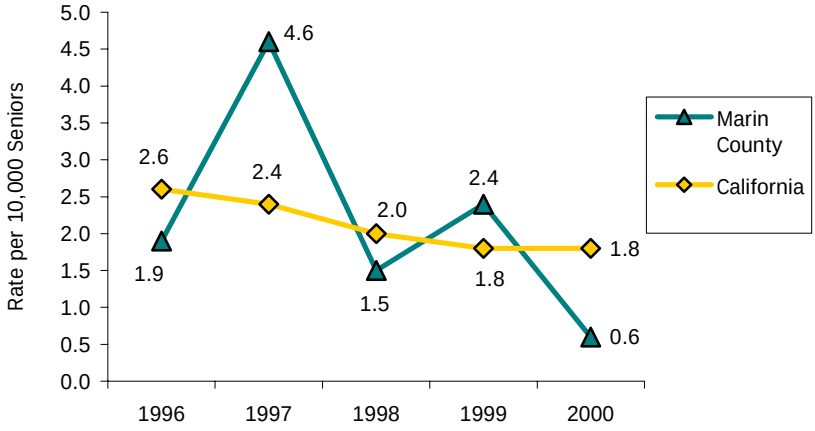
Figure IV-15
Total Number of Hate Crimes in Marin County



Source: 2001 Applied Survey Reseach

The number of violent crimes against the elderly has decreased. While incidents of violent crimes against the elderly have fluctuated since 1996, overall the rate has decreased from 1.9 (per 10,000 seniors) in 1996 to 0.6 in 2000 (Figure IV-16).

Figure IV-16
Violent Crimes Against the Elderly in Marin County and California

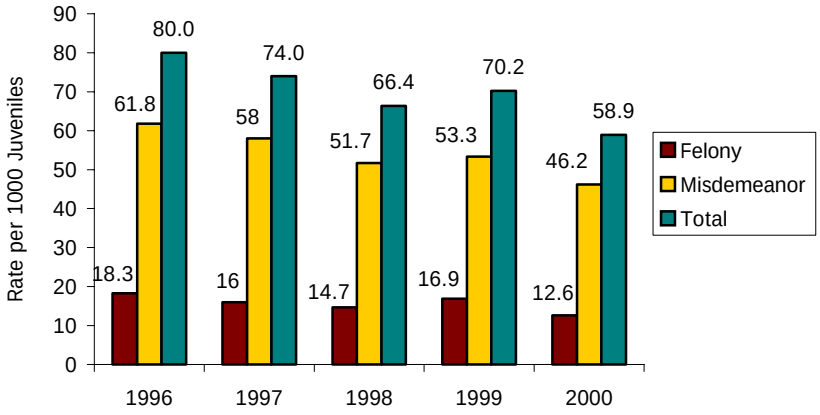


Source: 2001 Applied Survey Research

One in five young adults experiences violence. The 2001 Marin Community Health Survey found that 20 percent of young adults age 18–24 reported experiencing some type of physical violence or threat of violence within the past year.

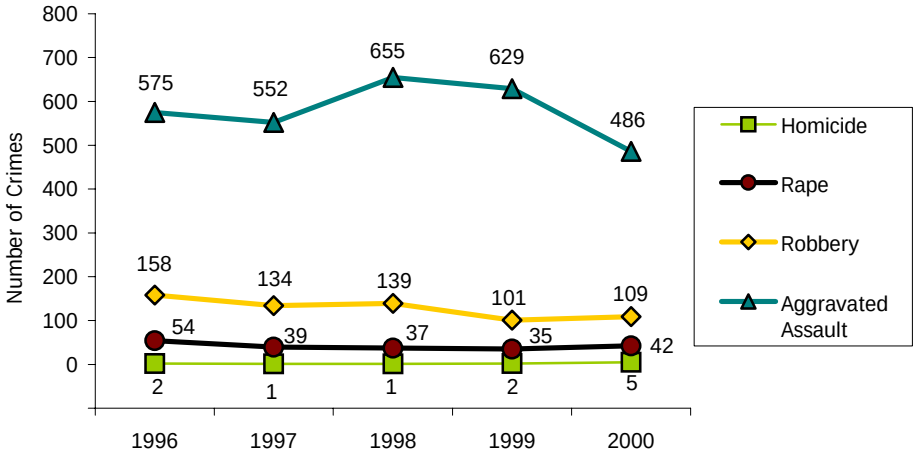
Other crime trends fluctuate. Juvenile misdemeanor and felony crimes have declined since 1996. Overall, the total juvenile arrest rate has been decreasing as well, from a rate of 80 in 1996 to 59 in 2000 (Figure IV-17). Overall, the total number of violent crimes (homicide, rape, robbery, and aggravated assault) has decreased since 1996, while the number of homicides has increased slightly (Figure IV-18).

Figure IV-17
Juvenile Arrest Rate in Marin County



Source: 2001 Applied Survey Research

Figure IV-18
Violent Crimes in Marin County



Source: 2001 Applied Survey Research

➢ Issues

a) Violence prevention needs to be more widespread.

b) Incidents of abuse and domestic violence often arise because people may be living in overcrowded conditions.

c) More needs to be done to prevent child abuse and neglect.

d) There is a need for targeted programs to reduce hate crimes.

IV

➢ Strategies

Maintain Marin County neighborhoods as safe, healthy places to live.

a) Review the design of new and rehabilitated buildings for ways to increase resident safety. Develop neighborhood patterns that encourage social interaction and avoid isolation. Ensure adequate street lighting in communities as needed.

b) Utilize community-based solutions for crime when possible, including community policing and restorative justice programs. Strengthen and expand neighborhood-watch programs, and include businesses. Develop a corrective plan to deal with high-crime areas.

c) Educate communities about hate crime awareness and prevention.

d) Promote self-defense and crime prevention education.

Reduce violence and crime rates among youth and young adults.

a) Support and encourage the work of the Youth Commission.

b) Establish a partnership between service agencies and law enforcement to address violence prevention.

c) Ensure that youth programs are located in areas that are easily accessible by youth.

d) Expand after-school and youth programs. Continue and expand mentoring programs for youth. Work closely with faith-based organizations to reach out to troubled youth.

e) Continue to support the use of mental health staff at juvenile hall to provide counseling.

Reduce the incidence of violence in the home.

a) Require mandatory counseling for perpetrators of child abuse and domestic violence.

b) Provide safe havens for victims of child abuse and domestic violence at fire stations.

c) Promote child abuse and domestic violence awareness and prevention programs.

Reduce substance abuse.

a) Support the education of all age groups in substance abuse prevention.

b) Encourage alcohol and drug abuse programs in the community. Include law enforcement, school districts, service agencies, and vendors of nicotine, alcohol, and prescription drugs in planning and operating programs for substance abuse prevention.

➢ Sample indicators

a) Child abuse and domestic violence rates (Healthy Marin Partnership).

b) Recurrence rates for child abuse and violent crimes (Healthy Marin Partnership).

c) Crime rates by type (Healthy Marin Partnership).

d) Number of hate crimes by city (Healthy Marin Partnership).

e) Rate of reported substance abuse (Healthy Marin Partnership).

➢ Sample targets

a) Rate of child abuse continually decreases through 2020.

b) Number of violent crimes continually decreases through 2020.

c) Number of hate crimes continually decreases through 2020 in all geographic areas.

d) Rate of reported substance abuse decreases continually.

9. Transportation

(See also III. The Built Environment, A. Transportation, and Economic Element.)

➢ Background and trends

Transportation issues are a priority for Marin County residents. Traffic congestion's impact on the economy and the built environment was discussed earlier in this report. Here we will look at the social equity impacts of our transportation system.

Because our transportation system is designed primarily for cars, those without a car are more likely to experience difficulty moving around the community, as well as into and out of the community. Low income families are less likely to own a car or multiple cars. A lack of urban bicycle and pedestrian paths, and of large-scale public transportation, means that often people without cars have difficulty traveling to jobs or to medical services, and difficulty taking advantage of cultural and economic services. For example, 22 percent of women 75 and older reported that a lack of transportation kept them from doing things they wanted to do outside the home (Field Research Corporation).

➢ Issues

a) Public transportation began as a private enterprise and was not considered a public service like police and fire protection. Although it is now public, the funding structure is inadequate.

b) The lack of reliable local public transportation means that many people without a car cannot travel to services or cultural events.

c) Transportation issues regarding the old, the young, and the poor, who are the primary users of public transportation, are not adequately addressed because these users do not have as strong a voice in shaping public policy.

d) Neighbors often do not want health and human services like child care, elder care, and churches in communities because of the traffic that these services generate.

e) Fossil fuels are an uncertain and time-limited fuel source. A transportation system powered by fossil fuel vehicles increases air pollution, including carbon emissions, and can lead to negative health impacts and global warming.

➢ Strategies

Make transportation accessible, safe, and efficient.

a) Update circulation/transportation elements in Marin's community plans to address the needs of those who are transit-dependent including the elderly, the physically disabled, youth, low income residents, and persons who do not own an automobile.

b) Work with the Marin County Transit District to improve both commute and intra-county transportation services. A significant proportion of transportation funding should be dedicated to serve residents who are transit-dependent. Transit routes should be convenient and flexible to meet the needs of the communities and residents who rely on their services.

c) Ensure that bus stops are located near public services, employment and commercial centers, neighborhoods, senior and youth centers, health care and social service facilities, schools, and hospitals.

d) Advocate a bridge in the Canal between the end of Canal Street and San Rafael High School for bike and pedestrian traffic to San Rafael High School and the Montecito Shopping Center.

e) Support alternatives to the use of vehicles powered by fossil fuels.

Ensure that transportation is affordable and accessible to the elderly, persons with disabilities, youth, and low income residents.

a) Provide for and maintain affordable transportation services to and from health care and social service facilities from all areas of the county, especially for the elderly, the physically disabled, and low income individuals.

b) Support efforts to inform the elderly, persons with disabilities, youth, and low income residents about the transportation services that are available, in multiple languages as needed.

c) Ensure implementation of the Marin Paratransit Development Plan.

d) Promote the Safe Routes to Schools program.

e) Encourage transportation providers to provide reduced rates for senior citizens, the handicapped, and youth.

➢ Sample indicators

a) Percent of transportation funding spent on public transit (County of Marin).

b) Number of complaints about access to public transit (Golden Gate Transit).

c) Percentage of public transportation information provided in multilingual formats (Golden Gate Transit).

➢ Sample targets

a) Increase the percentage of transportation funding spent on public transit by 20 percent in 2020.

b) Number of complaints about access to public transit decreases over time.

c) Language breakdown of transportation information equals percentage breakdown of non-English-speaking ridership on public transit.

10. Workforce Training and Compensation

(See also IV. The Economy, Equity, and Culture, A. Economy.)

➢ Background and trends

Workforce training and compensation is an area of concern as employers in the county have difficulty finding qualified entry-level employees. Compounding the shortage of entry-level workers is the number of jobs offered in Marin that don't pay a living wage.

The CalWORKS caseload in Marin is dropping dramatically, plunging new workers into the workforce. This trend could help employers seeking entry-level employees, but the lack of training, lack of support for child care, and low entry-level wages will act as significant barriers (Marin County Department of Health and Human Services).

➢ Issues

Increased skills are needed for workers.

a) Employers have difficulty hiring entry-level employees with adequate verbal and written communication, and arithmetic skills. Language is a barrier for non-English-speaking workers in service jobs.

b) There is a need for businesses to partner with schools to ensure that students graduate with skills they can use for well-paying, future-oriented jobs.

c) Businesses need to offer employees financial and other incentives to continually upgrade their work skills.

There is a need for equal access to fair job opportunities and adequate compensation for all workers, including entry-level workers.

a) Many service jobs in Marin County are low paying, and most of these jobs are performed by immigrants.

b) Gender inequality exists in the workplace, especially for working mothers.

c) Advocacy is needed for state funding to increase the quantity and quality of jobs, and to increase opportunities for employee advancement.

d) Private employers and unions in key growth industries need to pay a livable wage, and to hire and train unemployed and low income workers from within the county.

➢ Strategies

Enhance job experience opportunities for youth.

a) Link schools with businesses for job shadowing and early job education programs.

b) Encourage the establishment of more technical/vocational programs within the high school system. Implement a youth employment program.

c) Encourage colleges and universities to provide employment counseling and job referral services for students.

d) Provide opportunities for students to learn about sustainability and work in the field.

e) Participate in the School to Career partnership.

Provide mentoring, apprenticeship, and entry-level job opportunities for adults.

a) Develop personnel policies aimed at providing mentoring, apprenticeship, and part-time and entry-level positions, as well as job sharing opportunities.

b) Encourage businesses to provide jobs and mentoring for youth, senior citizens, and people with disabilities.

c) Seek out special grants for job training services for the disabled.

Provide job training for adults.

a) Increase language (especially ESL) classes in the county.

b) Increase financial management classes in the county.

c) Provide job training services for people with disabilities through JTPA funds, and seek out special grants for additional services.

d) Encourage local businesses to train and hire local residents.

e) Help businesses assist employees in upgrading their work skills.

Provide support for working parents.

a) Provide job share opportunities for working parents.

b) Require new commercial developments to include a quiet room for nursing mothers.

c) Allow telecommuting to reduce traffic congestion and provide flexibility for working parents.

Provide job opportunities for economically and physically disadvantaged people wherever possible.

a) Coordinate with nonprofit institutions and businesses that currently provide job opportunities for economically and physically disadvantaged people.

b) Study gender inequality in the workplace and create strategies to address identified issues.

c) Provide preferential job opportunities for applicants who are economically and physically disadvantaged.

d) Create mentor programs to help employees advance in the workplace.

Support fair compensation, especially for low income workers.

a) Apply the County living-wage ordinance for all applicable contracts.

b) Promote fair wages.

c) Support unions.

➢ Sample indicators

a) Unemployment rates by jurisdiction (Healthy Marin Partnership).

b) Number of job training programs for youth and for adults (Marin Employment Connection).

c) Average wages (California Employment Development Department).

➢ Sample targets

a) Unemployment rate in Marin remains below 5 percent.

b) Increase job training programs by 10 percent by 2020.

c) Increase the number of jobs paying a living wage by 10 percent by 2020.

D. CULTURE

➢ Background and trends

Culture is defined for the purpose of this document as the people's artistic and historical expression of the world around them. Marin is a culturally rich community that places importance on exposing the community to and involving the community in artistic expression, both modern and historical.

The arts industry is a strong contributor to the Marin economy. This is a mutually beneficial relationship, as Marin residents report a strong affinity for arts and humanities–related projects. In 1999, the arts industry in Marin employed roughly 2,200 persons. While Marin residents have historically attended cultural events in San Francisco, increased traffic congestion and the tendency of more people to work from home has precipitated a shift toward more Marin-based cultural events.

The primary cultural facility operated by the County of Marin is the Marin Center. Marin residents perceive the Marin Center as a gathering place for residents, rather than just a venue for events or performances. The County is currently preparing a report addressing ways to develop public-private partnerships to renovate the Marin Center facilities to improve its ability to serve as a civic and community gathering place.

The arts and entertainment industry remains a significant portion of Marin's economy. The combined annual operating budgets of 34 arts organization surveyed in 1997 exceeded $11 million, which included more than $5 million for personnel costs to employ people who live, work, shop, and play in Marin. The combined annual production budgets of the surveyed performing and producing organizations was nearly $3 million, providing approximately 1,200 performances of more than 700 productions. The surveyed arts organizations spent $1.5 million on local goods and services in 1996 and 1997 (Marin Arts Council).

In September 2000, a random telephone survey of Marin residents revealed that 22 percent of Marin households gave to the arts and humanities, compared with 11 percent nationally. In recent years, funding for the arts from the Marin Community Foundation (MCF) has been decreasing slightly. In 1987, 10 percent of the MCF's Buck Trust funds were dedicated to the arts and humanities, and in 2001 MCF directed 7 percent of its funds toward the arts (Marin Community Foundation 2001).

Although wages in the arts, entertainment, and recreation industry remain relatively low, they increased 13 percent between 1998 and 1999, from $23,459 to $26,588. This industry employed approximately 2,200 persons in 1999 (Marin Economic Commission).

A 2001 California public opinion poll found that 78 percent of those surveyed were willing to pay $5 more in state income tax if the money went directly to the arts, and 81 percent said they believe that arts programs improve children's overall academic performance (Hamlin).

Renovation and public-private partnerships represent the most viable opportunities for expanded cultural facilities. A survey of seven capital projects of arts facilities in the county found that the majority favor renovating over new construction, indicating a public desire both to rebuild infrastructure and to maintain treasured community landmarks. There is a growing interest in coordinating public-private partnerships to utilize private sources of support for direct capital funding, contributions of land, and/or project-specific approvals from jurisdictions (Saperstein and Associates).

Arts education is perceived to be an indispensable component of quality education for children. A 2001 statewide survey conducted by the California Arts Council found that 74 percent of respondents believe the arts improve the quality of children's overall education. The study also found that 72 percent believe arts education helps children develop skills for working with others as a team, and other strong social skills. When comparing the importance of arts education and sports, the 2001

California Arts Council survey found that few residents said arts education is more important than academics, but more than half, 57 percent, said that arts education is equally important.

Marin has abundant archaeological resources. The State of California has officially recorded 630 archeological sites in Marin County. These sites include settlements and villages, hunting camps, quarries, rock art sites, and trails associated with Native American settlement of the area. The distribution of known archeological sites in the county is concentrated in urban areas and the Point Reyes Peninsula.

1. Arts

➢ Issues

People place a high value on culture and the arts, though other issues and programs often receive higher priority in terms of funding and donations.

a) Community and public art projects need to be promoted because they will facilitate community development and cohesiveness.

b) It can be difficult to get funding for the arts from state and federal sources because of the perception that Marin is a wealthy community and that other communities are more needy. The Marin Community Foundation and the Marin Arts Council are two of the main resources in the county supporting the arts.

Community access to art needs to be increased.

a) Marin does not have a countywide arts and culture commission. The Cultural Development Committee (a subcommittee of the Marin County Parks, Open Space and Cultural Commission) is limited to making recommendations on Marin Center polices and programming.

b) Low income individuals and families do not have access to many arts events due to event costs.

c) Policies that promote or require public art are needed.

There are significant barriers to quality arts education.

a) Academic-achievement pressures on students can discourage them from participating in arts courses.

b) More funds are needed for scholarships, awards, and stipends for artists and students.

➢ Strategies

Improve communication between arts organizations, County decisionmaking bodies, and the public.

a) Evaluate potential barriers to attracting and retaining arts-related groups and ventures in the county.

b) Create a countywide arts and culture commission to develop a countywide vision for the arts in Marin and make policy recommendations.

c) Work with neighborhood associations and other community organizations to provide community arts programs and services. Encourage effective collaboration and communication between the Marin Center Renaissance Committee and the Civic Center Conservancy.

d) Create a bulletin board on the County Web site for the community to post arts events and engage in online arts-focused dialogue.

Expand exhibition opportunities featuring local artists.

a) Solicit performances and exhibitions from local artists of all skill and income levels at County facilities to encouraging a diversity of art styles and mediums. Provide professionally curated exhibition and gallery spaces in County-owned buildings and spaces.

b) Encourage the use of arts landmarks and reference them in County publications.

c) Promote multimodal transportation to cultural events.

d) Modify County development regulations to allow for artist live/work spaces.

Improve arts programming.

a) Conduct a periodic market survey of trends in the arts, then modify programming based on the findings.

b) Focus on the commonalties of art in differing cultures when soliciting and promoting arts programs.

c) Promote multicultural arts-related programs and services, including literature and poetry readings, in the libraries. Encourage and support participation by portions of the community that have been traditionally underrepresented.

d) Promote access to Marin 31 and other public access television for increased arts programming.

e) Promote and expand arts programs for individuals with disabilities.

Develop a public art program that is unique to Marin County.

a) Develop policies to encourage public art.

b) Encourage artist participation on design teams for planning public projects.

c) Identify appropriate sites for placement and inclusion of murals and other art on publicly owned property, such as community centers, parks, schools, and County property.

Enhance marketing and funding opportunities for the arts.

a) Develop promotional strategies for arts programs and facilities.

b) Publicly recognize those who create and support the arts in the county, including institutions, organizations, businesses, and individuals.

c) Assist in securing funds for the arts from state and federal sources. Establish a nonprofit organization that can raise funds and solicit resources for the arts. Encourage private support for the arts through the Marin Arts Council and Marin Community Foundation. Sponsor arts programs, groups, and events.

d) Allocate funds to operate, preserve, and expand access to the Marin Center.

e) Utilize market-based pricing to establish arts-related fees while providing a sliding scale to allow low income participation.

Promote community participation in the arts.

a) Implement measures to ensure that every person in Marin, regardless of age, race, or income, has an opportunity to participate in arts and cultural events.

b) Develop a subsidized ticket voucher program that offers reduced-cost tickets for the elderly, youth, low income, and disabled populations.

c) Involve the community in selecting artists for County-commissioned artwork.

d) Encourage and recognize volunteer involvement in arts programs.

e) Train social, health service, and recreation professionals who work with elderly, youth, disabled, low income, and minority constituencies on integrating the arts into their services.

Promote and expand arts education.

a) Support and expand arts classes in community recreation programs.

b) Explore ways that art can be used as an intervention for at-risk youth.

c) Improve artistic opportunities for Marin's senior population. Encourage all senior and assisted-living centers to include arts programs on site.

Celebrate and promote cultural diversity.

a) Create space in public and private spaces such as shopping malls to be used for cultural awareness activities including art and poetry.

b) Support and enhance murals, events, and community dialogue that focuses on or promotes diversity.

c) Support and enhance community festivals that promote diversity.

d) Create a commission that focuses on cultural diversity.

➢ Sample indicators

a) The number of arts events at public sites throughout the county (Marin County Department of Parks, Open Space, and Cultural Services).

b) Attendance at major arts events or cultural facilities in the county (Marin County Department of Parks, Open Space, and Cultural Services).

➢ Sample targets

a) Increase the number of arts events, performances, and exhibits at public sites by 10 percent by 2020.

b) Increase the attendance at major arts events at the Marin Center and Marin County Fair by 10 percent by 2010.

c) Increase the average instruction time devoted to art education activities and lessons by 5 percent by 2010.

2. Culture and Arts Facilities

➢ Issues

The Marin Center needs to be preserved and enhanced.

a) A survey found that many Marin residents would like the Marin Center to become a community cultural center, but that the resources of the center are not available to them.

b) The Marin Center structures and facilities need to be more versatile to easily accommodate users' needs.

c) Multicultural programs at the Marin Center are important and need to be enhanced.

Improved arts and culture facilities are needed.

a) It can be expensive to rent space for artistic and cultural events in the county. There is a need for more public-private partnerships that allow small groups to utilize facilities for the arts and culture. Many County–controlled facilities could be utilized to bring cultural events to communities underserved by typical cultural events.

b) The preservation of existing buildings is needed to create cultural centers for communities. Renovation of older theaters in downtown San Rafael and Novato is proving to be successful.

c) Space is needed for community art and cultural centers in local neighborhoods. Schools could be more fully utilized as locations for artistic and cultural expression.

➢ Strategies

Promote and enhance the Marin Center.

a) Prepare a plan to improve facilities through renovation, joint use, and development of new facilities if necessary.

b) Adhere to a regular schedule of inspection and maintenance of Marin Center facilities to ensure that high standards of safety, quality, appearance, comfort, and customer satisfaction are met.

c) Look to other funding sources, in addition to the County general fund, to finance improvements to the Marin Center.

d) Participate in studies for capital improvements for the Marin Center to make the facility as suitable as possible for the performing arts.

Promote and enhance arts and cultural facilities throughout the county.

a) Set up and maintain an inventory of cultural facilities in the county that are suitable for performances, exhibitions, rehearsals, or studio or classroom space, and assess the needs of cultural groups. Seek opportunities to utilize regional arts facilities.

b) Evaluate availability of rehearsal, performance, and studio space for local artists and multicultural events, and consider ways the County can facilitate the provision of space. Encourage existing and new businesses, churches, utility companies, and others to allow use of their facilities by community groups.

c) Determine the desirability and feasibility of constructing a warehouse for arts and theatrical storage to address both space and expense issues.

d) Determine the desirability and feasibility of constructing an arts or natural history museum, possibly at the Marin Civic Center or as part of a San Quentin reuse project, with a focus on art education.

➢ Sample indicators

a) Annually survey Marin Center users to determine if the Marin Center facilities are adequately meeting their needs (Marin County Department of Parks, Open Space, and Cultural Services).

b) Annually track the number of cultural and arts events in Marin facilities (Marin County Department of Parks, Open Space, and Cultural Services).

➢ Sample targets

a) Attain 75 percent user satisfaction at the Marin Center by 2010.

b) Increase facility use for cultural and arts events by 20 percent by 2020.

3. Archeological Resources

➢ Issues

We need to better preserve and protect Marin's archeological and historical resources.

a) The County lacks an updated archeological plan, which hinders the ability to preserve and protect archeological and historical resources.

b) The County lacks sufficient policies about archeological resources.

c) The reliability of current information on archeological resources varies. The exact size and distribution of each known archeological resource site is not well defined.

d) Many of the archeological resources in Marin are in a degraded condition.

➢ Strategies

Identify policies and programs to protect archeological and historic resources.

a) Update the County's archeological-sensitivity map. Develop a historical preservation plan, and consider establishing a Historical Preservation Commission.

b) Develop guidelines for preservation of the exterior design elements of structures of local historical or architectural interest as well as historic trees and landscapes. Include in the development-review process additional consideration of historical, cultural, and Native American concerns.

c) Ensure that field surveys yielding specimens or finds will be evaluated by qualified historians for archeological significance. Refer development proposals that may adversely affect archeological sites to the California Archaeological Inventory. Develop an ordinance to secure temporary delays on the alteration or demolition of designated cultural resources until their preservation or protection can be fully explored.

d) Conduct a survey and evaluation of existing archeology resources every three years. Maintain confidentiality regarding the location of archeological sites in order to protect these resources from vandalism and the unauthorized removal of artifacts.

e) Improve access to unrestricted archeological resources and improve interpretation of archeological history.

f) Encourage the inclusion of significant sites in the Federal or State Historical Register based on the recommendation of local historical societies.

Collaborate with others to protect archeological and historical resources.

a) Encourage and cooperate with the private sector in the implementation of innovative techniques to preserve archeological and historic sites by gifts, private conservancies, and easements. Publicize opportunities and incentives for historical preservation to owners of historic buildings.

b) Continue to assist owners of historic homes in lower-income areas with low-interest loans through Community Development Block Grants (CDBG), when available.

c) Cooperate with Native American representatives and local historical societies to protect significant archeological, cultural and historical artifacts.

Educate the community about archeological and historical resources.

a) Work with the public, the private sector, and community organizations to increase awareness of, protect, and enhance the county's historical resources.

b) Increase public awareness of local history through publications, sponsorship of events, dissemination of resource materials, a speakers bureau, displays, and commemorative plaques.

c) Provide for the placement of historical markers on county roadways to attract and inform visitors of important historical resource sites.

d) Promote historical resources as major contributions to the quality of life, as well as to cultural and economic vitality.

Expand funding opportunities for archeological and historical resources.

a) Increase financial incentives to encourage rehabilitation and restoration of archeological sites.

b) Encourage and promote legislation to provide tax incentives to encourage the rehabilitation of historical resources, including tax credits and tax abatements.

Support historical preservation programs that are holistic in scope.

a) Strive to interpret history and cultural heritage in the most inclusive sense by reaching across barriers of race, ethnicity, religion, class, and income.

b) Seek to protect not only historical resources themselves, but their context in the larger community by ensuring that preservation of significant structures is not limited to preservation of a building's "skin" without adequate consideration of its other component parts and history.

c) Support preservation strategies that respect the heritage, context, design, and scale of older neighborhoods while recognizing the evolution of a neighborhood's built form.

d) Become a Certified Local Government (CLG) by applying to the State Department of Historical Preservation.

e) Adopt and maintain a landmarks ordinance. Modify the zoning regulations to allow "adaptive reuse" of landmark properties.

f) Inform title companies that properties in Marin may be affected by historical preservation regulations.

g) Ensure the protection and preservation of artifacts in known and as-yet-unidentified areas through protective policies.

➢ Sample indicators

a) Number of known archeological and historical sites (Marin County Community Development Agency).

b) Number of community exhibitions or events with an archeological or historical focus (Marin County Department of Parks, Open Space, and Cultural Services).

➢ Sample targets

a) Update the known archeological information base (by revisiting sites to accurately log the exact size and distribution of each archeological resource) by 2020.

b) Increase community exhibitions or events with an archeological or historical focus by 20 percent by 2020.

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APPENDIX 1-N

MARIN COUNTY AGRICULTURAL ECONOMIC ANALYSIS, NOVEMBER 2003

MARIN COUNTY

AGRICULTURAL ECONOMIC ANALYSIS

FINAL REPORT

November 2003

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I. INTRODUCTION/FINDINGS

This report analyzes the economic issues currently facing agriculture in Marin County, with a primary focus on the impact of estate developments on agricultural lands. This analysis is intended to assist County decision-makers in formulating policies and programs that will maintain and support the future of Marin County's agriculture. It provides a background for the Agricultural Element of the General Plan.

This report addresses the following major topics:

- A review of the Baxter-McDonald-Smart study of 1973 – what was relevant 30 years ago, what is still relevant;
- Analysis of the impact of large estates on agricultural viability, including:
  - Costs and income of undeveloped agricultural land;
  - The impact of residential development on costs; and
  - Analysis of the current state of County-wide agricultural lands.
- Farm economics issues, addressing the key issues facing:
  - Organic vegetable farms;
  - Vineyards;
  - Dairies; and
  - Livestock operations
- Fiscal analysis – what are the County government costs and revenues attributable to agriculture.

Key Findings:

Baxter, McDonald & Smart Review: The major problem in 1973 was that agricultural lands were subject to speculation for subdivision into suburban housing. Today, the major issue is high value estate development. The concern, however, is similar - that land costs can be driven up beyond agriculture's ability to pay, thus discouraging maintaining agricultural use.

Impact of Large Estates:

- Grazing land under Williamson Act contract *without* residential improvements brings in more income for agricultural leases than the estimated costs of land ownership. Net income (not including debt service for land purchase) ranges from $7.46 to $21.23 per acre depending on parcel size.
- Adding high value residential development drives up land ownership costs beyond what agricultural income can cover, usually by large orders of magnitude (depending on parcel size and extent of improvements).
- On five case study parcels, proposed developments would shift the cost/income balance to large shortfalls in all but one case.
- Landholding costs far in excess of the potential agricultural income will, in the long term, be a disincentive to continued agricultural operations.
- County ranches over 60 acres account for 85% of the privately-owned agriculturally-zoned land. Of that, 14% of the acreage is assessed at values over $2,000 per acre. The three ranches assessed at over $14,000 per acre represent only 5% of the private agriculturally-zoned ranch acreage but 59% of the total assessed value (AV).
- Fortunately, the 86% of over 60-acre ranches with values ranging from $55 to $2000 per acre have estimated costs well below average lease rates for grazing land.
- It is timely for policy makers to develop approaches that will protect agricultural use from "gentrification" into non-productive estates.

Farm Economics:

- Organic Farms - Analysis of a hypothetical organic farm operation in Marin County shows that almost all crops can be profitable based on current estimated average costs and income. The most critical variable is successful marketing of products.
- Vineyards – Based on current estimated average costs and income, a Marin County vineyard should be profitable after four years. Value added for producing wine as part of the operation can ensure a market for the grapes and substantially increase potential profits.

- Dairies – While the number of dairies and cows in the County has decreased, milk output has increased. The County's dairies can benefit from value added products (such as cheese and yogurt), but face challenges of cost and availability of pasturelands.
- Livestock – The main operations are for raising cows and calves. Two operators are finding a niche in the higher-priced grass fed beef market.

Fiscal: Marin County agriculture contributes a significant net surplus to the County general fund of $1.3 million annually. Additionally, property taxes from agriculture generate almost $10.3 million annually to education and other County funds.

Note that almost 75% of the assessed value is from agricultural parcels under 60 acres in size. Large ranch holdings contribute relatively little in property taxes but also require less County services.

II. BAXTER-MCDONALD STUDY REVIEW

Thirty years ago, Marin County undertook a thorough review of its policies relating to agriculture. The goal was to protect and support the County's farmlands, which were increasingly endangered by urban/suburban development and speculative land values.

As part of that review, Baxter, McDonald and Smart Inc. conducted an analysis, dated September 1973. The 1973 report summarized the key issues as follows:

> "The question of the viability of agriculture in Marin is, simply stated, whether or not a rancher can and will stay in business or whether others will enter agriculture over the foreseeable future... We have determined that it is possible to make a living from ranching in Marin at the present time....
>
> "Whether a rancher will stay in business can best be described as an uncertainty over the land use – residential or agricultural – that will be predominant in west Marin in future years. Because of the potential value of these lands for residential development, making management decisions which commit the land to continued agricultural use means forgoing possible large capital gains from its sale for development purposes. The possibility that increased densities will be permitted in west Marin, however uncertain, has led many ranchers to regard their operations in an interim fashion: they put in enough work to cover their expenses and taxes while waiting for an optimum time when they can sell or develop.
>
> "Even those who do not wish to sell or develop are affected by the uncertainty. Due to the incompatibility of agriculture with high-intensity development, these ranchers are uncertain about their future prospects in the event that development is permitted. Their uncertainty makes them hesitant about taking on long-term loans for necessary capital improvements.
>
> "However, the analysis of economic and social attitudes done during the present study leads to the conclusion that:
>
> GIVEN SOME ASSURANCE THAT RURAL MARIN WILL BE PROTECTED FROM INCOMPATIBLE DEVELOPMENTS AND THAT PRIORITY IS GIVEN TO THE NEEDS OF AGRICULTURE WITHIN ITS REALM, PEOPLE WILL CONTINUE TO RANCH IN MARIN OVER THE FORESEEABLE FUTURE."

The Baxter, McDonald, and Smart report also noted that, even if marginal revenues from farming are not equal to marginal costs, there are other non-economic reasons

for farmers to maintain their operations in Marin, such as the environmental beauty, carrying on family traditions, and enjoying the community of family operated ranches.

In addition, the Baxter, McDonald & Smart report made recommendations, summarized as follows:

> "1. The County should improve its ability to assist ranchers in making necessary ranch improvements...
> "2. The County should adopt policies designed to ensure that any rural residential development is compatible with its agricultural neighbors.... Development rights should be purchased [where necessary].
> "3. Alternative land uses of both agricultural and recreational natures are available and should be encouraged [as] a more viable alternative than residential development in terms of agricultural compatibility."

Looking back over the 30-year time period since 1973, it is on the one hand gratifying to see how effective the County's policies have been in maintaining its agricultural land and economy, and on the other hand ironic that the issues in 2003 are almost identical to those faced in 1973.

The County has achieved success in consistent application of large lot sizes and agricultural use zoning, removing much of the speculative value increases - not to mention residential subdivisions - which would have otherwise occurred. This has been coupled with the effective program of Marin Agricultural Land Trust (MALT) to purchase agricultural open space easements and lease-back arrangements from the Point Reyes National Seashore and Golden Gate National Recreation Area (GGNRA) guaranteeing long-term agricultural use. In addition, the County continues to offer support to farmers, such as in meeting environmental regulations, making farm improvements, and developing marketing strategies.

What was not anticipated 30 years ago was that some landowners or buyers would use large agriculturally-zoned parcels essentially for estate development. High-value residential development keeps the large acreage intact, but it undermines the economics and the "will" to maintain agricultural use. This new (but similar) challenge is the major focus of this 2003 report.

III. IMPACT OF LARGE ESTATES ON AGRICULTURAL VIABILITY

The major problems identified in 1973 were that agricultural lands were subject to speculation for development rather than farming value. Today, the speculation is not so much for subdivision into suburban housing but is for high value estate development. The concerns are the same, however:

- Land costs can be driven up beyond agriculture's ability to pay for the taxes, insurance and maintenance costs association with the land;
- New estate owners may not be interested in making long-term investments in agricultural improvements, or even accommodating agricultural use; and
- There can be land-use conflicts between non-agricultural residents and commercial agricultural operations.

Viability of agricultural use still rests on whether the farmer or rancher can and will stay in business and whether others will enter into agriculture in the foreseeable future.

In this section we will look at:

- the costs and income of grazing land without residential improvements;
- the impact residential development has on the cost/income balance (based on average cost and income factors as well as specific case study parcels); and
- the current status of agricultural parcels county-wide.

A. Costs and Income of Agricultural Land

Livestock grazing land, which represents over 90% of the County's agricultural acreage, has fairly constant costs and returns per acre. Much of this land is hilly and unirrigated; its basic value is for growing grass, which can support a fairly predictable number of sheep or cows, which in turn provide income to the rancher from wool, meat, or dairy sales. Up until recently, there has been a balance, on average, between land ownership costs and agricultural income, helping to keep Marin County's grazing lands in productive use.

Table 1 estimates and compares the land costs and income from hypothetical average agricultural parcels of various sizes (without non-agricultural improvements). The major costs associated with the agricultural use of these lands include:

- Property taxes;
- Insurance; and
- Fence maintenance.

These are discussed below.

1. Property Tax: A large proportion of Marin's agricultural acreage is under Williamson Act (Land Preservation Act) contract, which limits the Assessor's evaluation to the agricultural value, rather than potential market value, of the land. The Assessor uses a conservative lease rate of $21 per acre for grazing lands. The Assessor calculates the capitalized value of that lease rate annually. For this analysis, we used a 3-year average of 7%, plus 1% risk and 1% property tax, for a capitalization rate of 9%. Based on that capitalization rate on annual lease income, the assessed value (AV) averages $233 per acre, for a tax cost of $2.33 per acre.

2. Insurance: According to knowledgeable insurance brokers, insurance for unimproved grazing lands can range from $500 for a 60-acre parcel up to $2,000 for a 2,000-acre parcel. The cost per acre decreases as parcel size increases, as estimated in the footnote of Table 1.

3. Fence Maintenance: A major expense for landowners for grazing operations is installing, repairing and replacing fencing. In the footnote of Table 1 we estimate the costs based on square parcels with cross fencing of 40-acre pastures. Assuming fencing costs at $4 per linear foot, with replacement required every ten years, fence costs will average $0.40 per linear foot per year. Smaller parcels have more linear feet of fencing per acre than larger parcels. Thus cost of fence maintenance can vary from an estimated $11.88 per acre for a 60-acre parcel down to $5.10 per acre for a 2,000 acre parcel. Actual costs vary based on the parcel's shape, the amount of cross fencing, the level of maintenance, and the quality of the fencing.

The total of these three major cost factors ranges from $22.54 per acre for a 60-acre parcel down to $8.43 per acre for a 2,000-acre parcel. (We have not included other costs such as water development or utilities which could vary widely by parcel.)

The income attributable to land can be either from the landowners' own grazing operations or from leasing their land to a ranch operator. The going lease rates in Marin range from $20 to $35 per acre for grazing land; we have used an average of $30 income generated per acre. It should be noted that lease rates will vary widely depending on factors such as slopes, soils, accessibility, size of parcel, and length of lease.

Comparing estimated costs with income, we see in Table 1 that grazing land without residential improvements can generally bring in more income than it costs. Even on a small hypothetical 60-acre parcel, costs of $22.54 per acre are exceeded by lease income of $30.00 per acre, for a net income of $7.46 per acre, or $447 annually for the parcel. For larger parcel sizes, the total costs per acre are reduced, and thus the net income per acre increases. For example a 400-acre parcel is estimated to generate a net income of $18.40 per acre or $7,359 for the whole parcel. A 2,400-acre parcel would have a net income of $21.23 per acre, or a total of $50,961 for the parcel.

Both the costs and potential income from grazing use of unimproved agricultural land are fairly fixed. The rancher may be able to improve income to some degree through skilled operations, capital investments, effective marketing and value-added products. Unpredictable weather, disease or the overall economy could also affect costs and income. These factors, however, are overshadowed by the impact of residential development.

B. Impact of Residential Development

The major wild card in the agricultural land cost/income balance is property value increase for new residential improvements. High-value estate development on the County's agricultural lands drives up the land ownership costs for both property taxes and insurance. This can tip the scales so that the cost of land ownership exceeds (by orders

of magnitude) what the agricultural income can cover. This may result in the owner of the new estate having little motivation to continue the traditional grazing use.

It should be noted that some owners of high value improved parcels may maintain agricultural use, even with little economic incentive to do so, because of other factors, such as family tradition and the esthetics of a pastoral setting. From an economics viewpoint, however, if agricultural income is no longer significant in offsetting ownership costs, the agricultural use becomes less likely, especially into the future as high-value parcels change ownership.

1. Potential Impact Analysis

Table 2-A estimates the increased assessed value and landowner's costs from a range of potential residential developments. The costs depend largely on the size of the residential development, so we have analyzed a range from an 1,800 sq. ft. to a 14,000 sq. ft. development (which could include one or more guest houses in addition to a main residence). The County Assessor uses a construction cost for housing of $175 per sq. ft. Other structural improvements (e.g. barns, garages) are estimated at an average of 50% of residential value, based on data from the case study (discussed below). In addition, we estimate that the site of the residence plus land-related improvements (e.g. driveways, well, septic systems) will add $300,000 per developed acre to total value. In all, the property value increase ranges from $772,500 for a 1,800 sq. ft. residence up to $6.1 million for a 14,000 sq. ft. development.

The estimated added costs to the landowner of these improvements include:

- Property tax, at 1% of the added value; and
- Insurance, at 0.2% of the added value.

Thus annual costs of land ownership for the added residential development range from $9,270 for a 1,800 sq. ft. home up to $72,900 for a 14,000 sq. ft. residential development.

Table 2-B spreads these added costs on a per acre basis to the entire parcel. The smaller the parcel, the higher the cost per acre will be for the residential development. For example, the 1,800 sq. ft. development would add annual costs of $155 per acre to a 60-acre parcel, compared to $4 per acre on a 2,400-acre parcel.

Finally, Table 2-C shows the impact of adding these residential-related land costs to the net lease income of undeveloped agricultural land (from Table 1). As noted above, without non-agricultural improvements, all parcel sizes had a positive net income, with a higher profit margin for larger parcels. When the ownership costs of large estate development are added, costs overwhelm potential income in most cases. The discrepancy between costs and income can be by orders of magnitude. For example:

- On a 60-acre parcel, even a moderate 1,800 sq. ft. residence results in costs exceeding income by $147 per acre.
- On a 400-acre parcel that would net $18.40 income per acre for agricultural use, adding a 7,000 sq. ft. residential development results in an $73 per acre net cost;
- On a 200-acre parcel, a 14,000 sq. ft. development results in a net cost of $349 per acre.

The scenarios that are close to break-even or still show a net income are the moderate 1,800 to 3,500 sq. ft. residences on larger parcels and the 7,000 sq. ft. development only on the largest 2,400-acre parcel size.

2. Case Study Parcels

While the foregoing discussed hypothetical cases, Table 3 shows the actual proposed (or in one case completed) developments on five case study parcels. These sample parcels, identified by the Planning Department, are proposed for (or have recently added) substantial improvements. They range in size from 60 to 845 acres. For each sample parcel, we describe:

- the existing unimproved land value;
- the proposed added value to land and structures; and

- the costs and agricultural income balance prior to and after the proposed improvements.

As summarized in Table 3-A, the assessed value of these sample case study parcels before and after improvements ranges widely:

- For the 60-acre Matthews parcel, before improvements assessed value (AV) is $6,468 per acre; after improvements it would be $25,344 per acre.
- For the 100-acre Moritz parcel, the $12,427 per acre existing land value rises to $27,309 per acre after improvements.
- For the 210-acre Hansen-Brubaker parcel, base land is valued at $4,024 per acre, rising to $9,362 per acre after improvements.
- For the 446-acre Patrick Brennan parcel, the land is valued at $432 per acre, rising to $1,629 per acre with the recently completed development.
- For the 845-acre Hick's Mountain Ranch parcel, the base land is valued at $1,558 per acre. After improvements, this would rise to $12,845 per acre.

Note that the scope of proposed improvements also ranges widely:

- A modest 1,850 sq. ft. residence on the Patrick Brennan parcel;
- Mid-range 3,500 to 4,000 sq. ft. residences with varying amount of related improvements on the Matthews, Moritz, and Hansen Brubaker parcels; up to
- Eight residences totaling 33,200 sq. ft. plus related improvements for the large Hick's Mountain Ranch parcel.

Each of the case study parcels and their proposed developments are described in detail in Appendix A. Appendix A also compares the total developed assessed values of these parcels with other parcels of similar size and zoning, illustrating that proposed high value improvements far exceed typical current values in the County.

Table 3-B compares the before and after improvement land costs with potential agricultural income on a per acre basis. The land costs included in this analysis are property tax, insurance (for both land and improvements), and fencing, using the same factors as Tables 1 and 2 above.

Before improvements, the parcels range from small net incomes to significant net costs. After proposed improvements, however, all of the parcels have costs exceeding potential agricultural income.

- Hick's Mountain Ranch goes from above break-even net income of $6 per acre to a net cost of $143 per acre after improvements.
- Patrick Brennan goes from a net income of $15 per acre to a small net cost of $7 per acre.
- Hansen-Brubaker is below break-even, at a net cost of $21 per acre, without development, but goes to a net cost of $103 per acre after development.
- Moritz has the highest pre-improvement costs, at $106 per acre, which would double to $332 per acre after development.
- Matthews, with a net cost of $47 per acre before improvement, rises to $307 net cost after improvement.

While these landowners may choose to sustain higher annual costs for the benefits of their rural estate lifestyle, landholding costs in the range of three to ten times the potential agricultural income will, in the long term, be a disincentive to continued agricultural operations.

C. Current Status of County-Wide Agricultural Lands

High-value residential developments adversely impact agricultural viability, both in theory and in current specific cases. This section looks at the County Assessor's data to determine how much land has already been affected and recommends corrective measures.

Table 4 shows Countywide Assessor's data on public and privately-owned lands designated for agriculture. Of the total 173,119 acres, just over 41,000 are publicly owned. Much of this acreage is leased for grazing, contributing substantially to the County's agricultural economy. Because of its public ownership, however, it is not threatened by

residential development. We will therefore focus on the 132,000 acres of privately-owned agriculturally-zoned lands.

As shown, parcels under 60 acres account for about 9% of the privately-owned agricultural lands while representing almost 75% of the assessed value. Much of this is due to residential value on these small parcels. About 5% of the privately-owned acreage and assessed value is in separate parcels over 60 acres in size. The lion's share (85%) of privately-owned acreage (112,436 acres) is in identified ranch units over 60 acres, often comprising several Assessor's parcels. These ranches are the most significant for purposes of protecting the County's grazing land.

Table 5 and 6 further analyze the 112,436 acres of Marin County ranches. As shown in Table 5-A, these 209 ranches range from 60 to 2,500 acres in size, with most (80%) from 200 to 1,600 acres. Generally, the larger sized ranches have a lower assessed value per acre. For example, the 1,200 to 1,600 acre ranches, with 16% of the acreage, represent less than 4% of AV, at an average of $537 per acre. The 100 to 200 acre ranches, in contrast, have an average AV of $2,308 per acre.

The exception to this picture is the largest sized ranches. These seven ranches, with 14% of the ranch acreage, account for almost 57% of the assessed value, at an average of almost $9,000 per acre. This anomaly is due to two ranches with high value large-scale developments, disproportionate to grazing land values.

As discussed above, the landowner's annual costs for such lands include property taxes, fence maintenance and replacement, and land-related liability insurance. Table 5-B estimates the average land costs as they apply to these various ranch sizes. The combination of property tax, insurance and fencing costs range from almost $78 per acre for the smaller 60 to 100 acre ranches down to only $12 per acre for the 1,200 to 1,600 acre ranches. From 200 acres through 1,600 acres, the estimated costs per acre are less than average lease rates of $30 per acre. Again, the largest ranches are anomalous, with costs over $104 per acre due to the two ranches with unusually high assessed values.

Table 6 looks at the same 112,436 acres of ranches grouped by their average assessed value per acre. Here we find that 86% of the acreage is assessed at between $55 and $2,000 per acre. The three ranches with the highest average values (over $14,000 per acre) account for 5% of the acreage but almost 59% of the total AV. The 37 ranches that range from $2,000 to $14,000 per acre represent an additional 9% of the acreage and 18% of the total AV.

Table 6-B shows the impact of estimated costs per acre for property tax, insurance and fencing to these ranches. In a nutshell, for the 86% of the ranch acreage valued at under $2,000 per acre, estimated costs are significantly below average lease rates of $30 per acre. (Again note that actual lease rates vary based on soils, slopes, access, lease length and other factors.) Ranches valued between $2,000 and $4,000 per acre (another 6% of the acreage) are on the margin, with costs of $42 per acre somewhat exceeding the average $30 per acre lease rate. In contrast, ranches from $4,000 to $14,000 AV per acre have costs of almost $100 per acre; and the three ranches of over $14,000 AV per acre have costs over $310 per acre.

So far only a limited number of the County's agriculturally-zoned ranches (8% of the privately-owned ranch acreage) are affected by high value development that overwhelms potential income for grazing use. Keeping land values (and thus costs) in balance with agricultural income is critical to maintaining long-term agricultural viability. Fortunately, this problem is being addressed at an early stage. Just as the County was able, through zoning and other policies and support efforts, to reduce land speculation for subdivision of agricultural lands, it is timely to develop approaches that will again protect and stabilize agricultural use from "gentrification" into non-productive estates.

County policy-makers should explore approaches to maintaining an "agriculture-friendly" ratio of land costs to lease income. Such approaches may include:

1. Define a reasonable ratio of lease income to land related costs, including placing a ceiling on the value of non-agricultural improvements. The economic analysis above could be applied on an area-specific basis to determine income and cost factors in order to limit

the impact of proposed new development, or an overall ceiling could be placed on the size of farm residences. The acceptable level is a policy decision that balances the long-term economic viability of agricultural use with the expectation of landowners to build a livable residence on a ranch.

2. Other measures to enhance long-term agricultural viability could include installing agricultural improvements, such as water development, land leveling (if appropriate) and financing animal waste disposal or watering facilities. If appropriate to the site and soil capacity, higher value crops such as vine or vegetable acreage could be developed. The landowner could also finance annual agriculture-related costs such as weed control, access roads, and fence maintenance.

Table 1: Land Cost vs. Lease Income

	< - - - - - - - - -		Per Acre	- - - - - - - - - - -		- - - >	Per Ranch
Ranch size	Insurance (1)	Fence cost (1)	Prop. Tax (2)	Total Land Cost	Lease Income	Net Income per Acre	Net Income Total
60	$8.33	$11.88	$2.33	$22.54	$30.00	**$7.46**	$447
100	$6.00	$10.33	$2.33	$18.66	$30.00	**$11.34**	$1,134
200	$3.50	$8.54	$2.33	$14.38	$30.00	**$15.62**	$3,125
400	$2.13	$7.14	$2.33	$11.60	$30.00	**$18.40**	$7,359
800	$1.25	$6.49	$2.33	$10.07	$30.00	**$19.93**	$15,943
1,600	$0.78	$6.09	$2.33	$9.20	$30.00	**$20.80**	$33,278
2,400	$0.63	$5.81	$2.33	$8.77	$30.00	**$21.23**	$50,961

(1) Insurance and Fencing Costs

	< - Insurance Costs - >		< - - - - - - - -		Fencing Costs - - - - - - -		- - - - ->
Ranch size	Per Ranch	Per Acre	Perimeter	Cross Fence	Total	Cost @$.40/ft	Per Acre
60	$500	$8.33	1,617	165	1,782	$713	$11.88
100	$600	$6.00	2,087	495	2,582	$1,033	$10.33
200	$700	$3.50	2,952	1,320	4,272	$1,709	$8.54
400	$850	$2.13	4,174	2,970	7,144	$2,858	$7.14
800	$1,000	$1.25	5,112	4,620	9,732	$3,893	$6.49
1,600	$1,250	$0.78	5,903	6,270	12,173	$4,869	$6.09
2,400	$1,500	$0.63	6,600	7,920	14,520	$5,808	$5.81

Fence maintenance costs based on square parcels with cross fencing in 40 acre quarter sections
Average $4 per linear foot for replacement fence - 10 year life = $0.40 foot year
Source: Stephanie Larson UC Coop Extension, Sonoma County 707-565-2621.
Insurance Sources:
Larry File, Broker: United International Insurance 559-226-1205
Larry Walsh lwalsh@entertainmentinsurance.com

(2) Property Tax based on Williamson Act Assessment

		Per Acre
Lease rate for land		$21
Capitalization rate		
Income (3 year average)	7%	
Risk	1%	
Property Tax	1%	
Total Capitalization rate	9%	
Capitalized Value		$233
Property Tax @ 1%		$2.33

Source: Nelson Gemmels, County Assessors Office

Table 2: Cost vs. Income With Added Residential

A - Residential Costs

Residential Size in Sq. Ft.	< - - - Residential Size 1,800	3,500	7,000	- - - > 14,000
Residential AV @$175/sq.ft.	$315,000	$612,500	$1,225,000	$2,450,000
Improvements @ 50%	$157,500	$306,250	$612,500	$1,225,000
Residential Land in Acres	1.0	2.0	4.0	8.0
Residential Land AV @$300K/Ac	$300,000	$600,000	$1,200,000	$2,400,000
Total Added AV	$772,500	$1,518,750	$3,037,500	$6,075,000
Costs				
Property Tax @1.0%	$7,725	$15,188	$30,375	$60,750
Insurance @ 0.2% AV (1)	$1,545	$3,038	$6,075	$12,150
Total Added Costs	**$9,270**	**$18,225**	**$36,450**	**$72,900**

B - Added Residential Cost Per Acre by Ranch Size

Ranch Size				
60	$155	$304	$608	$1,215
100	$93	$182	$365	$729
200	$46	$91	$182	$365
400	$23	$46	$91	$182
800	$12	$23	$46	$91
1,600	$6	$11	$23	$46
2,400	$4	$8	$15	$30

C - Net Income vs. Residential. Costs Per Acre by Ranch Size

Ranch size	Net Ranch Income (2)	< - - Ranch Income Less Residential Cost			- - >
60	$7.46	($147.04)	($296.29)	($600.04)	($1,207.54)
100	$11.34	($81.36)	($170.91)	($353.16)	($717.66)
200	$15.62	($30.73)	($75.50)	($166.63)	($348.88)
400	$18.40	($4.78)	($27.17)	($72.73)	($163.85)
800	$19.93	$8.34	($2.85)	($25.63)	($71.20)
1,600	$20.80	$15.01	$9.41	($1.98)	($24.76)
2,400	$21.23	$17.37	$13.64	$6.05	($9.14)

(1) Strong Associates estimate of insurance costs

(2) Net Income per Acre from Table 1.

Table 3: Case Study - Lease Income to Cost Analysis

A- Parcel Description

	A	B	C	D	E
Name	Matthews	Moritz	Hansen Brubaker	Patrick Brennan	Hick's Ranch
Parcel #'s	121-120-31	188-90-13	106-220-22	106-110-1	121-10-1 121-10-3
Parcel Size in Acres	60.0	99.5	209.6	446.0	845.2
Land Value					
Existing	$368,069	$1,237,114	$843,654	$192,451	$1,316,672
Residential Acres	1.0	1.0	1.0	1.0	10.0
Added Land AV	$300,000	$305,000	$344,400		$2,600,000
Improvement Value					
Residential Sq. ft.	3,588	4,100	3,449	1,850	33,200
Residential Value	$536,200	$703,000	$603,575	$323,750	$5,810,000
Related Improvements	$294,395	$473,448	$170,960	$210,414	$1,129,600
Total Improvement Value	$832,595	$1,176,448	$774,535	$534,164	$6,939,600
Total Land + Improvements	$1,520,664	$2,718,562	$1,962,589	$726,615	$10,856,272
B - Costs/Income					
Existing Land Costs/Income per Acre					
Land Value / Acre	$6,468	$12,427	$4,024	$432	$1,558
Property Tax Cost	$65	$124	$40	$4	$16
Land Insurance Cost (1)	$8	$8	$6	$6	$4
Fence Cost (1)	$12	$12	$10	$10	$9
Total Costs	$77	$136	$51	$15	$24
Lease Income	$30	$30	$30	$30	$30
Net Costs/Income	**($47)**	**($106)**	**($21)**	**$15**	**$6**
Ratio of Lease Income to Total Costs	2.6	4.5	1.7	0.5	0.8
Costs/Income With Improvements per Acre					
Land plus Improvement Value / Acre	$25,344	$27,309	$9,362	$1,629	$12,845
Property Tax Cost	$253	$273	$94	$16	$128
Improvement Insurance Costs (2)	$63	$68	$23	$4	$32
Land Insurance Cost	$8	$8	$6	$6	$4
Fence Cost	$12	$12	$10	$10	$9
Total Costs	$337	$362	$133	$37	$173
Lease Income	$30	$30	$30	$30	$30
Net Costs/Income	**($307)**	**($332)**	**($103)**	**($7)**	**($143)**
Ratio of Lease Income to Total Costs	11.2	12.1	4.4	1.2	5.8

(1) From Table 1
(2) From Table 2

Table 4: County-Wide Agricultural Zoned Land

	Acres	% of Acres	Assessed Value	Per Ac Value	% of AV
Publicly Owned Ag Land					
Parcels under 60 acres	9,396				
Numbered Ranches over 60 acres	31,667				
Subtotal	**41,063**		$0		
Privately Owned Land					
Parcels under 60 acres	12,208	9.2%	$943,336,182	$77,272	74.6%
Parcels over 60 acres	7,412	5.6%	$66,924,280	$9,029	5.3%
Numbered Ranches over 60 acres	112,436	85.1%	$253,887,412	$2,258	20.1%
Subtotal	**132,056**	100.0%			100.0%
Total	**173,119**		$1,264,147,874	$7,302	

Source: County Assessor's Office

Table 5: County Wide Ag Land - Ranches Sorted by Size

A - Description of Ag Ranches

< - Ranch size - > From	To	Total Ranch Count	Total Acres	% of Total Ac	Average Ranch size	Assessed Value Total	% of Total AV
60	100	9	731	1%	81	$4,001,764	1.6%
101	200	39	5,887	5%	151	$13,590,034	5.4%
201	400	67	19,693	18%	294	$26,888,928	10.6%
401	800	49	28,483	25%	581	$42,259,685	16.6%
801	1,200	25	23,632	21%	945	$13,897,997	5.5%
1,201	1,600	13	17,952	16%	1,381	$9,648,650	3.8%
1,601	2,500	7	16,058	14%	2,294	$143,600,354	56.6%
Total All Parcels		209	112,436	100%	538	$253,887,412	100.0%

B - Estimated Costs per Acre

< - Ranch size - > From	To	AV	PropertyTax @1.1% of AV	Insurance(1)	Fencing	Total Costs Per Acre	Est. Net Income (2)
60	100	$5,474	$60.22	$6.63	$10.90	$77.75	($47.75)
101	200	$2,308	$25.39	$4.19	$9.19	$38.77	($8.77)
201	400	$1,365	$15.02	$2.45	$7.70	$25.17	$4.83
401	800	$1,484	$16.32	$1.57	$6.52	$24.41	$5.59
801	1,200	$588	$6.47	$1.29	$5.87	$13.64	$16.36
1,201	1,600	$537	$5.91	$1.01	$5.45	$12.38	$17.62
1,601	2,500	$8,943	$98.37	$0.84	$4.98	$104.19	($74.19)

(1) Insurance costs for land only. Does not include improvement value insurance.

(2) Assumes an average lease income of $30 per acre.

Table 6: Ranches Sorted by Assessed Value per Acre

A - Description of Ag Ranches

< - Per Ac AV - >		Ranch	Total	% of	Average	AV Total	% of AV
From	To	Count	Acres	Total Ac	Ranch size		
$55	$200	27	17,744	16%	657	$2,730,616	1.1%
$201	$400	33	23,209	21%	703	$7,022,128	2.8%
$401	$600	28	16,168	14%	577	$8,110,997	3.2%
$601	$800	26	14,458	13%	556	$9,754,849	3.8%
$801	$1,200	25	13,447	12%	538	$13,698,013	5.4%
$1,201	$2,000	30	11,465	10%	382	$17,300,244	6.8%
$2,001	$4,000	19	6,775	6%	357	$19,604,939	7.7%
$4,001	$14,000	18	3,801	3%	211	$26,613,621	10.5%
$14,001	$33,000	3	5,370	5%	1,790	$149,052,005	58.7%
Total All Parcels		209	112,436	100%		$253,887,412	100.0%

B - Estimated Costs per Acre

< - Per Ac AV - >		AV	PropertyTax	Insurance(1)	Fencing	Total Costs	Est. Net
From	To		@1.1% of AV			Per Acre	Income (2)
$55	$200	$154	$1.69	$1.47	$6.10	$9.27	$20.73
$201	$400	$303	$3.33	$1.44	$6.04	$10.81	$19.19
$401	$600	$502	$5.52	$1.57	$6.34	$13.43	$16.57
$601	$800	$675	$7.42	$1.62	$6.35	$15.39	$14.61
$801	$1,200	$1,019	$11.21	$1.64	$6.40	$19.24	$10.76
$1,201	$2,000	$1,509	$16.60	$1.18	$4.16	$21.94	$8.06
$2,001	$4,000	$2,894	$31.83	$2.43	$7.95	$42.21	($12.21)
$4,001	$14,000	$7,002	$77.02	$5.18	$15.28	$97.48	($67.48)
$14,001	$33,000	$27,755	$305.31	$0.91	$5.12	$311.34	($281.34)

(1) Insurance costs for land only. Does not include improvement value insurance.

(2) Assumes an average lease income of $30 per acre.

IV. FARM ECONOMICS ISSUES

Marin County had 133,444 acres of land in agricultural use in 2000, according to the U.S. Department of Agriculture. Of this, 177 acres were in vegetable and non-grape fruit production, 94 acres were in vineyards, 6,065 acres were used for livestock feed crops (hay and silage), and the remaining acreage was used as pasture for livestock grazing.

This section of the report will focus on four components of the County's agriculture:

- Organic vegetable farms;
- Vineyards;
- Dairy operations; and
- Livestock operations.

A. Organic Vegetable Farming

Both cost and revenue estimates vary widely based on a variety of factors, including some beyond control (such as weather and national economy) and some partially controllable (such as regulatory costs, erosion or crop damage, and marketing success). See Appendix B-1 for a detailed cost/income analysis of a hypothetical 40-acre organic farm with a variety of different crops. The analysis shows that almost all crops can be profitable based on current estimated average costs and income.

On the cost side, most growers own their own land and (until a change of ownership occurs) are not adversely impacted by annual land costs. We estimate annual rent or ownership cost at $400 per acre, or $250 per crop-acre. Some farmers lease land in this cost range. Much of the cropland is adjacent to wetlands that cannot be developed. Limited acreage is available.

The proximity to creeks, wetlands or publicly owned lands makes many of these farms subject to strict regulations by a variety of government agencies, including both State and federal fisheries, wildlife, and water quality agencies. In some cases, the

requirements of these agencies can be at cross-purposes with the County's goals of protecting and supporting agriculture, forcing farmers to make large capital investments or simply to stop their operations altogether.

Potential income from each crop varies widely depending both on the yield and the price per unit. Clearly these are the biggest variables in the economic performance of each crop and the overall farm.

In the past, Marin County's organic growers had a secure market niche that included fairly large retail outlets such as Whole Foods. Unfortunately for the small-scale farmers, organic production has now become a big business, with large commercial farms supplying an increasing share of the market, at highly competitive prices.

The growers and Marin County's policy makers will need to work creatively together to help keep these farms viable. Some of the marketing strategies that should be aggressively pursued include:

- Direct marketing, possibly through a collective broker, to consumers, restaurants, and farmers' markets;
- Expanding direct sales to new markets, for example to local schools, hospitals and senior residences;
- Establishing a collective permanent farmers' market and marketing; and
- Educating local residents on the advantages of buying locally.

B. Vineyards

Marin County currently has limited acreage in vineyards, 94 acres in 2000, compared to its neighbors to the north (Napa, Sonoma, and Mendocino Counties). Vineyards require labor- and capital-intensive investment with no or very low yields for the first three years. After that period, they can be very profitable but, as with any crop, are subject to fluctuations in demand and price. Wine grapes have recently experienced a drop in sales income.

Appendix B-2 estimates per acre costs and income over time from a hypothetical 40-acre Marin County vineyard operation. The first three years involve major investments (including land, planting and cultivation, and water) with no or minimal yields. Note that land costs for new and expanding vineyards, estimated at $20,000 per acre (or $1,200 per acre per year), are much higher than for organic farms. By year 4, vineyards should begin producing a small net profit. From 5 on, they show a good annual profit (over $2,000 per acre).

Two Marin wine grape growers are also producing their own wines. This value added agricultural product provides a guaranteed market for the grapes and increases the income to the operator as the prestige of the wine grows.

C. Dairies

Milk and milk products have dominated agricultural sales in Marin for over 125 years. Between 1950 and 2000, however, the number of dairies in Marin County decreased from 200 to 31, and the number of head of dairy cattle decreased from approximately 20,000 to 12,000. Despite this downward trend in dairies and animal numbers, countywide milk production has increased slightly, going from 1.95 million pounds in 1964 to 2.25 million pounds in 2000, due to increased milk production per cow and other improvements in farming practices. About 20% of the Bay Area's milk comes from Marin dairies. (Source: Marin County "Key Trends, Issues, & Strategies Report" December 2002)

In general, Marin County dairies raise their own heifers (calves up to 2 or 3-years old, before they have their first calf and begin milking), mostly on pasturage. Some heifers may be sold (or bought) to keep the desired number of dairy cows for the operation. A few ranchers have gone exclusively into raising and selling heifers, without running a dairy operation. Once the cows are milking, they are kept in more concentrated areas, fed primarily on imported feed.

Dairies are much more intensive operations than livestock grazing, requiring up to 12 employees for a 200-cow dairy (usually milking twice a day), extensive capital

investments, importing of feed to maintain balanced nutrition and healthy milk production, veterinarian services, good access to transportation, and so forth. While operating costs are higher, so are potential returns. Dairies may pay up to $70 or $75 per acre per year for good pastureland that is convenient to their operation.

Some of the assets of Marin's dairies are:

- A well-established organic dairy business that has a strong and growing market niche;
- The grasslands along the coast have a higher moisture content, minimizing the need for supplemental feed or irrigation;
- The milk and milk products from the coastal grassland-fed cows have a unique flavor that is popular, especially for gourmet cheeses; and
- A few dairies have successfully gone into value added products, primarily cheese and yogurt, that enhance income from their operations.

On the other hand, challenges facing Marin's dairies include:

- Rising land costs for pasture areas on private lands;
- The pasture use of federal lands, for example Pt. Reyes National Seashore, is leased rather than owned, discouraging the long-term investments required to a successful dairy operation.

D. Livestock Operations

Livestock ranches in Marin County are predominantly cow/calf operations. Typically, the rancher maintains a herd of cows that calve every year (usually in early Fall). The calves nurse and graze until June or July when, at an average weight of about 750 pounds, they are sold for beef. One rancher in Sonoma County is doing Spring calving, with a new calf able to reach about 450 pounds by June or July, without requiring as much import feed. Few of the County's ranches buy stockers, that is weaned calves of about 650 pounds, with the goal of grass feeding them to add another 200 pounds per cow.

With a typical Fall calving operation (calves being born from mid-August to mid-October), the rancher will need to import hay from late summer until the grass is ample to feed both the cows and calves. Depending on when the rain starts, this may be from early February to late March. The amount of forage crop can vary widely from year to year based on rainfall and of course also varies with the soil, slope and vegetation conditions of the land. Wildlife grazing can have a minor impact on how much forage is available for the cattle. Grass production can range from about 1,800 to 7,000 pounds per acre per year (some of which is left to protect the next year's crop).

Generally, ranchers need from 6 to 15 acres per head (which includes both cow and calf). Whether from grass or supplemental feed, each animal unit needs about 1,000 pounds of feed per month, or about six tons per year. Imported feed can range from about $60 to $105 per ton depending on quality.

An operation needs a minimum of about 100 head of cattle to have enough calves to make the weight of a truck shipment. A 200-head ranch gives more flexibility for marketing. Thus a viable ranch unit could range from 600 acres (for example in coastal areas where grass is relatively lush) to over 2,000 acres. In this range of 100 to 200 head (with cow and calf counting as one head), one rancher runs the operation single-handedly, with only occasional specialized help. Ranches generally have no employees.

At least two operators are innovating by going into the grass-fed beef market. There is a growing market for grass fed beef, and these products demand a higher price that generally exceeds the increased operating costs. These operations take full advantage of Marin's proximity to a large, relatively wealthy urban area. Most of the grass fed beef is marketed through direct sales either via the Internet or to specialty meat markets and restaurants.

In addition to cattle livestock, some Marin ranchers also raise sheep. This sector, however, has been shrinking due primarily to problems of predators (coyotes) and

international market competition (mostly from Australia and New Zealand). Marin County has an innovative program of paying sheep ranchers (out of the General Fund) to implement non-lethal controls for predators and to reimburse losses due to predators.

It should be noted that a portion of the publicly owned Point Reyes National Seashore is leased for livestock grazing, making a significant contribution to the County's agricultural economy. These leases are based on animal units per month (AUMs), rather than per acre, which allows the public agency to control extent and seasons of use.

V. FISCAL ANALYSIS

In addition to the value of agriculture for food supply, jobs, income, and land management, Marin County's agricultural economy also contributes significantly to County government revenues. As discussed below and shown in Table 5, agriculture generates significantly more revenues than it requires in County costs, yielding a net annual surplus of **$1.3 million** (or $7.50 per farm acre) to the general fund.

In addition, the County's farms contribute $8.1 million in property taxes to education, $1.7 million to fire and utility districts, and over $0.4 million to County Library and Marin Open Space funds.

A. Revenues

The major source of revenue is from property tax. The assessed value of all agricultural lands in Marin County is almost $559 million and the value of improvements on agricultural property an additional $705 million, totaling $1.26 billion in assessed value (AV) in 2001-02. It is interesting to note that parcels under 40 acres in size represent only 6% of the agricultural land acreage but over 70% of the AV. The 94% of the acreage that is in parcels over 40 acres is valued at $350 million, with most of that concentrated in the highest value parcels (as noted above in Table 4).

The total property tax revenue is 1% of the total AV, or $12.6 million annually. Of that, the County general fund receives an average net, after shifts to the education fund, of 18.7% (the actual percentages vary by tax rate area, as detailed in Appendix C). Thus the County receives an estimated **$2,365,000** from this source. In addition, agriculture annually contributes $8.1 million in property taxes to education, $1.7 million to fire and utility districts, and $440,000 to County Library and Marin Open Space funds (shown in Appendix C).

Supplementing the property tax revenue is the State's subvention of taxes from lands under Williamson Act contracts. This adds **$235,000** annually to the County's revenues.

The County's revenue from Cooperative Extension operations includes State and federal subventions, grant funds, and gifts, amounting to almost **$703,000** annually. Revenues generated for the County's Agricultural Commissioner's office include fees for environmental protection/ pest control services and consumer protection inspections, as well as the agricultural share of gas tax revenues, coming to over **$527,000** annually.

In addition, there are an estimated 2,392 residents associated with agriculture – an agricultural work force of 1,415, times the ratio of workforce-to-residents of 1.69 (from George Goldman, Cooperative Extension). Each resident will generate the same estimated per person revenues as all County residents. At an average of $721 per person, this accounts for an additional **$1,724,000** in annual revenues. See Appendix C for a detailed analysis of revenues and costs attributed to population (such as judicial, welfare, and most services) versus land and other sources (such as property tax and business-related sources). Some items (such as sales tax and interest) are split proportionately between population and other sources.

Total annual revenues from agriculture to Marin County's general fund in 2001-02 are thus estimated at **$5.55 million**, as summarized in Table 5. Note that these estimates do not reflect potential cutbacks in local revenues that may result from current State budget shortfalls.

B. Costs

The itemized budget costs directly attributable to agriculture are for:

- The Cooperative Extension support services and grant-funded programs, amounting to **$907,000** in 2001-02; and

- The Agricultural Commissioner's Office pest control, consumer protection, apiary and report services, coming to **$1,068,00** annually.

In addition, the people-related costs of serving agricultural residents (at the $953 per person average of all unincorporated area residents) come to **$2.28 million** per year. (Note that residents of unincorporated areas bear both county-wide costs and added sheriff costs of serving only the unincorporated area. Again see Appendix C for details.)

Total agriculture-related costs are thus **$4.26 million** annually.

Comparing revenues and costs, as shown in Table 5, agriculture yields a **net surplus** of **$1.3 million** annually to the general fund, or $7.50 per acre of agricultural land. In other words, for each $1.00 in costs, agriculture generates $1.31 in revenues.

Table 7: Fiscal Impact of Agriculture on County General Fund

Revenues				
Property Tax Revenue		Assessed Value (1)	Prop Tax @1%	County Total
Land		$558,933,232		
Improvements		$705,214,642		
Total		$1,264,147,874	$12,641,479	
County's Share (1)	18.71%			$2,365,451
Williamson Act Subvention				$235,000
Cooperative Extension (3)				
Federal Subvention			$67,410	
State (University of Cal. Budget)			$369,753	
Gifts			$2,500	
Grants			$262,953	$702,616
Ag Commissioner - Fees for services (3)				
Environmental Protection - Pest control			$313,761	
Consumer Protection & Inspection			$5,503	
Apiary & Reports			$0	
Gas Tax (9265)			$207,416	$526,680
Population Related Revenues		Ag pop (2)	Rev/pop (4)	
		2,392	$720.62	$1,723,558
Total Revenue from Agriculture				**$5,553,305**
Costs				
Cooperative Extension				
Grant Funded programs			$262,953	
Coop Extension Agricultural Support			$644,218	$907,171
Ag Commissioner				
Environmental Protection - Pest control			$959,223	
Consumer Protection & Inspection			$91,588	
Apiary & Reports			$16,922	$1,067,733
Population Related Costs		Ag pop (2)	Cost/pop (5)	
		2,392	$953.45	$2,280,432
Total Cost from Agriculture				**$4,255,336**
Net Revenue from Agriculture		County Ag acres		**$1,297,970**
Revenue per Acre		173,119		$7.50

(1) See Appendix A: Ag Share of County Prop. Tax

(2) Ag population estimated based on ratio to ag work force:

Ag work force (George Goldman-Coop Ext.)	1,415
Ratio of population to workforce (ABAG)	1.69
Ag population	2,392

(3) Coop Extension and Ag Commissioner Annual Reports

(4) County Pop-related Revenues	Revenue/Cost	Population	Per person
County wide	$180,084,068	249,900	$720.62
(5) County Pop-related Costs			
County wide	$218,140,224	249,900	$872.91
Unincorporated area	$5,549,545	68,900	$80.54
Total	$223,689,769		$953.45

Note: For (4) & (5) see Appendix B: Budget Analysis 2001-2002

APPENDIX 1-O

MARIN COUNTY GREENHOUSE GAS REDUCTION REPORT, OCTOBER 2006

Marin County
Greenhouse Gas Reduction Plan
October 2006

Prepared by the Marin County Community Development Agency
As part of the Cities for Climate Protection Campaign

Marin County Community Development Agency
3501 Civic Center Drive, San Rafael, CA 94903

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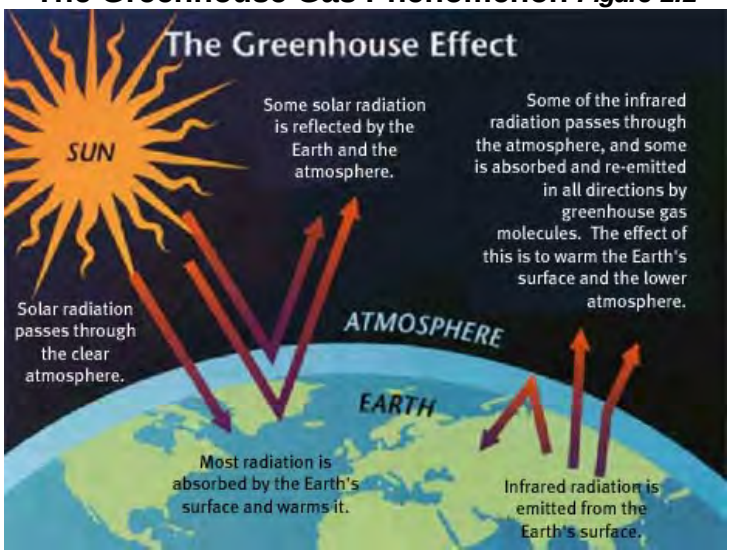
Section 1:
Introduction

Leading scientists around the world agree that climate change is a reality and that human activities are disrupting the earth's climate by intensifying the greenhouse effect. Its effects will be felt throughout our communities and while local action alone cannot solve the problem; the County of Marin is well positioned at the local level to reduce its contribution to climate change.

The Greenhouse Effect

A balance of naturally occurring gasses dispersed in the atmosphere determines the Earth's climate by trapping solar heat. This phenomenon is known as the greenhouse effect. As sunlight passes through our atmosphere, the incoming solar radiation is re-radiated from the earth's surface as heat energy. Greenhouse gases like carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, and water vapor trap some of this reradiated energy. This trapped heat warms the earth, much as the glass of a greenhouse traps reradiated energy from sunlight and thereby warms the interior of the structure.

The Greenhouse Gas Phenomenon *Figure 1.1*



Source: Environmental Protection Agency

Global Warming

While greenhouse gases play a vital role in maintaining the necessary conditions for life on Earth, the rapidly increasing concentrations of these gases are causing a rise in global temperature – Global Warming. Human activities are adding gases to the natural mix at an unprecedented rate. The Intergovernmental Panel on Climate Change (IPCC) states that water vapor is the most abundant greenhouse gas; it occurs naturally and makes up about two thirds if the natural greenhouse effect. Fuel burning and other human activities, however, are adding large amounts of greenhouse gases to the atmosphere—the most important ones being carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_20), and hydrofluorocarbons (HFCs). Greenhouse gases are increasing due to four major human activities:

1. ***Combustion of fossil fuels.*** Carbon dioxide is produced when gasoline is burned in automobiles, and when coal and natural gas are burned to heat and light our homes and businesses.

2. ***Deforestation.*** When vegetation is cleared, burned, or left to decay, carbon dioxide is released into the atmosphere. Vegetation also absorbs carbon dioxide. Once the vegetation is gone, less carbon dioxide will be absorbed out of the air.
3. ***Decomposition of organic matter.*** The decay of organic landfill waste releases both carbon dioxide and methane into the air. Methane is over 21 times more potent than carbon dioxide as a greenhouse gas.[1]
4. ***Livestock.*** Animals such as cows and sheep also release methane.

Scientific Facts and Projections

- The atmospheric concentration of carbon dioxide (CO_2) during the last two decades has increased at the rate of 0.4% every year.
- Current CO_2 concentrations are higher than they have been in the last 420,000 years, and according to some research, the last 20 million years.
- About three-quarters of the CO_2 emissions produced by human activity during the past 20 years are due to the burning of fossil fuels.

Source: IPCC

Climate Change and Marin County

It is now apparent that the increasing atmospheric concentration of greenhouse gasses (GHGs) resulting from human activities is changing the climate in ways that pose serious risks to Marin County's health, economy, and environment. Potential consequences could include impacts on the County's climate, sea levels, public health and electricity demands.

California Climate Projections:

- ***Temperature:*** Average temperatures could increase as much as 10 degrees by the end of the century.[2]
- ***Sea Levels:*** Calculations estimate rises ranging anywhere from approximately 1-3 feet or 8.5-35.2 in by the end of the Century.[3]
- ***Fire Risk:*** The occurrence of large wildfires could increase as much as 35-55%.[4]
- ***Public Health:*** Climate change is likely to affect the health of Californians by increasing the frequency, duration, and intensity of conditions conductive to air pollution, harsh heat, and wildfires.[5]
- ***Electricity Demand:*** Under the worst cast scenario, electricity requirements in 2010 would increase by approximately 7,500 GWh, and would require an additional peak capacity of 2,400 MW.[6]

Marin County's Commitment to Sustainability

In May 1999, the Marin County Board of Supervisors unanimously approved a set of sustainability recommendations. Through these recommendations, the Board of Supervisors committed the County to undertake actions such as: public environmental education, improving County operations, and using sustainability as the foundation for the current update of the Countywide Plan.

During Earth Week 2002, the Marin County Board of Supervisors signed a resolution to join the Cities for Climate Protection Campaign (CCP). This campaign is administered under the International Council for Local Environmental Initiatives (ICLEI) and attempts to reduce international greenhouse emissions through actions by local governments. As of July 2006, there are 561 local governments involved in CCP activities the world,

including 134 in the United States and 30 in California. The U.S. participants account for 17% of total U.S. greenhouse gas (GHG) emissions.

CCP calls on municipalities to proceed through five milestones to reduce their contribution to climate change:

1. ***Analyze greenhouse gas emission levels.*** Determine current greenhouse gas (GHG) emissions and forecast the growth in emissions that will occur without preventative action.
2. ***Set a reduction target.*** The target is the specific reduction that Marin aims to achieve by a designated year; e.g. 20 percent GHG reduction by 2020.
3. ***Develop a local action plan***. This plan is a description of policies, programs, and measures that Marin will implement in order to meet its target.
4. ***Implement the local action plan.*** Follow through on the proposed actions.
5. ***Monitor the progress and report results.*** Determine the success of the plan.

Marin County has conducted an emissions inventory (See - Milestone 1) and has developed a GHG reduction target (See - Milestone 2). Many actions that reduce GHG emissions have already been initiated by the County and by organizations and individuals in the community. This local action plan (See - Milestone 3) outlines activities that can help achieve Marin County's target.

State and Federal Mandates for Sustainability

The state of California has taken the lead in setting specific targets for reducing greenhouse gas emissions from the burning of fossil fuels in both power plants and vehicles. California has been leading the charge on combating climate change through the following legislation:

- ***California Solar Initiative Program, 2006***. Comprehensive $2.8 billion program that provides incentives toward residential and commercial solar development over 11 years.
- ***Senate Bill 1078 Sher, 2002***. Established a Renewable Portfolio Standard requiring electricity providers to increase purchases of renewable energy resources by 1% per year until they have attained a portfolio of 20% renewable resources.
- ***Assembly Bill 1493 Pavley, 2002***. Requires the State Air Resources Board to develop and adopt regulations that achieve the maximum feasible reduction of greenhouse gasses from vehicles primarily used for non-commercial transportation by January 2005.
- ***Senate Bill 1771 Sher, 2000***. Requires the California Energy Commission (CEC) to prepare an inventory of the state's greenhouse gas emissions, to study data on global climate change, and to provide government agencies and businesses with information on the costs and methods for reducing greenhouse gases. It also established the California Climate Action Registry to serve as a certifying agency for companies and local governments to quantify and register their greenhouse gas emissions for possible future trading systems.
- ***AB 32 Nuñez & Pavley, 2006***. Institutes a mandatory limit on greenhouse gas pollution – reducing emissions in California to 1990 levels by the year 2020, or 25% below forecasted levels. The bill also directs the California Air Resources Board (CARB) to establish a mandatory reporting system to track and monitor

emission levels and requires CARB to develop various compliance options and enforcement mechanisms.

Currently, there is no federal mandate for greenhouse gas emission reporting or reduction in the United States. Local action in addition to strong support from State legislation will help Marin County achieve its CO_2 reduction targets.

Section 2:
GHG Emissions in Marin County

The first step in reducing greenhouse gas emissions is to determine the quantity of greenhouse gas emissions Marin County is currently emitting and to identify which sectors are responsible for the bulk of these emissions. This information was collected by the Marin Community Development Agency (CDA) as a basis for identifying possible reduction measures, which are listed in Section 3 & 4.

GHG Emissions Inventory

The greenhouse gasses analyzed in Marin County's GHG emissions inventory include carbon dioxide, methane, nitrous oxide, and various hydrofluorocarbons. All emission levels are reported in equivalent carbon dioxide (eCO_2) units. Since CO_2 is the most significant GHG in terms of our emissions, it is used as the standard. Converting all emissions to carbon dioxide units allows for comparison between greenhouse gasses of varying strengths.

An inventory of 1990 greenhouse gas emissions calculates countywide levels at approximately 2.6 million tons of eCO_2. Figure 2.1 summarizes the results of the emissions analysis. Overall, Marin County has experienced a 15% increase in GHG emissions from 1990 to 2000.

Results of Emissions Analysis *Figure 2.1*

Countywide (Tons)		
Year	**1990**	**2000**
Unincorporated	617,562	639,741
Incorporated	2,237,162	2,473,825
Total	2,634,003	3,113,565
Percentage Growth	+15%	
Internal (Tons)		
Total	16,945	18,451
Percentage Growth	+8%	

Figure 2.1 also displays emission figures for internal County operations. Within the Countywide inventory, figures for emissions being released by County of Marin vehicles and buildings were extracted. An 8% increase in GHG emissions occurred by Marin County facilities and internal government operations.

Countywide Emissions Analysis, 2000 *Figure 2.2*

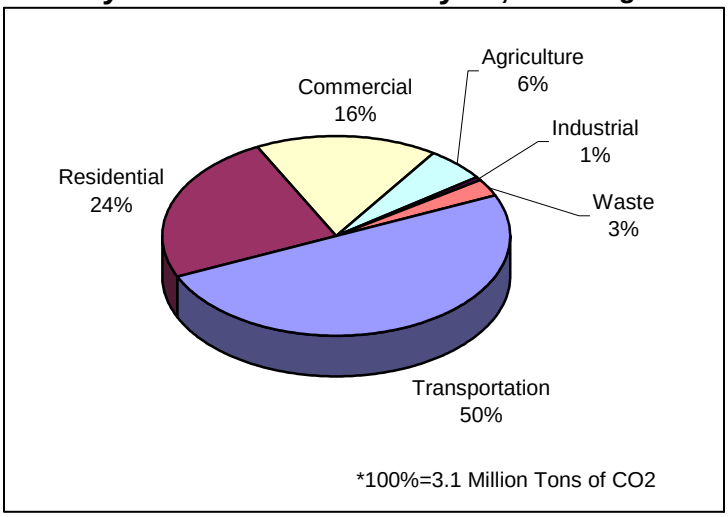


Figure 2.2 displays countywide emissions broken down by industry. The transportation sector accounts for 50% of Marin County's GHG emissions making it the largest contributor.

Greenhouse Gas Emissions Reduction Target

A target has been set to reduce GHG emission 15-20% below 1990 levels by the year 2020 for internal government and 15% countywide. This target exceeds the state target for GHG reductions. The inventory shows that in order to reduce GHG emissions, Marin County needs to address transportation issues as well as residential and commercial energy use. Section 3 of this plan lists resources and programs available to support measures, and describes potential actions that can be taken to further reduce emissions.

Section 3:
Meeting the Reduction Target

Internal measures already in place through the Department of Public Works (DPW) will likely result in the County's achievement of the internal reduction target at the low end of the 15-20% range. The measures listed in the next section are intended to provide internal government options for additional GHG reductions beyond a 15% reduction.

Reaching the countywide target, however, will require significant additional efforts by the County, cities and towns within the county, and the State government. For example, the implementation of Community Choice Aggregation or the purchase of green tags could allow Marin to achieve its Countywide target. Launching a car-share program or using local landfill and wastewater treatment facilities for energy production could also have a significant impact. Local cities could adopt many of the measures listed below to increase the impact on countywide emissions levels. Support for vehicle fuel efficiency standards at the State level could have a wide-reaching impact on Marin's countywide emissions levels.

Existing measures in place through the Community Development Agency (CDA) will help reduce the countywide emissions level. These measures range from energy efficiency programs and green business support to solar rebates and green building incentives and ordinances. Many such measures are included in the draft Countywide Plan. Existing measures in place through AB 32 and other state initiatives will also contribute to a countywide reduction. It is estimated that overall, such existing measures will result in a GHG reduction that is 21% below the expected 2020 level. This is significant; however, it is 1,190,639 tons shy of the target, which is set at 15% below the 1990 level.

All of the potential measures listed in the next section will add to Marin's GHG reduction and are consistent with one or more Countywide Plan update programs. For reference, the Countywide Plan programs are listed below according to their section and number. Programs which have already been enacted are marked with an asterisk.

Agriculture

- AG-1.q: Support irrigation alternatives.

Atmosphere & Climate

- AIR-3.c: Consider model clean vehicle requirements.
- AIR-4.a: Reduce greenhouse gas emissions resulting from energy use in buildings.*
- AIR-4.b: Reduce greenhouse gas emissions resulting from transportation.
- AIR 4.c: Reduce methane emissions released from waste disposal.
- AIR-4.e: Reduce County government contributions to greenhouse gas emissions. *
- AIR-4.k: Encourage the planting of trees with urban forestry practices.

Community Development

- CD-1.a: Keep urban uses in the city-centered corridor.*
- CD-1.b: Preserve resources in the Baylands corridor.
- CD-2.g: Identify and plan mixed use sites.*

Design

- DES-2.b: Define flexible-use building types.
- DES-3.a: Encourage mixed use projects. *

Economy

- EC-1.k: Provide assistance with green practices.*

Energy & Green Building

- EN-1.e: Offer energy efficiency information, technical assistance, training and incentives.*
- EN-2.f: Use renewable energy in county facilities.*
- EN-2.d: Facilitate renewable energy technologies and design.*
- EN-2.e: Provide incentives for alternative energy production.*
- EN-2.g: Explore Community Choice Aggregation.*
- EN-3.c: Divert construction waste.*

Housing

- HS-3.a: Complete a non-residential job/housing linkage study.
- HS-3.o: Conduct a survey of potential mixed use sites.
- HS-3.q: Establish mixed use development standards and incentives.
- HS-3.v: Evaluate the feasibility of an "Affordable Housing Overlay Designation".

Public Services and Facilities

- PSF-4.b: Divert construction waste. *
- PSF-4.c: Reduce waste at county landfills.*
- PSF-4.d: Offer recycling education.*

Transportation

- TR-1.a: Support alternate work schedules.
- TR-1.c: Promote transportation alternatives.*
- TR-2.b: Adopt standards for pedestrian and bicycle access.
- TR-2.k: Consider pedestrian needs.
- TR-2.j: Ensure safe routes to schools.*
- TR-3.f: Promote transit-oriented development.
- TR-4.c: Support green fuels.*

Water

- WR-3.a: Support water conservation efforts.
- WR-3.b: Support and integrate water district conservation efforts.

*Program has already been enacted.

Reduction Measures

Based on the distribution of emissions revealed in CDA's emissions inventory, existing priorities and resources, and the potential costs and benefits of various potential emissions reduction projects, the County in collaboration with ICLEI identified this set of potential GHG reducing measures to supplement efforts already underway.

Each potential measure is presented here along with the potential reduction of eCO_2 that could be achieved. The four most significant energy dependent categories included in the analysis are: building energy use, transportation, waste management, and land use. These potential measures will offer reductions in addition to those already proposed or achieved by existing County and statewide measures.

Building Energy Use

Stationary energy use by buildings in all sectors (residential, commercial and industrial) accounts for 44% of the total GHG emissions in Marin. Marin County relies on electricity, natural gas, and fuel oil for energy. Most energy in the County is imported, and Pacific Gas and Electric (PG&E) is the sole distributor of electricity and natural gas locally. 47% of PG&E's energy supply for Marin County comes from natural gas, one of the single largest contributors to greenhouse gas emissions.

The County has experienced an overall increase in energy use from 1990 through 2000 of 10%, from 1.23 megatons of eCO_2 to 1.38 megatons of eCO_2. In 2000, unincorporated Marin is responsible for approximately 17% of emissions from stationary energy sources.

County DPW remains proactive in implementing GHG emissions reduction projects in County buildings. CDA efforts already in place such as the Marin Energy Watch Partnership, Single Family Dwelling Energy Efficiency Ordinance, Solar Energy Rebate Program, Green Building Program and future sustainable affordable housing projects, will help in reducing residential and commercial building energy use and subsequently GHG emissions throughout the County.

Proposed Building Energy Use CO2 Reduction Measures *Figure 3.1*

New Measure	Supporting CWP Program	Potential Annual CO2 Reduction (Tons)	Existing Annual CO2 Reduction (Tons)
Implement tidal power project	AIR-4.a, EN-2.d	446,408	n/a
Implement a form of community choice aggregation	EN-2.g	294,165	n/a
Purchase "green electricity" from solar, geothermal, wind, hydroelectric sources through green tags (60%)	AIR-4.a, AIR-4.e, EN-1.j, EN-2.f	4,260	n/a
Or - Purchase "green electricity" from solar, geothermal, wind, hydroelectric sources through green tags (20%)	AIR-4.a, AIR-4.e, EN-1.j, EN-2.f	1,420	n/a
Initiate a community energy efficiency rebate program	AIR-4.a, EN-1.e, EN-2.e	3,320	830
Install solar panels on municipal facilities	AIR-4.a, AIR-4.e, EN-1.j, EN-2.f	1,100	736
Install energy-efficient street lights	AIR-4.a, AIR-4.e, EN-1.j, EN-2.f	n/a	182
Install green or reflective roofing	AIR-4.a, AIR-4.e, EN-1.j, EN-2.d, EN-2.f	n/a	34
Perform energy-efficient lighting retrofits	AIR-4.a, AIR-4.e, EN-1.j, EN-2.f	190	22

Transportation

Emissions from transportation come from vehicles that use gasoline and diesel. Transportation is responsible for 53% of total greenhouse gas emissions in Marin County. Current trends are toward lower fuel economy and more vehicle miles traveled, which means more emissions of GHG's and other air pollutants. Car ownership is increasing at a faster rate than Marin County's population.

From 1990-2000, the County experienced a 6% overall increase in transportation emissions. As of 2000, transportation within the unincorporated areas of Marin accounted for approximately 15% of total Countywide emissions, based on CalTrans vehicle studies.

Proposed Transportation CO2 Reduction Measures *Figure 3.2*

New Measure	Supporting CWP Program	Potential Annual CO2 Reduction (Tons)	Existing Annual CO2 Reduction (Tons)
Improve traffic signal synchronization / decrease stop rate and time	TR-2.k	16,000	n/a
Encourage community car-sharing (run a program as municipality/ support for-profits that give car-sharing services, eg Zipcar)	AIR-4.b, TR-1.c	11,880	n/a
Expand local or regional bus service in range and/or frequency	AIR-4.b, TR-3.a	10,000	n/a
Offer prioritized parking for hybrid cars	AIR-4.b	4,615	n/a
Encourage car-pooling or van-pooling by municipal employees	AIR-4.b, AIR-4.e, TR-1.c	1,192	1192
Expand community bicycle infrastructure (e.g., dedicated bicycle lanes, additional bicycle parking spaces)	TR-2.b, TR-2.c, TR-2.d, TR-2.e, TR-2.g, TR-2.h, TR-2.I, TR-2.l	400	n/a
Expand the "safe routes to school" program	TR-2.b, TR-2.j, TR-2.k	239	239
Purchase fuel efficient (e.g., hybrid) and/or smaller fleet vehicles	AIR-4.b, AIR-3.c, AIR-3.c, AIR-4.e, TR-4.c	173	69
Encourage telecommuting by municipal employees	AIR-4.b, TR-1.a	48	n/a

Waste Management

The disposal of waste results in the direct release of greenhouse gasses when it is burned in incinerators and when it degrades in landfills and produces methane. The manufacturing, processing, and transporting of new goods also creates emissions. In 2000, waste was 4% of Marin's GHG emissions, which means it serves as a net loss of eCO_2.

Marin County leads the state in the diversion of waste from landfills, currently at a rate exceeding 75%. CDA efforts already in place such as the Construction and Demolition Waste Ordinance will help further reduce GHG emissions associated with waste generation throughout the County.

Proposed Waste to Energy CO2 Reduction Measures *Figure 3.3*

New Measure	Supporting CWP Program	Potential Annual CO2 Reduction (Tons)	Existing Annual CO2 Reduction (Tons)
Establish/expand recycling programs in the community	AIR-4.c, PFS-4.d	119,300	140,770
Implement solid waste reduction program through creation of reuse facilities /programs	AIR-4.c, PFS-4.c, PFS-4.d	33,000	n/a
Establish system for reuse or recycling of construction and demolition materials	EN-3.c, PFS-4.b	30,000	150,000
Produce electricity from recovered methane in local landfills	AIR-4.c	5,300	n/a
Install an anaerobic digester at wastewater treatment facilities	PFS-4.h	3,200	n/a

Land Use

Land use measures such as those relating to housing, community development and public facilities have the potential to directly correlate with the County's GHG emissions. Although the impact of the measures listed below are difficult to quantify and therefore list do not have their potential eCO_2 reductions, implementing them can significantly alter the County's emissions totals.

CDA efforts already in place such as master planning for mixed-use development projects and a proposed housing overlay designation in the draft Countywide Plan will help in reducing GHG emissions throughout the County.

Proposed Land Use CO2 Reduction Measures *Figure 3.4*

New Measure	Supporting CWP Program	Potential Annual CO2 Reduction (Tons)	Existing Annual CO2 Reduction (Tons)
Foster downtown neighborhood development	HS-3.o, HS-3q	775	n/a
Encourage mixed-use development	CD-2.c, CD-2.g, CD-5.b, DES-2.a, DES-2.b, DES-2.c, DES 3.a, HS-3.o, HS-3p, TR-3.f	n/a	n/a
Promote transit-oriented development	DES.2.a, CD-5.b, DES-2.a, HS-3.m, TR-3.f, EC-1h	n/a	n/a
Encourage water conservation	WR-3.a, WR-3.b, AG-1.p, AG-1.q	n/a	n/a
Establish city-centered corridors	CD-1.a	n/a	n/a
Institute growth boundaries, ordinances or programs to limit suburban sprawl	AIR-4.l, AIR-4.m, OS-2.b, OS-2.c, OS-2.g, OS-2.h, CD-1.a, CD-1.b, CD-	n/a	n/a
Implement Housing Overlay Zone focused on city centered corridor	CD-2.d, HS-3.v	n/a	n/a
Maintain a jobs/housing balance	CD-5.f, HS-3.a, HS-3.b	n/a	n/a
Plant trees for energy savings	AIR-4.k, BIO-4.l, DES-3.e	n/a	n/a

Section 5:
Conclusion and Next Steps

Climate change is an issue that Marin County is taking seriously and has shown significant leadership in addressing. This Greenhouse Gas Reduction Plan is intended to serve as a guide to help Marin County pursue work plans with the objectives of conserving resources and further abating global warming.

As mentioned previously, activities are already underway to help Marin meet or exceed the target greenhouse gas reductions. Such measures include solar rebates, DPW's and CDA's energy efficiency programs, CDA's green business support and green building incentives and ordinances. Many such measures are included in the draft Countywide Plan which is likely to further their impact.

In some cases, implementation will require the cooperation of other agencies, private businesses, and residents. And, although some of the initiatives in this document are already being implemented by County departments, others will require additional resources. The success of these measures will be tracked using indicators and targets such as these in the draft Countywide Plan: reduce total countywide energy use by 2% per year to achieve 20% by 2015; increase total megawatts of photovoltaic systems to 15 MW by 2010 and 30 MW by 2015; and decrease fuel consumption by county-owned vehicles 10% by 2010 and 15% by 2015.

Further, the actions are intended to be implemented over a period of several years. During that time, it is likely some measures will evolve as circumstances change and new opportunities present themselves. Therefore, monitoring of progress and periodic evaluation of measures will be carried out to ensure successful and continued greenhouse gas reduction.

Appendix A:
Data Collection Process

Measures identified in this plan were developed by three University of California at Berkeley graduate students in collaboration with the County and ICLEI. Using available data from state and county sources, a list of potential measures were developed for this plan.

Energy
Proposed measures were selected by performing an analysis of Marin County's electricity and transportation use. Specific data for the County's energy use was provided by the California Energy Commission (CEC) and was divided into industry categories (residential, commercial, industrial, agriculture and unclassified). Similar data for the entire State of California's energy trends were also used to determine potential measures. Indicator values for residential energy use (population and number of households) for 1990 and 2000 were determined from the United States Census.

Transportation
Local transportation figures such as data on the County's total vehicle miles traveled (VMT) were used to establish potential measures. VMT figures for Marin County were found in the California Department of Transportation (CalTrans), Division of Transportation System Information, Office of Travel Forecasting & Analysis, Highway Inventory & Performance Branch Database (HPMS Database) at http://www.dot.ca.gov/hq/tsip.

Waste Management
Potential waste to energy measures were developed with the assumption that there are 16,000 cows in the County. The measures also assume that there could be multiple systems operating at 300kW for 11 hours per day year- round. This would result in an average of 1.2 million kWh per year reduction. These reductions are based on Marin County's Straus Dairy energy system savings.

Proposed Measures Selection Process
The proposed measures included in this plan were selected based on the following selection criteria:

Cost Criteria
- Cost for implementation to local government
- Percent pay-back per year
- Cost effectiveness

Additional Selection Criteria
- Potential Emissions Reduction
- Uniformity with Existing Priorities
- Ease of Implementation
- Assistance/ Support Available
- Examples of Others Doing It
- Funding Sources
- Visibility
- Community Reaction
- Implementation Timeframe

In addition to these decisive factors, a set of "pre-selection criteria" was used. It was determined that all local measures were to be derived from a long list of best practices found in other jurisdictions. In addition, suggestions from Marin County were also used to create measures. The initial list included approximately 100 potential measures

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APPENDIX 1-P
MARIN COUNTY TARGETED INDUSTRIES STUDY
JANUARY 6, 2004

Marin County
Targeted Industries Study

FINAL REPORT
January 6, 2004

Prepared for:
The Marin Economic Commission &
The Community Development Agency

Prepared by:
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ECG
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Executive Summary

Purpose of the Study

The ECG project team was tasked with developing a set of economic, social and environmental criteria that will help Marin County to evaluate which types of industries should be encouraged, or discouraged, using a variety of policy instruments available to the County. Using these criteria, the team was to develop a list of target industries that meet these criteria.

Approach

While the team worked closely under the supervision of a subcommittee of the Marin Economic Commission, the team was given a free hand to propose a methodology that would be suitable to this type of study. As documented in this report, the team:

- conducted a review of economic trends and other factors that have an impact on business location decisions;
- undertook a *cluster analysis*, identifying the underlying drivers of the region's economy;
- conducted interviews and focus groups with community leaders and business owners and executives;
- developed a list of target industries (grouped by industry clusters), that are consistent with the criteria; and
- prepared recommendations the Marin Economic Commission can consider as it shapes its vision for Marin's economic future.

Background to the Study

This report responds to concerns, both in the business community and the County administration, that Marin's sustained prosperity cannot be taken for granted.

All regional economies are comprised of two components: the **'local-serving'** employment, such as gardeners, plumbers, and haircutters; and the **'traded-sector'** employment, comprised of companies whose markets are not limited to the region, but serve state-wide, national or international markets, such as software producers and financial service providers. It is this latter component which is the principal source of wealth for most communities: as the clusters in the traded sector prosper or decline, so goes the average income in the whole community, thus affecting the incomes for local-serving employment as well.

The situation in Marin is somewhat complicated by the large number of relatively wealthy commuters, who live in Marin but work elsewhere (they are in turn working in the traded sector clusters of nearby San Francisco and other counties). This source of wealth for Marin does not appear to be threatened. However, the 'traded' component of Marin's economy is quite sensitive to changes in the cost of doing business – arising from factors such as the efficiency of zoning regulators, traffic congestion, and so on.

Marin's potential to host commercial activity is also affected by its physical limitations. The County's first Countywide Plan in 1973 defined the County (unincorporated area) as 606 square miles of land and water (whereas the County's 11

cities only comprise 169 square miles) and recognized certain environmental corridors. The Coastal Recreation Corridor preserves West Marin for recreational and agricultural uses. The Inland Rural Corridor similarly preserves the central and northwestern part of the County for agricultural and compatible uses. This leaves the City-Centered Corridor along U.S. Highway 101 for urban development. This narrow band comprising only 16% of the County's land is the primary area in the County where economic development can take place.[1]

Recommendations that affect the cost of doing business in Marin are beyond the scope of this study, although they might be considered in one or more subsequent studies. However, identifying ***which types of businesses can thrive in such an environment***, and what policies can support them to flourish in Marin, is the focus of this report.

[1] In addition, the population projections of 1973 have not been met: conservative estimates in 1973 forecast the county's population to grow to 485,000 in 2000. The 247,289 actual population in 2000 is nearly half of what was expected.

Summary of Findings

The ECG project team has identified nine core existing clusters – groups of enterprises in related industries that exhibit high employment concentrations, and have strong existing or potential linkages. These are:

1. **Real Estate and Construction**
2. **Multimedia**
3. **Business Services**
4. **Finance & Insurance**
5. **Restaurants &Tourism**
6. **Health Services**
7. **Agriculture**
8. **Community Building (Non Profits, Philanthropy)**
9. **Arts & Crafts**

As shown in Figure ES-1, below, these clusters all have linkages with one another, but all appear to derive from a core set of capabilities and attributes of Marin County, which is an amalgam of **artistic talent, entrepreneurial spirit, environmental consciousness, creativity and innovation capacity.** It is this set of capabilities which appear to explain the richness of Marin's economic fabric, from leading digital movie technologies and software, to specialty cheeses, to the invention of the mountain bike.

Figure ES-1: Marin County's Clusters and Linkages

In many respects, Marin's uniquely attractive physical setting, combined with its proximity to San Francisco, enhances this superb innovation engine. Because of these physical characteristics and its location, Marin attracts entrepreneurs with a unique set of talents and interests, and their capacity to innovate is in high demand in today's economy. As Professor Michael Porter of Harvard Business School has stated, "prosperity is driven by productivity, and productivity is driven by innovation. The most economically competitive regions are those that can build and sustain their innovation capacity."[2]

Marin's future economy will build on the clusters of today – new niches and markets will be found, and a dynamic interplay between clusters makes the exact outline unpredictable. But the expansion path for Marin that is most likely is summarized in Table ES-1, and explained more fully in Section V. The project team has identified those target industries that most reflect value-added potential and are consistent with the County's social and environmental criteria.

[2] Presentation to The Competitiveness Institute, September 19, 2003. (www.competitiveness.org)

Table ES-1: Target Industries for Marin

Existing Clusters	Target Industries
Real Estate & Construction	Green Building
Business Services	Boutique Consulting Environmental Technology
Multimedia	Digital Imaging (Motion Pictures) Interactive Media & Game Development Engineering & Design Software Biotechnology (technology distinct from Multimedia)
Finance and Insurance	Integrated Wealth Management Services On-line Financial Services Personal Financial Advising
Restaurants & Tourism	Agri-Tourism Outdoor Recreation and Equipment Arts and Crafts
Health Services	Alternative Healing & Meditation Alternative Medicine Emergent Care
Agriculture	Organic Value-Added (Niche) Agricultural Products Food Product Manufacturing

The Way Forward

The project team concludes that much of Marin's past economic success and social progress has been engineered by a complex process, which we have termed the *virtuous cycle*. In the *virtuous cycle*, wealth is generated within these existing clusters and then reallocated via an intricate relationship involving community-building, philanthropy, open space preservation, funding of the arts and innovation. This *virtuous cycle* is the ultimate manifestation of the Marin County ethos and links the County's existing clusters to those about to emerge.

Marin County will need to build on these strengths in order to achieve its goals of establishing and maintaining a diversified and sustainable local economy. While the market is likely to bring to Marin the types of industries that are consistent with the County's stated goals, it is also likely to bring industries that cater only to Marin in its capacity as a wealthy suburb. A healthy, well-diversified regional economy should have both "local serving" and "traded" industries.

This study was commissioned, in part, due to a growing concern on the part of the Marin Economic Commission that a number of prominent, traded-sector firms have left or may leave Marin County. With their departure, Marin's economy may become unbalanced, less diversified. In addition, the threats of traffic congestion, land use constraints, and lack of affordable housing require a strategy unique to Marin and its goals.

The first step towards achieving Marin's goals, as reflected in the Countywide Plan, is to "Target Appropriate

Companies". The criteria developed in this study will enable the County to determine which companies are appropriate. The question of how to target them is more complex. Businesses generally respond well to a region's clarity about what it wants because it provides them the sense of assurance they need in order to make long-term investment decisions. The mechanics of shaping public policy and selecting concrete actions that help support and nourish, or target, selected industries, is the subject of the study's recommendations.

The report concludes with four main recommendations.

1. **Recognize and Reinforce the Virtuous Cycle.** Marin County is fortunate to be home to a unique set of mutually reinforcing phenomena that allow Marin to be a highly productive, highly prosperous place. These include the engines of wealth creation (highly productive industries and individuals), the core value of philanthropy (the Marin Community Foundation and others), a shared desire to preserve open space and encourage the arts (something afforded by the previous two elements of the cycle), and a culture that values creativity and on-going innovation. In recognizing the relationship between these four elements, the County may want to take steps to reinforce them over time. Should one weaken, the others will surely be affected, as will the ability of the County's key industries to function as well as they do today.
2. **Shift Gears.** Given the shifting trends in economic development thinking, Marin County officials may want to reconsider the conventional, *target industry recruitment*, approach to industry development and move toward a more holistic, comprehensive approach that focuses on growing industries from the rich soil of the region's existing clusters. This shift involves moving away from the idea of target industry recruitment and towards the idea of *economic gardening*. There is still room for industry attraction here, but it becomes just one tool among many
3. **Support Stars and Nourish Seeds.** Marin County has the tremendous good fortune of having a disproportionate number of its industries in the "Star" category, meaning that the industries in which it is currently highly concentrated are also industries that are forecast to grow rapidly over the next five years. The degree of success and potential of these clusters and their component industries must be recognized, extolled, and supported in terms of public policy. The mechanics of supporting existing "Star" industries will be discussed below. The principal foundation of that support, however, and of what is needed to nourish newer industries that are beginning to emerge from existing ones, *is a healthy business climate, or garden.* As regions move from an awareness that the health of their community is founded more in their ability to tend to the core issues faced by their existing businesses rather than by their ability to attract new ones from outside the region, the importance of maintaining an excellent business environment in which the types of industries the region wants can grow, increases.

   The Marin Economic Commission has already executed the first and most crucial step in establishing a

nourishing business climate: it has *identified very clearly, in the context of this Study, the kinds of businesses it wants.* As mentioned earlier, businesses respond well to this kind of clarity in that it helps them decide whether and to what extent they want to invest in the County. In order for the County to attain its goals of engaging with the private sector along issues of workforce training, transportation improvements, and civic participation, it is crucial that it convey to business owners that it is investing in them as much as it is asking them to invest in the long-term health of the County.

Part of this is beginning to see businesses on an equal footing with residents. A recognition on the part of the County that businesses have made at least as much (and frequently more) of an investment in the County as its residents is required. Then, once a vision for the County is established detailing the kinds of businesses that are desired, the next step in strengthening the business climate is a clear and consistent *communication of that vision.*

Finally, while supporting "Star" industries is essential, nourishing the seeds of new industries is equally important. No economy stands still. Economies are living organisms comprised of individuals making choices on a daily basis. Some stars will fade, and a healthy, well-diversified economy, will see that they get replaced by launching new stars.

Given the results of this Study, it is clear that Marin has fertile soil in terms of sprouting new, entrepreneurial, seeds. The stories of the digital arts, organic cheese, and mountain bikes are only a few examples of the kinds of "new" industries that can sprout from existing ones. These new ones will likely be the "Stars" and "Mainstays" of the future.

Some of these emerging "seeds" have been identified in this Study. Others will evolve over time. By establishing a mechanism for recognizing and nourishing these seeds over time, Marin stands the best chance of breeding the types of companies that will meet its criteria in the future.

4. **Adopt A Cluster Strategy and Implement it**. One way to focus County economic development priorities and provide the business community in the key industries identified in this report with the active support of the County is a "Cluster-Based Collaborative Approach" to economic development. This approach uses the clusters defined in this report as a springboard for working with the public and private sectors in a collaborative process aimed at refining the County's overall economic agenda and identifying specific action steps for achieving that agenda.

   Regions around the world are realizing enormous benefits when the different parts of each cluster work better together. This means a better dialogue between businesses in the cluster. It also means a more responsive relationship between the cluster, government, and the cluster's support institutions (universities, research centers, etc.). Those regions that have fully developed economic clusters have proven to

be the best performing regions in the world. They exhibit higher levels of job creation, higher wages, and higher levels of wealth creation than regions without well-integrated clusters

By working together and taking concrete steps to assist businesses, the County can demonstrate its commitment to creating a positive, supportive business environment. On the basis of the findings of this Study, a collaborative, cluster-based approach to economic development that focuses on nurturing and supporting existing clusters so that innovative, new industries can emerge from them would be well received by the greater Marin County community.

I. Introduction

The essential question this report hopes to answer is, "What kind of businesses can thrive in the Marin environment and which of them meet the County's criteria?" Our short answer is: highly innovative firms that are on the cutting edge in terms of product development or technology. Whether it is a food product company making award-winning gourmet cheeses, or a digital imaging company creating state-of-the art inter-active video applications, these firms can thrive in Marin for a few, simple reasons. Marin County has been and continues to be a highly productive center for creativity and innovation. From mountain bikes to *Star Wars*, the County has traditionally spawned and attracted true entrepreneurs who have a great impact on their respective industries.

This report builds upon the findings and conclusions of *The Key Trends, Issues, and Strategies Report* released by the Marin County Community Development Agency in January of 2003. Specifically, this *Targeted Industry Study* examines how the County might implement a number of strategies outlined in the *Key Trends* report, with particular attention to the task of "determining how the County might identify and support the types of business that comprise a vibrant, viable and sustainable economy […by] identifying criteria for businesses that should be targeted for development in and attraction to Marin County."

This *Target Industry Study* develops the criteria Marin County might apply to businesses it considers attracting, retaining, or helping to expand. It also reviews the various economic trends and attributes that have an impact on business location decisions. Through an application of the criteria and a process of cluster analysis, this report identifies a list of target industries, and industry clusters, that are consistent with the criteria. Finally, this report concludes with recommendations the Marin Economic Commission can consider as it shapes its vision for Marin's economic future.

This report is organized as follows:

1. A review of the methodology used in the preparation of this report;
2. An Economic Base Analysis which reviews the major economic trends impacting business location decisions in Marin County;
3. A review of the attributes of Marin County and the types of industries, and industry clusters, that have located in Marin due to those attributes;
4. A cluster-by-cluster application of the criteria developed for this Study (which reflect the County's goals and principles);
5. The identification of "target industries," or industries the County might consider supporting given their consistency with the criteria;

6. Conclusions and Recommendations.

The principles specified in the County's *Trends, Issues and Strategies Report* guided the research and analysis conducted in this report. These guiding principles are:

- Link equity, economy, and the environmental locally, regionally, and globally.
- Use finite and renewable resources efficiently and effectively.
- Reduce the release of hazardous materials.
- Steward our natural and agricultural assets.
- Provide efficient and effective transportation.
- Supply housing that is affordable to the full range of our workforce and community.
- Foster businesses that provide a balance of economic, environmental, and social benefits.
- Educate and prepare our workforce and residents.
- Cultivate ethnic, cultural and socioeconomic diversity.
- Support public health, safety, and social justice.

In order to identify a list of "target" industries consistent with these principles, the ECG project team used the following methodology in the preparation of this report:

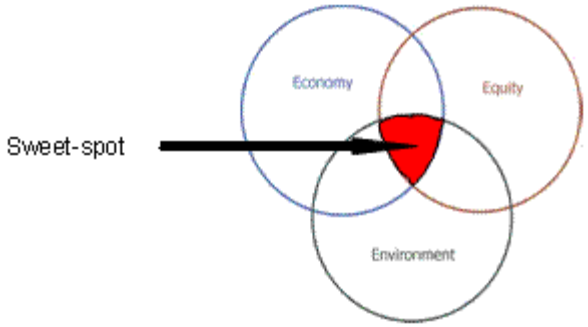
1. Develop criteria consistent with these principles;
2. Conduct research using primary and secondary data sources;
3. Identify clusters and linkages between clusters; and
4. Identify target industries.

II. Methodology

DEVELOP CRITERIA

The first step in developing a list of target industries consistent with the County's guiding principles was the development of a set of criteria with which to evaluate prospective industries. These criteria strive to address issues, cultural norms, and aspirations of the Marin community within the "Three E's: Environment, social Equity and Economy," a framework detailed in the County's *Trends, Issues, and Strategies Report*. Incorporating the "Three E's" into the analysis imposed strict parameters within which the project team identified potential "target" industries.

Figure 1: The Intersection of the Three E's



It was ECG's understanding that the County is interested in retaining and attracting companies that operate at the intersection of the "Three E's," or the "sweet-spot" (see Figure 1). This spot is where the County's goals for a robust economy, a healthy, non-polluting environment, social justice and equity are **all** met. Firms operating at this intersection invest in socially responsible activities, help provide

affordable housing for their employees and conduct joint ventures with other groups. They also work with local community colleges to train residents as employees to ensure that these firms have access to a local talent pool.

The project team's first step, therefore, was to develop indicators, or measures, for assessing an industry's ability to operate in the "sweet-spot." It is important to note that ECG applied these criteria at the industry level rather than the firm level because the task of this Study was to identify target industries. Obviously, within each industry, the performance of individual firms may vary greatly. Keeping this in mind, the project team made assessments on the aggregate performance of each industry and the likelihood of the majority of firms in that industry to operate in a particular way.

That is not to say that ***all*** Business Services firms pay above-average wages or are likely to invest in the training of their workforce. Some do not. It was in this distinction that the project team used the criteria to identify emerging or "target" industries, such as Boutique Consulting, that are more likely than other Business Service firms to operate in the "sweet-spot." In each industry cluster, the project team identified industries that would facilitate a diverse and sustainable economy while utilizing environmentally sound business practices and incorporating policies that would ensure social equity. For example, selected industries should create above-average wage opportunities and be highly productive while encouraging diversity and minimizing environmental impacts. They should employ both local residents and green business practices, but their activities should not augment the congestion problem. These issues are summarized in Table 1, below, as well as in Appendix A.

The project team applied these criteria to existing clusters using both quantitative and qualitative methods. Quantitative methods were used to assess criteria that were measurable, such as: wages, profits, productivity, educational attainment of workers, number of employees, typical work hours and quantity and quality of non-labor inputs. Qualitative methods such as the results of our interviews, focus groups, industry reports and market research, were used to assess criteria that were less measurable, such as: industries' commercial real estate requirements, propensity for implementing green business practices, and ability to offer a range of progressively responsible occupations.

By applying these criteria, the project team was able to isolate the salient characteristics of the existing clusters that already are successful within Marin's particular reality. The project team then used them to assist in the identification of emerging target clusters that may be even more successful in operating in Marin's unique social, economic and environmental context.

Table 1: Targeted Industries Selection Criteria (*)

	Issues	Industries Targeted for the County should…
Economy	**Jobs/Housing Balance.** Housing costs have risen much faster than income over the past decade. As a result, many people who work in Marin County can't afford to live here. Residents who live here must commute to other areas where higher-wage job opportunities exist	▪ Create above-average wage opportunities. ▪ Be profitable and highly productive. ▪ Place an emphasis on value-added activities. ▪ Be a primary engine of growth (attracting wealth and investment to the region) rather than be a secondary, local-serving activity. ▪ Rely on technological advances for production of goods and services. ▪ Have labor force requirements that match the demographics of Marin County working residents (e.g., educational attainment, age of worker).
Environment	**Transportation, Congestion and Land Use.** Traffic congestion is among the top concerns of Marin County residents and business operators alike. Due to a limited number of arterial routes through the County and an increasing number of vehicle trips per year, this problem is worsening. Public support for infrastructure changes (such as highway or rail improvements) has not been strong.	▪ Be no bigger than the largest firms currently operating in Marin. ▪ Do not create dependence (more than 50%) for labor or other inputs coming from other regions. ▪ Employ local residents to minimize commute times. ▪ Have the potential to implement flexible schedules for employees and offer non-peak hour commute opportunities. ▪ Be housed (if possible) in home office locations and work/live spaces. ▪ Be transit-friendly (able to locate near transit hubs; not requiring large parking fields). ▪ Be consistent with existing agricultural base and land use.
	Green Building. Marin residents have a strong socio-economic and cultural tie to the land and the environment. Marin residents value preserving the physical landscape and limiting the negative impacts of economic activity on the environment.	▪ Implement green business practices as defined by the County of Marin. ▪ Have the potential to qualify for the County's "Sustainable Partners" Program. ▪ Leverage the existing environmental attributes of Marin.
Equity	The County places high value on socioeconomic diversity and economic sustainability. Commercial enterprises must incorporate equitable practices into their business activities.	▪ Offer a range of occupations and the potential for upward mobility. ▪ Represent a diverse mix of activity in terms of firm size and range of occupations. ▪ Have goals and objectives consistent with Marin County Vision including the provision of fair compensation, employee health insurance, childcare and other benefits and a decent work environment.

(*) Refer to Appendix 1 for a complete discussion of the criteria.

The project team assessed each cluster on the basis of these criteria using the following template:

Screening Criteria		Existing	Emerging
Economic	Above-average wages	~	~
	Emphasis on value added activities	☑	☑
	Primary vs. secondary engine of growth	~	~
	High productivity	☑	☑
	Occupational diversity and upward mobility	☑	☑
	Industry diversity	☑	☑
Environment	Average firm size	☑	☑
	Reduce dependence on inputs from other regions	✗	✗
	Employs local residents	~	☑
	Telecommuting or transit-friendly	~	☑
	Allows flexitime	✗	✗
	Potential sustainable partner	~	☑
Equity	Creative and innovative	~	☑
	Links to aging population	~	☑
	Consistent with County goals and principles	~	☑
Key	☑ = yes ✗ = no ~ = uncertain	5	11

Given the quantitative or qualitative information collected for each industry, the team determined whether or not the majority of industries in a cluster would, would not, or might meet each criterion. Each criterion was then given a "yes," a "no," or an "uncertain." Only "yes" ranks were totaled and presented as a raw number or score. The total number of "yeses" possible is 15.

A cluster-by-cluster assessment on the basis of these criteria as well as details concerning each cluster's composition and the performance of its component industries are presented in the Cluster Template supplement accompanying this report.

Conduct Research Using Primary & Secondary Data Sources

The second step in developing a list of "target" industries consistent with the County's guiding principles involved a comprehensive review (or, Economic Base Analysis) of what is currently known about the economy of Marin County and going beyond what has been done to date in three key respects:

- Review of studies of the economy of the San Francisco Bay Area so as to highlight the ***regional dynamics*** that are so crucial to the *Targeted Industries Study*;
- Marin County's economy was benchmarked against a reference group of counties with some similarities both in terms of their economic structure as well as their strategic goals; and

- The ECG team conducted a preliminary cluster identification, helping Marin County officials and stakeholders to better understand the economic drivers of the County, and their relationships.

The ECG project team collected and analyzed information including:

- Growth rates of individual industries (employment growth, productivity growth, and net new enterprise formation rates);
- Forecasts of employment growth rates by industry;
- Average wages by industry;
- Employment concentration ratios (or location quotients);
- Linkages between industries; and
- An occupational profile of Marin County's workforce, with special emphasis on those who currently commute outside the County.

In addition to gathering and analyzing primary source data on these quantitative economic indicators, the project team conducted a series of one-on-one interviews with representatives from key leaders in Marin as well as a series of focus group discussions involving business leaders in several of the core clusters. The results of this, more qualitative, research is woven into the findings of this report. Summary notes from both the interviews and focus groups can be found in Appendices B and D.

IDENTIFY LINKAGES BETWEEN CLUSTERS

In this task, the project team brought together the information from the Economic Base Analysis and the interviews and focus groups to identify the key industry clusters in Marin County today, as well as the important linkages, both present and potential, between these clusters.

To identify clusters, the project team used both quantitative and qualitative methods. Using employment and output data from Global Insight (an economic data and forecasting firm), the team calculated the Employment Concentration Ratios (ECR) for each industry in Marin (see Appendix E for a detailed description of this methodology). Using qualitative information from interviews and focus groups, the team refined the definition of each cluster and identified two "cross-cutting" clusters: Community Building and Arts & Crafts, which serve to connect and spur economic activity in the other clusters. For a complete list of industries in each cluster, see Appendix F.

Next, the project team began defining the key linkages internal to each cluster as well as the linkages between clusters. This step involved comparing Marin's clusters with national and regional trends (presented in each of the cluster templates in the attached Cluster Template Supplement). Much of this research was based on reports from industry analysts, site selection magazines, trade journals, company web sites, and other secondary sources.

IDENTIFY TARGET INDUSTRIES

By benchmarking the performance of Marin's clusters with national and regional trends, comparing each cluster (and its component industries) with the selection criteria, as well as exploring the possible linkages between clusters, the project team developed of list of "emerging" clusters that can be considered good "targets" for the County in the future.

These results are presented in Sections V and VI.

III. Economic Base Analysis

A number of excellent recent reports have been written regarding the state of the Marin County economy and the impact of such major issues as high housing costs and traffic congestion on the economy.[3] In the context of the Countywide Plan, research conducted by *Mundie & Associates* in 2002 highlighted a number of key issues and trends affecting the Marin County economy:

- Job growth in Marin County has been steady (average annual growth of 1.4% over the last 10 years);
- There has been a loss of manufacturing jobs and a dramatic increase of service jobs (most notably in business services, retail, and amusement services);
- Housing prices have increased by 95% over the last 10 years;
- Mean household income has only increased by 24.5% in a similar period;
- The cost of doing business in Marin County is high relative to surrounding regions (commercial rents and average wage rates are higher in Marin than in the neighboring counties of Sonoma, Napa, Contra Costa and Alameda).[4]
- Significant inter-county commute patterns conflict with the sustainability goals of the new Marin Countywide Plan.

Mundie & Associates argue that the region's housing and income trends have had a significant impact on the social fabric of the County. Because incomes have not risen as quickly as housing costs, more people per household must work to pay for housing (*Mundie & Associates* estimate a secondary school teacher would need 2.7 incomes to purchase a home in Marin County).[5] This allows people less time in the day for volunteering or charitable giving, let alone community involvement and activism.

Another demographic trend that is having unclear impacts on Marin's social fabric is the increase in the average age of Marin's residents. *Mundie & Associates* hypothesize that this may be due to housing price trends and housing production: "the County has fewer multi-family housing units than other areas, making it harder for younger households to move in; prices of single family homes are relatively high, creating further obstacles for younger households; and older households have few incentives to vacate their units" [given the property tax protection conferred by Proposition 13 and limited transitional housing for seniors].

[3] This section will provide a brief review of what is known from this body of existing literature. For a complete listing of documents reviewed, see the Bibliography in the Appendix.

[4] While *Mundie & Associates* also observe that commercial vacancies have risen, it is worth noting that they continue to be lower than those in the surrounding Bay Area. According to BT Commercial, overall regional vacancies were 21% while those in Marin County were 16.7% during the second quarter of 2003. Over time, Marin County's office market has performed very well relative to the region.

[5] More people working per household likely increases the numbers of vehicles per household.

The most significant trends impacting the County's ability to attract and retain companies are (1) the lack of affordable housing for the County's workforce; (2) the traffic congestion that results as employees need to migrate farther away in search of housing; and (3) the lack of space or facilities into which growing companies can expand. In 2002 and 2003, the Marin Economic Commission conducted a series of studies that examined why major companies are leaving or may leave the County. While most of the respondents of the 42 companies interviewed indicated a significant loyalty to Marin, the overwhelming majority identified these three factors as the most significant in terms of the respondents' ability to do business in Marin. The remainder of this section briefly reviews what is known about each of these phenomena

HOUSING

In 2002, the average purchase price of a single family home in Marin County was $685,000.[6] In the same year, the mean annual wage for occupations in San Francisco, Marin, and San Mateo Counties (the statistical area of which Marin is a part) was $47,272.[7] As *Mundie & Associates* point out in their report, a Marin household would need nearly 3 average incomes in order to purchase a single family home (nearly 2 average incomes to purchase a condominium).

OCCUPATION AND COMMUTE PATTERNS

More than half of employed Marin residents work as managers or professionals (52.5%, or 67,674).[8] In Marin County, there are 37,380 jobs in these occupations. This creates a net difference of 30,294 professional Marin residents who, it is presumed, must leave the County to go to work. By contrast, there appear to be more job opportunities in the County in the service, sales, farming, production and construction occupation categories than there are Marin residents working in these occupations (see table below).

[6] Marin Profile, 2003.
[7] California Employment Development Department.
[8] U.S. Census, 2000.

Table 2: Occupation of Employed Marin Residents and Jobs based in Marin County, 2000

Category	Marin Residents	Marin Jobs	Net Difference	Mean Annual Wage*	Marin Jobs as % Total Workforce
Management, professional, and related occupations:	67,674	37,380	(30,294)	$93,245	34%
Sales and office occupations:	31,867	34,850	2,983	$42,937	32%
Service occupations**:	15,446	18,440	2,994	[$31,402]**	17%
Production, Construction, Operating, Maintenance, Material Handling Occupations	13,494	17,590	4,096	$51,572	16%
Farming, fishing, and forestry occupations	374	1,990	1,616	$27,692	2%
TOTAL	128,855	110,250	(18,605)		100%

Sources: Occupations of Marin Residents from Census 2000, sf3, sample data. Occupations of jobholders in Marin County from CA Employment Development Department, 1999.
Note: U.S. Census categories and EDD categories do not always match perfectly. For example, the U.S. Census breaks construction and production apart in greater detail, whereas the EDD lumps them together. Also, the Census gives far greater detail to the service occupations. It also gives different definitions in the management category. For this reason, this data is presented by broad category only.
** EDD wage data is for 2001. The wages given are averages for the entire San Francisco MSA. The Marin County mean annual wage (mean wage paid to workers employed in Marin County) for 2001, according to County Business Patterns, is $41,652.*
*** Service wages are not directly comparable as Census and EDD definitions for this category differ slightly. The mean annual wage reported here is based on the Occupational Employment Survey (2001) as reported by the Employment Development Department.*

The preceding chart illustrates the phenomenon known to many who experience it daily: a high percentage of those who commute out of the County earn significantly higher wages than those who commute into the County. This is likely due to the fact that a majority of Marin's residents work in highly skilled, professional occupations, the opportunities for which are located outside of the County (largely in San Francisco).

This trend is visible in the map in Figure 2. According to the 2000 U.S. Census, 62% of those working in Marin live in Marin, while the remaining 38% commute out. The lion's share of those commuting out (65.4%) go to San Francisco. By contrast, the migration into the County is slightly more diversified (see Figure 3), although a significant portion of those coming into Marin for work comes from Sonoma County (41.8%). Again, given the results of Table 2, it appears that those migrating into the County for work are making considerably lower wages than those leaving the County for work.

These trends are reflected in the selection criteria for "target industries." The goal is that new industries should create highly skilled job opportunities, which match the skills of the residential population, within the County. This is expected to improve the overall commute patterns (Figures 2 and 3).

It is worth noting, however, that relative to other counties in the Bay Area, Marin County is in the middle of the pack in terms of its ability to host jobs appropriate for its residents (Table 3).

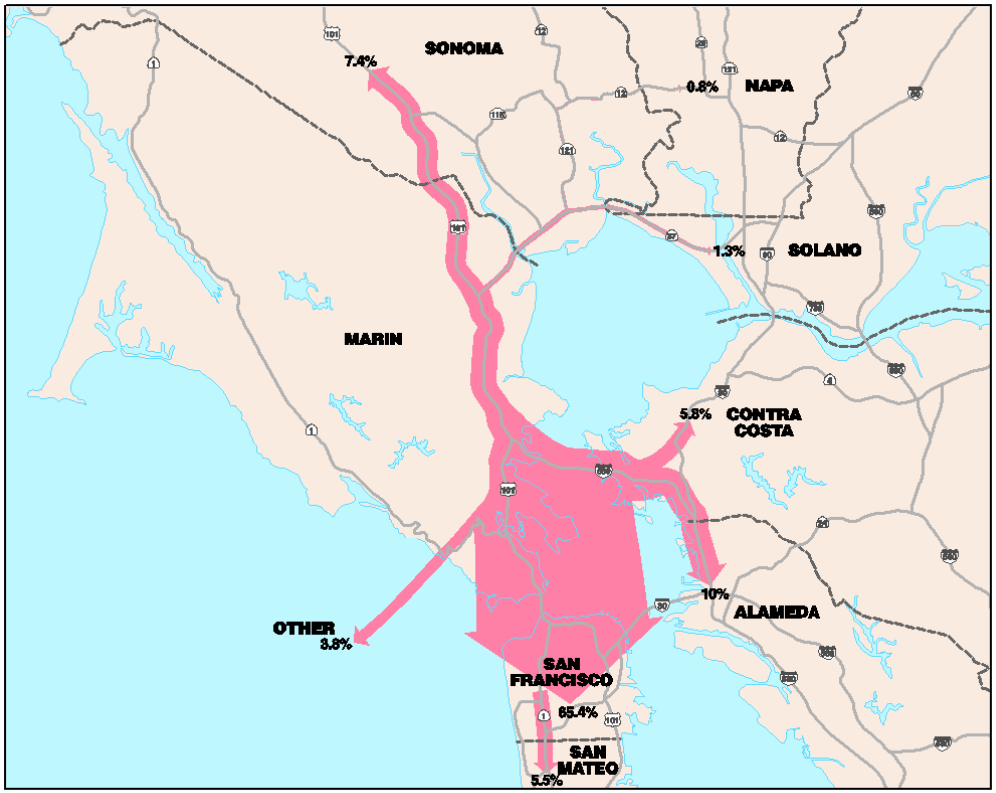
Table 3: Percentage of Bay Area Workers Who Live and Work in the Same County, by County, 2000.

County	% County Workforce who are Residents
San Francisco	76%
Santa Clara	74%
Sonoma	74%
Napa	71%
Marin	**64%**
Alameda	64%
Solano	53%
Contra Costa	52%
San Mateo	52%

Source: U.S. Census 2000 Journey to Work data.

This might indicate that for a county like Marin, with a significant amount of its land dedicated to open space, its current residential occupation/job opportunity balance is not atypical.

Figure 2: Marin County Outflow Commuting Pattern



Marin County

Residence County to Workplace County

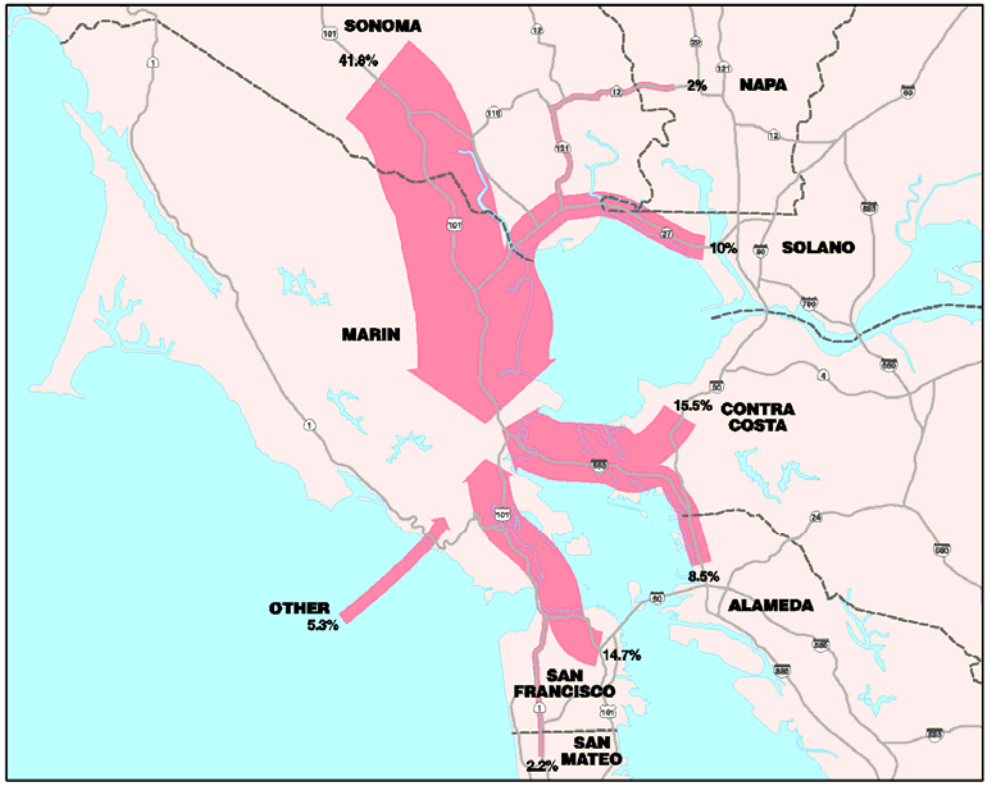
Residents Leaving Marin County For Work

2000

County	Total	Percentage of Marin County Working Residents	Percentage of Residents Leaving Marin County For Work
Alameda County	4,729	3.8%	10%
Contra Costa County	2,740	2.2%	5.8%
Napa County	380	0.3%	0.8%
San Francisco City & County	30,894	24.5%	65.4%
San Mateo County	2,614	2.1%	5.5%
Solano County	610	0.5%	1.3%
Sonoma County	3,493	2.7%	7.4%
Other	1,823	1.4%	3.8%
Marin County (Residents working in county)	78,681	62.5%	
Total Marin County Working Residents	125,964	100%	

Source:
US Census Bureau Residence MCD/County to Workplace MCD/County Flows for California: 2000

Figure 3: Marin County Inflow Commuting Pattern



Marin County

Residence County to Workplace County

Workforce Entering Marin County

2000

County	Total	Percentage of Marin County Workforce	Percentage of Workforce Entering Marin County
Alameda County	3,745	3.1%	8.5%
Contra Costa County	6,803	5.5%	15.5%
Napa County	894	0.7%	2%
San Francisco City & County	6,450	5.3%	14.7%
San Mateo County	973	0.8%	2.2%
Solano County	4,418	3.6%	10%
Sonoma County	18,336	15%	41.8%
Other	2343	2%	5.3%
Marin County (Residents working in county)	78,681	64%	
Total Marin County Workforce	122,643	100%	

Economic Competitiveness Group
2236 6th Street, Suite B
Berkeley, CA 94710
(510) 849-8400
www.ecgroup.com

Source:
US Census Bureau Residence MCD/County to Workplace MCD/County Flows for California: 2000

AVAILABILITY OF COMMERCIAL REAL ESTATE

With nearly 9 million square feet of commercial office space, Marin County represents only 4% of the Bay Area office market. At $2.50 per square foot, its average rents in 2003 (2Q) are 12% higher than the Bay Area average of $2.19. As of the second quarter of 2003, vacancy rates in Marin dropped from 17.6% in 2002 to 16.7% (down from its peak of 21.9% at the time of the first Economic Alert report).[9] The County has very little R&D, industrial or manufacturing space and very few opportunity sites for expansion for these activities.

Representatives from the real estate community are alarmed by the recent exodus of companies and workers in key industries such as high technology and insurance. Recently, Lucasfilm vacated 400,000 square feet. Fireman's Fund, while not leaving the County, is vacating 250,000 square feet of space. Real estate professionals express concern over these trends due to the nature of the vacated space in that it is not easily converted for use by small firms.

While key economic trends and market forecasts for the computer and related high-tech industries show that this industry is and will continue to recover from the dot-com collapse, real estate professionals are skeptical that Marin is still attractive to these kinds of companies. It appears that the County's office market is robust and improves quickly as the business cycle improves. However, those filling the space vacated by others may not be in high-tech or other traded sector activities.

In the *Mundie* report, it is evident that the future pipeline for new office space is limited. As part of the selection criteria, therefore, the real estate requirements of target industries should be flexible and oriented toward office, or mixed-use, properties. In general, target industries should also not be large companies with excessive workforce space requirements. Small and mid-sized companies are the best fit for Marin's available commercial real estate.

In summary, the consequences of the housing, traffic, and real estate trends reviewed in this section on the ability of companies to do business in Marin are consistent with the findings of the two Economic Alerts issued by the Marin Economic Commission:

- Employees are hard to recruit as most are unable to afford the cost of living in Marin;
- Work hours and productivity are impacted by traffic congestion problems;[10]
- Rents paid for commercial and industrial space are at a premium;
- Due to land use constraints, small businesses perceive that Marin County is not a place to grow bigger.[11]

[9] BT Commercial Real Estate, *Marin County Office Report*, 2Q-03, 2003.

[10] According to the Marin Congestion Management Agency, traffic congestion over the next 20 years is predicted to increase at three times the rate of population growth.

[11] Views expressed in the Focus Group discussions during this Study.

Some wonder whether or not to even start in Marin because if their growth requires additional land use or labor, they will have to move out.

TWO POSSIBLE RESPONSES

Two schools of thought regarding the appropriate public sector response to the issues cited above became evident during the interviews and focus group discussions held in the context of this Study:

(1) **Laissez-Faire.** Do nothing. Marin is a highly desirable place to live and work. High costs are not a problem. We must allow the market to determine who can afford to be here; and

(2) **Clear Vision.** The County cannot allow the market exclusively to determine who can live and work in Marin, because that will threaten our quality of life. We will become a suburb for the wealthy employed in San Francisco. To preserve socio-economic diversity and economic sustainability, the County must make an active effort to shape the future of the economy. Businesses need to know that the community wants and will support them; otherwise they will not make long-term investments in the County. A clear vision of what the County wants will help in this regard. (Most proponents of this perspective feel that this strategy should be subject to the overall constraint that county-wide employment, built-up area, and traffic should not increase).

One possible consequence of the first, *Laissez-Faire approach* is likely to be the exodus of large companies and their replacement by relatively small companies. The Economic Alert #1 issued by the Marin Economic Commission in 2002 highlighted this issue. It argues that the commercial space vacated by large companies leaving Marin is often filled with smaller, new businesses. [12]

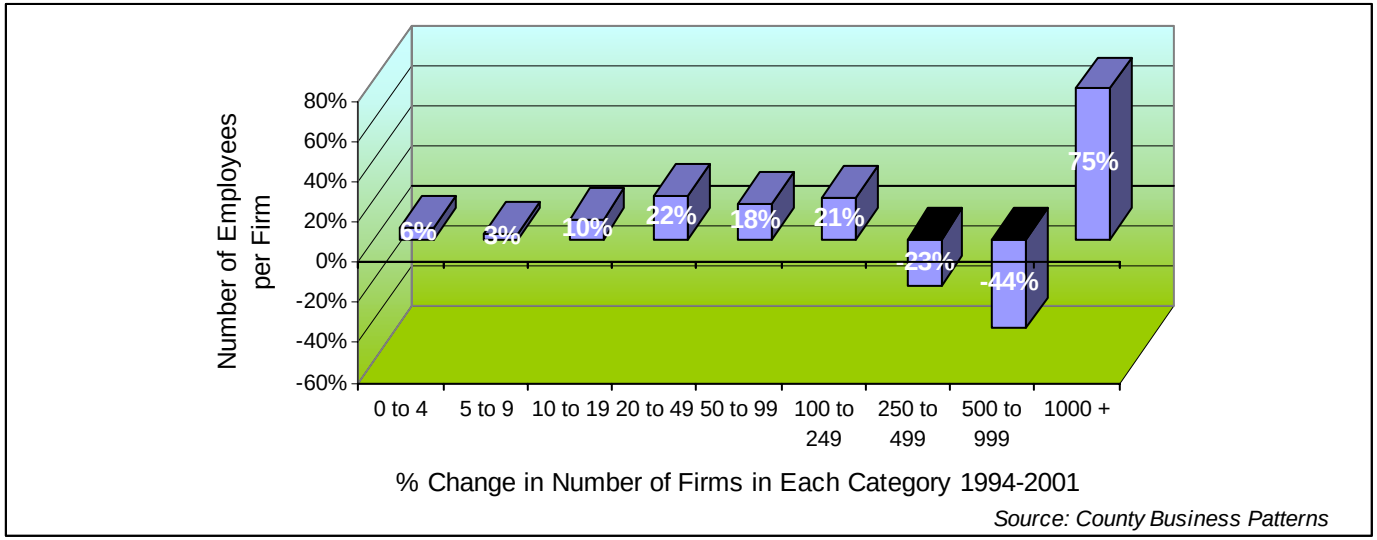
The Alert goes on to make the case that only mature companies are able to make significant charitable contributions to the community. The Alert makes the case for the idea that an economy driven by small firms will ultimately compromise the quality of life in the County as small firms tend to be focused on growing their business, and do not generally involve themselves in community-building efforts to the same degree.

The record of companies starting in Marin shows that most firms (83% of those interviewed in Economic Alert #2) locate in the County because the founder, partners or key employees live in Marin. [13] The community-mindedness of business owners and leaders, therefore, may be correlated with their place of residence in addition to their place of business.

Since 1994, Marin has seen solid growth in small and mid-sized firms and a significant drop in the number of large companies (although, according to County Business Patterns, it appears that the number of firms employing 1000 or more jumped from 1 to 4 between 1994 and 2001). See Figure 4.

[12] Marin Economic Commission, Economic Alert #1, May 2002.
[13] Ibid.

Figure 4: Trends in Firm Size in Marin County from 1994 to 2001



The second approach, which could be referred to as the *Clear Vision approach*, is based in skepticism of the sustainability of the type of economy the free market would produce, as well as the consistency of that economy with the region's cultural norms and values.

Those interviewed in the context of this report frequently questioned the sustainability of a local economy based on only local-serving businesses. While the research for this Study as well as the Economic Alerts (#1 and #2) revealed that the sectors of the economy that rely on a local client base, such as real estate, construction, and local-serving business service firms, have done and continue to do extremely well, they also found that firms that otherwise meet all of the County's criteria - such as digital arts and computer programming – are leaving the area.

The results of our interviews and focus groups yielded the following remarks:

"It's a great customer base and we are privileged to be here," said one partner at a law firm.

"It is great to be a banker in an affluent community," said a local banker. "We're not going anywhere. Our business is County-specific," said the owner of a title company. "To survive here, you need to have local clients. Anyone who doesn't will probably leave. People who don't need to be here will leave."

At the same time, companies whose client base is more regionally dispersed, expressed concern and interest in moving: The owner of an instrumentation manufacturing company said, "New companies would be crazy to come here; no business is going to start in Marin in our field. I'm not sure how smart we are to stay here."

While the Economic Alerts found a significant correlation between business formation in Marin and the residence of the founders in Marin, it also found a correlation between the departure or sale by the founders and the departure of the company itself from Marin. One interviewee noted, "as the company founders leave, the [businesses] are gone. They can improve their balance sheet by 15% by leaving the County." There are examples of this phenomenon, including the sale and departure of Gary Fisher Bikes in the 1990s.

The *Clear Vision approach* assumes that there are real and tangible benefits to sustaining a more balanced economy in terms of traded and non-traded industries. It calls on the County, therefore, to play a more active role in retaining companies that are not only serving the needs of local residents but that do meet the County's other criteria.

FRAMING THE QUESTION

This Study is meant to inform the debate as to which of the previous approaches the public sector might take in response to the economic trends facing the County, and possibly spawn a third. Some of the questions raised by each of the preceding approaches are:

- What kinds of industries is the free market bringing to Marin County?
- Are those industries consistent with the County's overall goals and principles as shaped in its Countywide Plan?
- If the general market trends are consistent with County goals and principles, what should the role of the public sector be?
- If the market trends are not consistent with County goals and principles, what might be done about it?

To answer these questions, the remainder of this report is organized in the following manner:

1. A review of the attributes of Marin County and the types of industries, and industry clusters, that have located in Marin due to those attributes;
2. A cluster-by-cluster application of the selection criteria developed for this Study (which reflect the County's goals and principles);
3. The identification of "target industries," or industries the County might consider supporting given their consistency with the criteria;
4. Recommendations.

IV. Review of Attributes

There are a number of reasons why Marin County is a relatively high-cost place to live and do business. Many have to do with its role in the Bay Area economy, the greatest value-generating region in the world. Greater-than-average incomes create greater-than-average demand for everything from housing to office space. This greater-than-average demand, in a supply and demand-driven economy, raises prices commensurately.

There are other, less mundane, reasons for Marin's high cost structure, however. Many of these have to do with what makes Marin unique: its climate, its bucolic landscape, its proximity to water and recreational resources, its plethora of cultural events, its tradition of philanthropy and concern for the environment. These factors increase demand above and beyond what it would be already given the County's regional context.

In this Study, the project team sought to produce a list of industries (economic activities) that could thrive in Marin, despite its high-cost environment. Many of the industries on this list are those who, for economic or personal reasons (of the founders), derive economic value from proximity to the very things that make Marin a high-cost region. In short, people whose businesses need to be in Marin because it offers them a higher-than average return on their investment.

This section reviews a number of attributes of the region that allow certain enterprises to reap a higher-than-average rate of return.

MARIN COMPANIES ARE HIGHLY PRODUCTIVE

Compared to U.S. and state of California averages, the Marin County economy is highly productive. The average Marin County worker produces 5% more revenue than the average U.S. worker (Figure 5). The output (sales) of existing Marin companies has grown faster than those in California and the U.S. over the past 20 years (Figure 7).

The Marin economy is also highly successful at creating jobs. Its 20-year job growth rate has been nearly 10% greater than that of the U.S. and California (Figure 8). And yet, the growth in the net number of companies in Marin (new companies, less companies that have left or gone out of business) has not been as rapid as it has in California and the U.S. (Figure 6).

These trends are consistent with the sales growth patterns of the County's key industry clusters (discussed in Sections V and VI), which show that nearly all of the County's key industry clusters are growing faster than the national average.[14]

[14] Global Insight, 2003.

Figure 5: Sales per Worker, 2003.

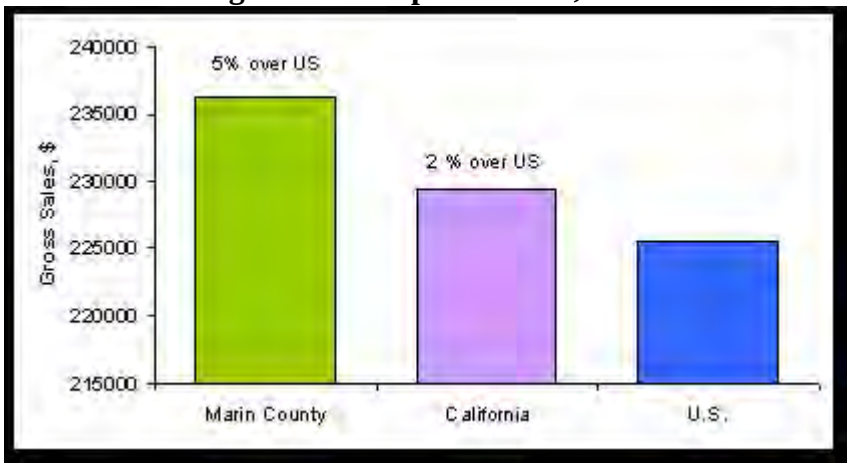


Figure 6: 20-Year Net Growth # of establishments 1983-03.

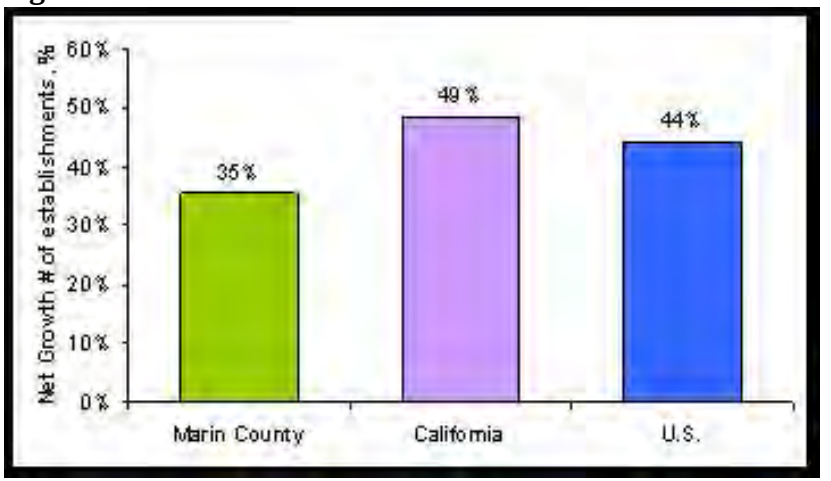


Figure 7: 20-Year Growth in Sales: 1983-03

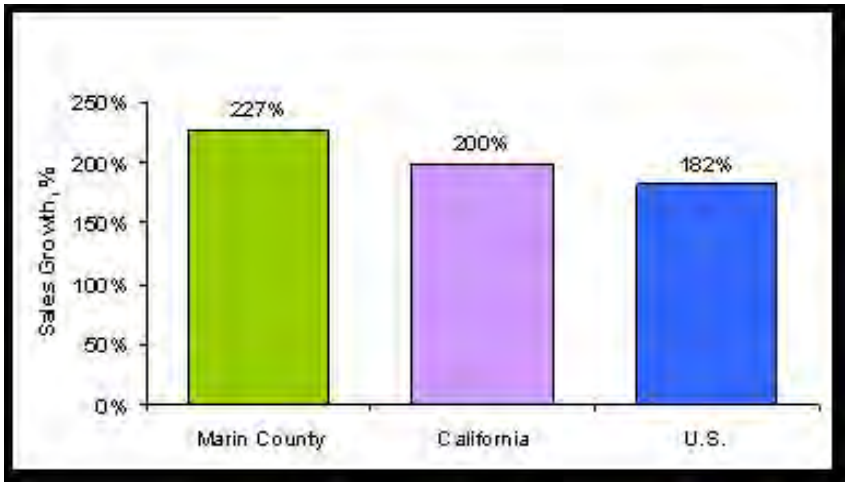
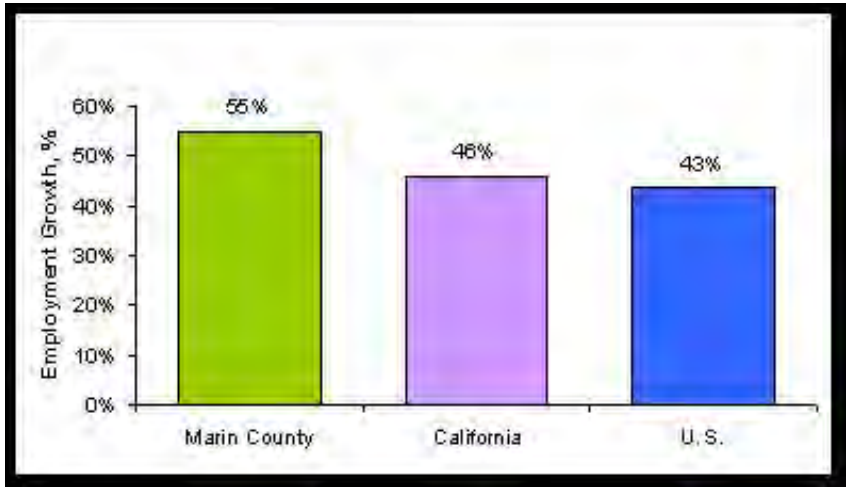


Figure 8: 20-Year Growth in Employment: 1983-03



Source: Global Insight, 2003

MARIN COUNTY IS A CENTER OF CREATIVITY

The Rise of the Creative Class [15]

In his recent book, "The Rise of the Creative Class," Richard Florida argues that human creativity [rather than factor endowments (land, labor, capital), economies of scale, or even technology] has become the driving force of economic growth. While there has been much written about the "information" or "knowledge" economy, Florida argues that today's economy is more fundamentally powered by our "ability to create meaningful new forms." He makes this case based on research in which he examines the dramatic changes in the way people live and work: how traditional work schedules, hierarchical power relationships, and dress codes have fallen by the wayside. He documents the extent to which employers have sought to create more open, tolerant workplaces in order to attract a new type of worker, "the Creative Class," because they see the value of the "maverick," the non-traditional thinker, in every industry, from automobiles to fashion, food products, and information technology itself. "Access to talented and creative people is to modern business what access to coal and iron ore was to steel making." [16]

In the 1990's, many of the traditional assumptions of how regions should attempt to shape their economic development crumbled. It became apparent that workers were no longer moving to be near companies, but that companies were beginning to move to where the talented labor pool is. Where regional economic development professionals traditionally sought to attract new companies to their regions (a term we euphemistically call *buffalo hunting*) by offering tax incentives or infrastructure improvements, in the 1990's, it increasingly became clear that companies were looking for communities that are centers of creativity, where innovation is valued, and where they would be assured a steady supply of talented labor.

In order to gauge a region's ability to do this, Richard Florida developed a new measure called the *Creativity Index* which is a mix or four, equally weighted factors:

1. The Creative Class share of the workforce;
2. Innovation, measured as patents per capita;
3. High-tech industry, using the Milken Institute's widely accepted Tech Pole Index;
4. Diversity, measured by the Gay Index, a reasonable proxy for an area's openness to different kinds of people and ideas.

Florida ranked the forty-nine largest metro regions in the United States and found that "the San Francisco Bay Area is the nation's undisputed leader in creativity." While a separate ranking for Marin County is not currently available, its role in the region's creative strength cannot be disputed.

[15] Florida, Richard. The Rise of the Creative Class. New York, NY: Basic Books, 2002.
[16] Ibid, p.6.

How Creative Are We?

Other indicators of Marin County's relative creativity include occupational trends and the number of patents issued per resident of resident industry.

If we examine the current occupations of the residents of Marin, we find it ranks 1st in the country in terms of individuals engaged in "creative" work.

Table 4: Top 10 County Share of Workforce in Creative Occupations, 2000

						Share of Total Employment	
County	**State**	**Total Population**	**Total Employed**	**Rank Arts share**	**Rank Management & Professional share**	**Arts, design, entertainment, sports and media**	**Managerial & Professional Except Arts**
Marin County	**CA**	**247,289**	**128,855**	**1**	**4**	**5.73%**	**46.79%**
Boulder County	CO	291,288	162,428	2	5	3.53%	46.65%
Santa Cruz County	CA	255,602	129,380	3	33	3.10%	37.16%
Santa Barbara County	CA	399,347	180,716	4	79	2.88%	32.48%
Leon County	FL	239,452	122,840	5	12	2.88%	42.38%
Washtenaw County	MI	322,895	172,373	6	6	2.72%	45.59%
Dane County	WI	426,526	246,064	7	16	2.69%	40.93%
Alachua County	FL	217,955	105,293	8	15	2.68%	41.32%
Sarasota County	FL	325,957	135,419	9	113	2.63%	29.06%
Larimer County	CO	251,494	136,903	10	36	2.61%	37.03%
U.S. Average						**1.92%**	**31.73%**

Source: Don Grimes, University of Michigan, based on U.S. Census occupational data. The arts employment is based upon individuals (residents) identifying themselves as working in "arts, design, entertainment, sports or media" occupations.

When we consider the number of patents issued to Marin County residents or resident firms, we see that the County, while small, produced a higher percentage of patents per capita in 1999 than the state of California or the U.S.

Table 5: Ratio of U.S. Patents per Person by County, 1999

County	Patents, 1999	Population, 1999	Ratio
Santa Clara	5,664	1,658,000	0.0034
San Mateo	1,153	698,300	0.0017
Santa Cruz	245	251,600	0.0010
Alameda	1,186	1,412,100	0.0008
Westchester, NY	614	937,279	0.0007
Marin	**154**	**243,800**	**0.0006**
San Francisco	393	762,400	0.0005
CA TOTAL	16,776	33,140,000	0.0005
US TOTAL	83,905	267,801,951	0.0003
Los Angeles	2,348	9,330,100	0.0003
Sarasota, FL	85	339,625	0.0003
Monterey	61	390,500	0.0002

Source: U.S. Patent & Trademark Office, U.S. Utility Patents Granted 1999, A Technology Assessment & Forecast Report, April 2000. Population data from Global Insight, 2003. This data is the most recent available.

The key for Marin County will be its ability to translate its underlying advantage as a host of the *Creative Class* into "economic outcomes in the form of new ideas, new high-tech businesses and regional growth."[17] The good news is that Marin County has a long history of being a center of creativity where innovation is not only valued but is considered an art form.

The creative legacy of George Lucas, Gary Fisher, Bob Weir, Anne Lamott and many, many others fosters a long-standing culture of iconoclasm, activism, and difference from the norm. These cultural traits are precisely where much of the energy driving the "New Economy" comes from. These traits are and will continue to be tremendous economic assets for the region.

[17] Ibid, p. 244.

MARIN CONTINUES TO BE A CENTER OF INNOVATION

"This is the idea place. This is where we reflect and think and create. This is where we do our most important work."

-- George Lucas, referring to Marin County, as reported by the *Chicago Sun-Times*, 2002

"At the Buck Institute, we have research resources, and we have the capacity to partner them with new companies. We can help, but the community as a whole must drive the effort to improve the outlook for high-tech and biotech in Marin."

-- Jeff Labovitz, PhD, Director of Technology Transfer at The Buck Institute for Age Research, in a recent interview with the *North Bay Business Journal* (Issue Number 131, 2003).

THE IDEA PLACE: THE GEORGE LUCAS STORY

George Lucas chose to base his studios in Marin County, as opposed to Los Angeles, because of the lifestyle. Lucas' has four main divisions in Marin County: Lucas Digital, which is Industrial Light and Magic; Skywalker Sound; Lucas Entertainment, the makers of video games; and Lucas Leasing, have developed over time to meet the growing demand for their products.

These divisions have also spawned new companies. In 1986, Industrial Light and Magic sold its Computer Division which became Pixar Animation to Steve Jobs. Pixar Animation Studios went on to create and produce the first computer-animated feature film, the Academy Award-winning *Toy Story*, released in 1995. Also, The Learning Division was established to design multimedia educational products, which emphasize freedom, self-discovery, choice, and no "rules". Games are designed to nurture both creativity and critical thinking by learning through play.

At the Technical Building at Skywalker Ranch, a 140,000-square-foot post production sound recording and mixing facility has sound stages and mixing rooms with some of the strictest sound control criteria in the world. The scoring stage has been used for recording by such luminaries as Pearl Jam, Philip Glass, Isaac Stern, The Count Basie Big Band, The Grateful Dead, Paul McCartney, and Rosemary Clooney. [18]

"Because of their presence here, they are drawing others, such as software companies and other entertainment companies," Elissa Giambastiani, President of the San Rafael Chamber of Commerce, said, "their impact on this county has been substantial." According to a study conducted by Lucasfilms five years ago, the company pumped about $80 million per year into the local economy. The jobs created by Lucasfilms generate an additional $80 million per year, according to the study.

[18] http://www.geocities.com/Hollywood/Bungalow/3577/lucas.html

Lucas wanted to build another animation campus in Marin, but there was no more space to offer due to land use restrictions, so Lucas decided to build a campus in the Presidio of San Francisco that will be completed over the next few years. According to our interviews, though they will be moving a part of their production to the new Presidio site, most of their production activities will remain in Marin, and all the payroll dollars come back to Marin. Lucas hopes to have the new site be an incubator for new innovations in film and technology.

INNOVATION CENTER OF EXCELLENCE: THE TOMALES BAY FOODS STORY

Despite getting started only 5 years ago, Tomales Bay Foods dairy initiative, Cowgirl Creamery, was the winner of the prestigious annual American Cheese Society (ACS) competition, which featured specialty, artisan and farmstead cheese producers.

The competition's "Best of Show" award was presented to Cowgirl Creamery of Point Reyes for Red Hawk, a washed rind cheese. Among the first-place winners was the state's oldest cheese producer, Marin French Cheese Company of Petaluma, which won five awards this year.

How can a company that only started five years ago get so good so fast? Sue Conley, founder of Tomales Bay Foods, sees the success as twofold. In all of the big cheese producing regions in the U.S., cows are unhealthy, stressed due to weather extremes – too cold in Vermont and Wisconsin, too hot in the Sacramento Valley. Marin cows are not only very healthy due to our year-round great weather, but they also have fresh grass to feed on nine months of the year, far more than those other regions. So they start with great milk.

The flavor of the cheese comes from another source: the concept of terroire, or "place-specific foodstuffs". Conley and her partners went to Italy and observed how the culture in a region, people's attitude towards the wine or food product, contributed to the ultimate quality of that product.

In France, the concept of "terroire," roughly translated to mean the interconnections among people, nature, soil, taste, place – perhaps best described as the soul of a region – often dictates how crops are grown, the way food products are cured, how animals are treated and how communities share food. There are cultural, ethical and community reasons for decisions about agriculture. Short-term economic gain is not always the bottom line.[19]

On their return, they applied this approach with a vengeance, and their cheese line is only one of their successes.

Another remarkable aspect of Tomales Bay Foods is the spontaneous realization of the concept of a business incubator. The company, along with the Creamery and several other partners, is housed in a large converted barn, one block from downtown Pt. Reyes Station. This

[19] Source: http://www.mda.state.mn.us/ESAP/greenbook2000/essaygilje.pdf. "Sustainable Agriculture Marketing in Action: Where the Sticker meets the Scanner."

lovingly restored building has honey, vegetables, cheeses, a bakery, and a clothing retail outlet, among others on the ground floor (as well as Cowgirl Creamery's production unit, behind glass, where visitors can watch the cheese being made). Upstairs, the offices of not only Tomales Bay Foods, but also a graphic designer, an architect (who designed the renovation of the building), and two environmental-related offices.

The synergies between these businesses makes it a genuinely innovation-rich environment, and contributes to the overall atmosphere of dynamism, combining the best of modern marketing savvy and traditional, quality-oriented production. It should come as no surprise that this building is also a hub of activity supporting the Marin Agricultural Land Trust, dedicated to preserving open space and active use of agricultural lands in Marin.

A Cross-Pollination Of Ideas: The Mountain Bike Story

One of the great stories of innovation in Marin County is the history of the mountain bike. A motorcyclist turned cyclist discovered an old dirt road west of Fairfax, Marin County, in the early '70s. He and his friends would ride or push bicycles to the top of the ridge and the road plummeted 1300 feet in less than 2.1 miles. On the twisting road down, the hub coaster brakes would get so hot that the grease would vaporize. After several runs, the hub would need to be repacked with new grease. This also was the first time a derailleur had been seen on a balloon-tire bike. The thumb-shifters and handlebars were equally forward thinking.

The "Repack" race became a magnet for riders from all around the Bay Area. Initially, races were held once a week. At the starting line on the top of Pine Mountain, riders would talk about their new bike discoveries and developments and the sport of mountain biking was born. This cross-pollination of ideas spurred the bike's evolution and solidified the sport.

According to the Mountain Bike Hall of Fame in Crested Butte, Colorado, "the continuous history of the mountain bike is most evident in Northern California. There are a few areas that will claim to be the first mountain bike community, but every history book will lead you to Marin County. The origins of mountain biking were totally innocent. It came into being not as some faddist vision of profit-oriented marketing types, but rather as the product of true cycling enthusiasts trying to find something new to do on two wheels. These cyclists found through fun and competition that the old one-speed klunkers they were using could be improved with modern cycling technology. One thing led to another and mountain biking "the sport" was born.[20] From these early days of the Repack race, companies like Gary Fisher Bikes and Marin Bikes were born. Of these, only Marin Bikes remains in Marin today.

Each of these stories is an excellent example of how Marin's climate of innovation and creativity has led to economic success. In each case, an entrepreneur realized the value of an idea that sparked from a place. Because of their allegiance

[20] http://www.mtnbikehalloffame.com/history.cfm?page=3

to that place, they started their company there. What also becomes evident, however, is that despite each entrepreneur's success in identifying a niche and creating a company around an idea, his/her ability to grow his/her particular company was ultimately limited by the place as well. The very factors that make Marin so appealing - open space, value of the arts, creative-minded residents - are also those that physically limit companies' ability to grow. Generally, companies in Marin can only grow to a certain extent before leaving due to Marin's infrastructure and land-use limitations.

Each of the entrepreneurs discussed here faced a choice: stay small, grow and leave Marin, or sell. This is a difficult choice for many as the initial attraction to locate in the area is part of why they started their company here. Not all entrepreneurs make the same decision.

SMALL, FLEXIBLE AND HOME-BASED FIRMS CAN BE INNOVATIVE

In the "New Economy," new products and services frequently emerge from small, flexible firms that have ready access to employees and financing once they have patented technologies or proven that markets exist for their products. Marin is home to a higher-than-average concentration of small and home-based firms. This may allow the County's industries a greater degree of flexibility. It may also be a function of a constrained real estate environment.

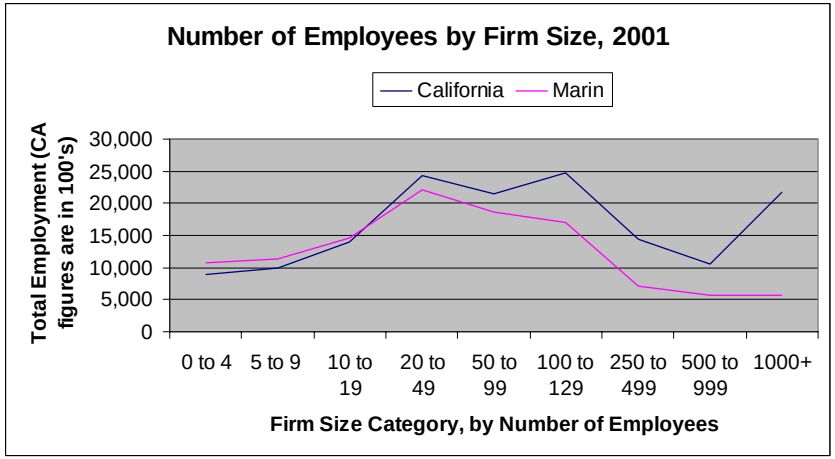


Figure 9: Number of Employees by Firm Size, 2001

Source: California Employment Development Department, 2001.

Home-Based Business Trends

Another indicator of innovation and the potential for entrepreneurship in an economy is the number of home-based businesses. Many businesses are launched out of a residence and only move to commercial space once a particular revenue level or target market has been reached. In Marin County, nearly 1 in every 3 businesses (30.6%) is based in someone's home.[21] (This number grew more than 4% from 2001 to 2002.

Figure 10: Marin County's Home Based Businesses, 2003

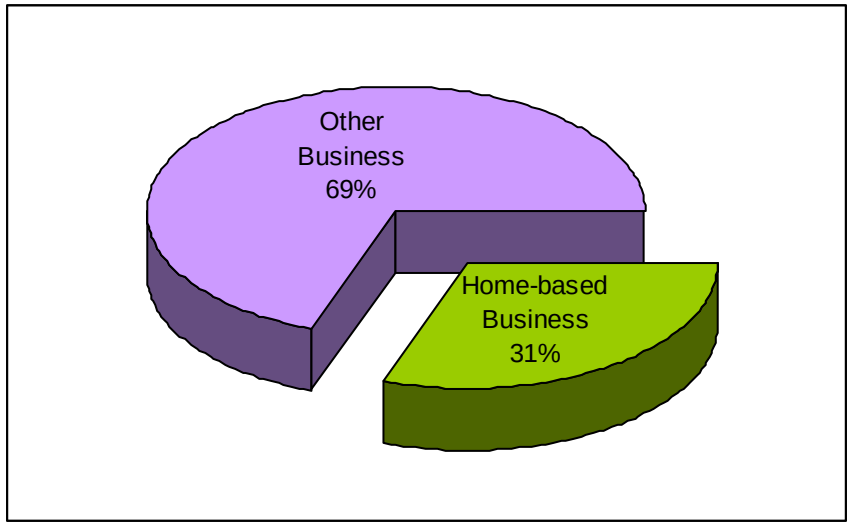


Table 6 depicts this trend by city. Larkspur, San Anselmo, and Tiburon see more than half of their registered businesses operating out of a residence. The County's two largest cities, Novato and San Rafael, contribute the largest share of home-based businesses to the County total.

Table 6: Home-Based Business Licenses Trends by City, 2002

City	% of Total City	% of Total County
Marin County	31%	100%
San Rafael	20%	34%
Novato	27%	20%
Mill Valley	20%	10%
Sausalito	23%	8%
San Anselmo	64%	7%
Larkspur	75%	6%
Corte Madera	39%	5%
Fairfax	47%	3%
Tiburon	54%	3%
Belvedere	17%	2%
Ross	8%	2%

Source: Municipal Business License Data, 2002.

[21] Municipal Business License Data, provided by the Marin County Community Development Agency, 2001-2002.

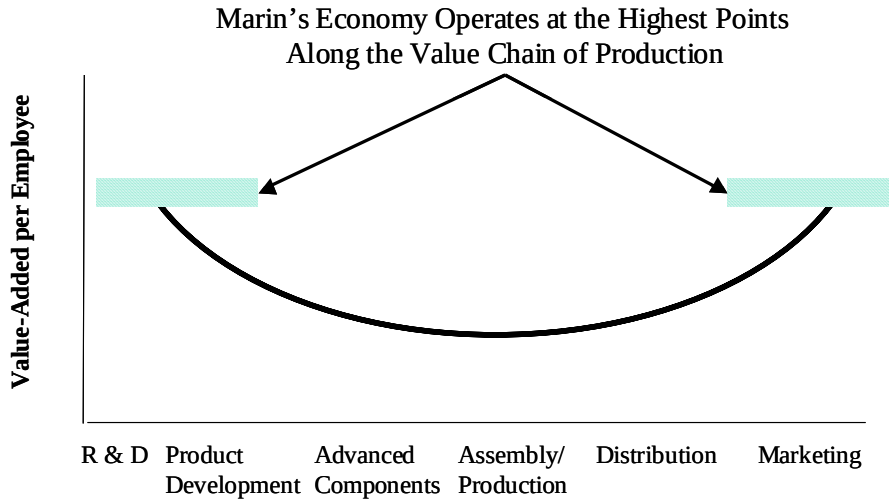
MARIN'S ECONOMY OPERATES AT THE HIGH ENDS OF THE PRODUCTION CYCLE

One important consequence of the fact that Marin is home to highly productive, creative, and innovative industries is that it can afford to operate primarily at the high ends of the production cycle. Product Life-Cycle theory (developed in the 1960's by Harvard Economist Raymond Vernon), observes that a new product moves through several stages in its production cycle. Initially, the product is developed in a place where local demand for the product is fairly high or, at least, more sophisticated. As demand grows for the product, its production is refined and ultimately routinized (e.g., the assembly line at an auto plant) to the point at which it could be produced anywhere in the world. Frequently, production then moves out of the higher-cost region where the product was developed and to a lower cost region for continued production.

With mass production come increasingly sophisticated requirements for distribution, inventory management and marketing. These activities tend to be information intensive, requiring complex market research and international negotiations with customs agents and distributors. The return on these activities (value added per employee) is frequently high.

What is unique about Marin is that its traded sector economy operates primarily at the highest points of the value added chain of production (see Figure 11). As the region's manufacturing and warehousing sectors have declined, high-end service sectors (financial and management services, for example) have increased dramatically. By being concentrated in activities such as research, product development and marketing, as opposed to assembly and distribution, much of Marin's traded sector employment can afford to pay higher-than-average wages. Most regions operate at various places along the chain of production. Marin enjoys a unique position in that much of its production is highly valued but tends to have minimal impact on its natural resources. When considering whether or not Marin's position as a high-cost place to do business is sustainable, it is important to consider how much of its production remains at the high (and higher paying) ends of the value added scale.

Figure 11: Marin's Value Chain of Production



LIFESTYLE MATTERS IN THE CREATIVE ECONOMY

The Economic Alert Report #2 found that 83% of the company executives they interviewed located in Marin because of lifestyle reasons. This fact was corroborated in the interviews and focus group discussions held in the context of this Study as well. Research conducted in the 1990's found that lifestyle amenities, such as cultural districts, retail venues, sports and recreation opportunities, were a powerful draw for companies requiring a high-skilled workforce. The logic seemed to be that workers with higher income could afford a higher quality of life.[22]

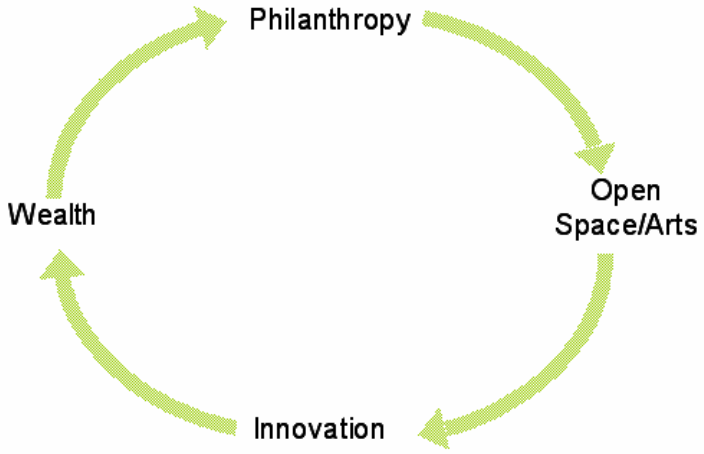
To identify the Creative Class, Richard Florida also develops a *Composite Diversity Index* (CDI) which is a combination of his (1) *Bohemian Index* (which measures the number of writers, designers, musicians, actors and directors, painters and sculptors, photographers and dancers in an area); (2) *Gay Index*, which ranks regions by their concentrations of gay people (a proxy for tolerance); and (3) *Melting Pot Index*, which measures the relative percentage of foreign-born people in a U.S. region. Not surprisingly, the San Francisco area (including Marin), ranked highest. Florida found this Index to be an excellent predictor of a region's high-technology base, results that support his major finding: "that diversity and creativity work together to power innovation and economic growth."[23]

[22] Richard Florida, The Rise of the Creative Class, New York: Basic Books, 2002, p. 258.
[23] Ibid., p. 262.

Marin's Virtuous Cycle

In the case of Marin County, the mutually reinforcing cycle between creativity, innovation and wealth creation is well known. When the region's values of philanthropy, community-mindedness and environmental preservation are added to this mix, something happens that the project team calls *Marin's virtuous cycle.* The tremendous synergies between the region's values of philanthropy, open space preservation (and support for the arts) and creativity result in an astounding degree of wealth creation, which in turn re-fuels the region's ability to fund charitable giving, preserve open space, and fund the arts. This *virtuous cycle* is depicted as a reinforcing circle:

Figure 12: Virtuous Cycle



V. Identifying Marin's Existing Clusters

To understand how the industries in Marin derive benefit and provide reinforcement to this *virtuous cycle*, we must take a moment to identify those industries as well as the industry *clusters* of which they are a part. *Industry clusters* are geographically specific groupings of inter-connected companies (specialized suppliers, service providers and support institutions). Examples include the film industry in Los Angeles, the high technology industry in Silicon Valley and the finance industry in New York. By locating near each other, or clustering, businesses can increase their productivity, accelerate innovation, and stimulate new business formation.

Figure 13: The Structure of a Cluster

The Structure of a Cluster Pyramid ©ECG

Figure 13 illustrates the general structure of a cluster: leading firms (usually larger firms), who export goods and services out of a region, thereby bringing new wealth into the region, are supported by a network of supplier firms who provide the inputs and expertise needed by the lead firms. In turn, both the lead and supplier firms draw support from a region's economic, environmental and social foundations: its human resources, access to technology, access to capital, business climate (relationship with the public sector), as well as its physical infrastructure.

The principal clusters that comprise Marin's economy today are[24]:

- Real Estate & Construction
- Multimedia
- Business Services
- Finance & Insurance
- Restaurants & Tourism
- Health Services
- Agriculture
- Community Building (Non-Profits; Philanthropy)
- Arts & Crafts

The project team identified these existing "traded" industry clusters by first calculating how concentrated Marin County

[24] Identified using a cluster segmentation framework, described in Appendix E.

is in each cluster in terms of employment (Employment Concentration Ratio, or ECR). This ratio (ECR) compares Marin to other regions in the U.S. A ratio of "1," therefore, implies that Marin's concentration of employment in that cluster is the same as that of the U.S. average. When a cluster has an ECR greater than 1, it reveals that Marin is more highly concentrated in that cluster than a typical U.S. region.[25]

After identifying which industry clusters are concentrated in Marin, the project team then examined the growth potential if each cluster. The growth potential is simply the sales growth forecast for that cluster over the next five years (as estimated by *Global Insight*, an economic forecasting service).

Figure 14 below compares Marin County's relative employment concentration in each cluster (y-axis) with the potential growth of that cluster (x-axis).[26] Each cluster is depicted as a bubble and the size of each bubble reflects the total employment in that cluster in Marin County.

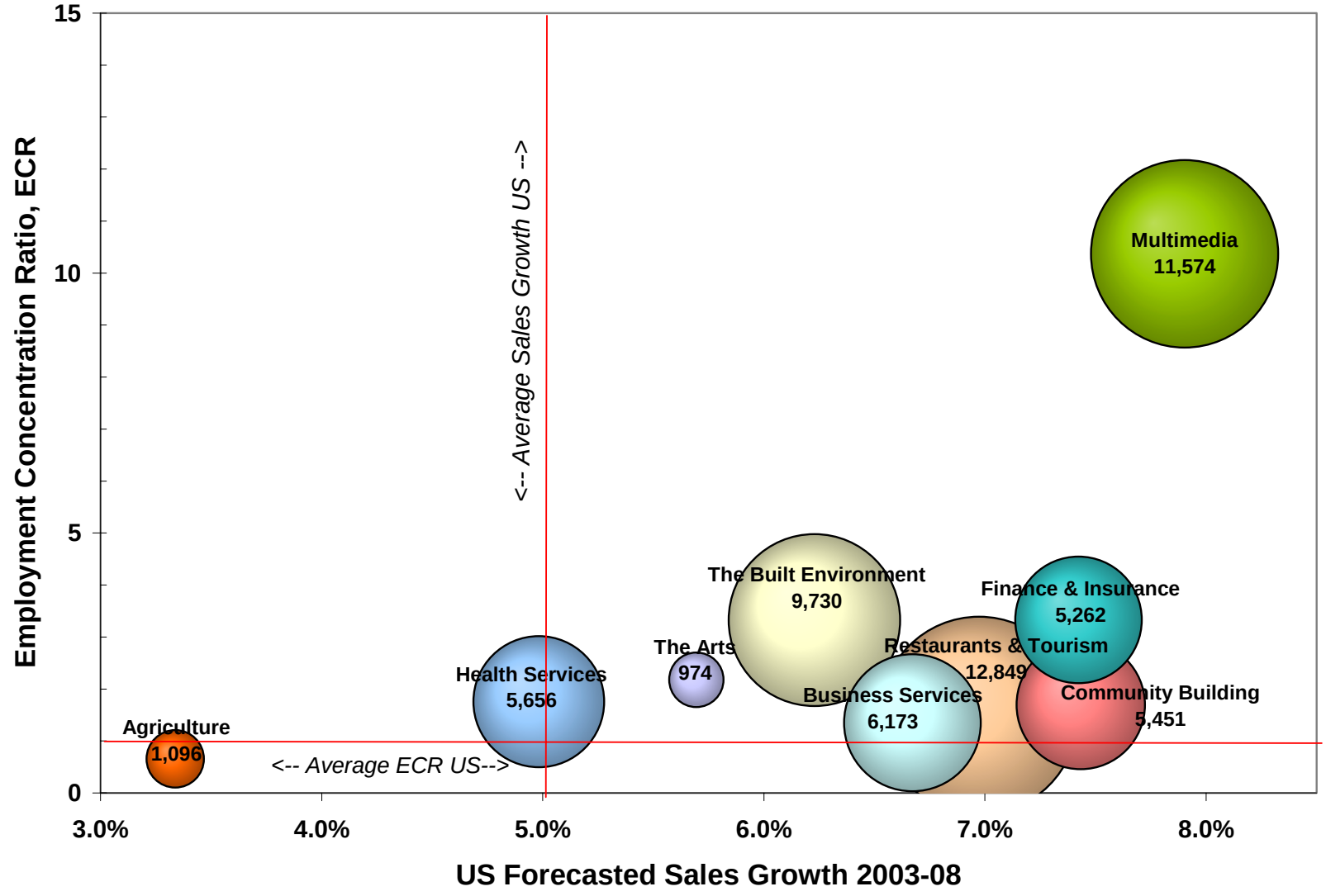
Two lines are superimposed on the chart in order to more easily compare the performance of Marin's clusters with those in the U.S. The horizontal dotted line depicts an ECR of "1" or an average level of industry employment across the U.S. The vertical dotted line depicts the average U.S. growth in sales forecast for the next five years across all industries.

These two dotted lines divide the chart in Figure 13 into four quadrants which the project team refers to as Stars," Opportunities," "Challenges," and "Mainstays." The clusters in the upper right-hand corner of the diagram are considered "**Stars**," in that the region (Marin in this case) is highly concentrated in them and they are due to experience faster than average sales growth. Clusters in the lower right-hand corner are considered "**Opportunities**" because although Marin is not concentrated in these activities now, they are forecast to do well and so Marin may want to explore their potential. Clusters in the lower left-hand corner are called "**Challenges**" because Marin is neither concentrated in them nor are they forecast to do well. Finally, clusters in the upper left-hand quadrant are called "**Mainstays"** because although they are not growing very fast, the region is nevertheless highly concentrated in them and they are likely to be older, mainstay, industries on which the region has relied for a long time but which may not be part of the region's future unless they can be helped to regain competitiveness and boost sales.

[25] The industries included in each of these clusters can be found in Appendix F and in each of the cluster templates found at the end of this report.

[26] This approach was originally conceived by Chris Holling of Global Insight.

Figure 14: Marin County - Cluster Segmentation Chart



ECG
ECONOMIC COMPETITIVENESS GROUP

What is remarkable about Figure 14, is that nearly all of Marin's key traded clusters are "Stars." Only Agriculture is considered a "Challenge" industry in that it is slow growing and Marin is not concentrated in it relative to other counties. But each of Marin's other clusters is either a Star or an Opportunity. Health Services, in the middle of the chart, is accurately depicted as average in that the bulk of this cluster is devoted to providing health services in proportion to the Marin population. In other words, Marin is not exporting Health Services at this point.

Table 7: Marin County Clusters by Category, Employment, and Output (Sales), 2003.

Cluster	Category	Employment	ECR (*)	% Total Employment	% Total Sales ($)
Restaurants & Tourism	Star	12,849	1.49	11.09%	4.10%
Multimedia	Star	11,574	10.37	9.99%	10.90%
Real Estate & Construction	Star	9,730	3.33	8.40%	20.40%
Business Services	Star	6,173	1.35	5.33%	6.50%
Health Services	Average	5,656	1.75	4.88%	3.00%
Community Building	Star	5,451	1.70	4.71%	1.50%
Finance & Insurance	Star	5,262	3.33	4.54%	6.00%
Agriculture	Challenge	1,096	0.66	0.95%	0.50%
Arts & Crafts	Star	974	2.18	0.84%	1.00%
Total Clusters		58,765		50.73%	46.10%
Non Clusters		57,073		49.27%	53.90%
Marin Employment 2003		115,838		100%	100%

An Employment Concentration Ratio of 1 means an industry that is no more concentrated than the average county in the US. Multimedia, for example, is nearly four times as concentrated in Marin as in the US as a whole. Source of sales and employment data: *Global Insight.*

Another way of looking at Marin's existing traded clusters is comparing how much they produce (see Table 7). A cluster's output is defined as the gross sales of companies in each cluster. Interestingly, the largest clusters in terms of sales are not necessarily the largest clusters in terms of employment. For example, Restaurants & Tourism employs nearly 10% of the County's workforce but produces only 4.1% of its output. This comparison is a good indication of why the cluster may pay lower than average wages. This issue and its impact on how this and other industry clusters compare to the County's criteria will be discussed in the next section as well as in the Appendix.

That nearly all of Marin's existing clusters are Stars is highly unusual. Most regions have a few Stars but many more Mainstays and Opportunities. While the challenge for most regions lies in public-private collaboration so that more industry clusters move into the upper-right "Star" quadrant; Marin's challenge is to ensure that its existing clusters remain Stars and that new, emerging clusters are identified and nurtured to replace any stars that may fade.

Depicted graphically with the *virtuous cycle*, the mutually reinforcing nature of these clusters becomes evident:

Figure 15: Relative Output of Marin Clusters, 2003.

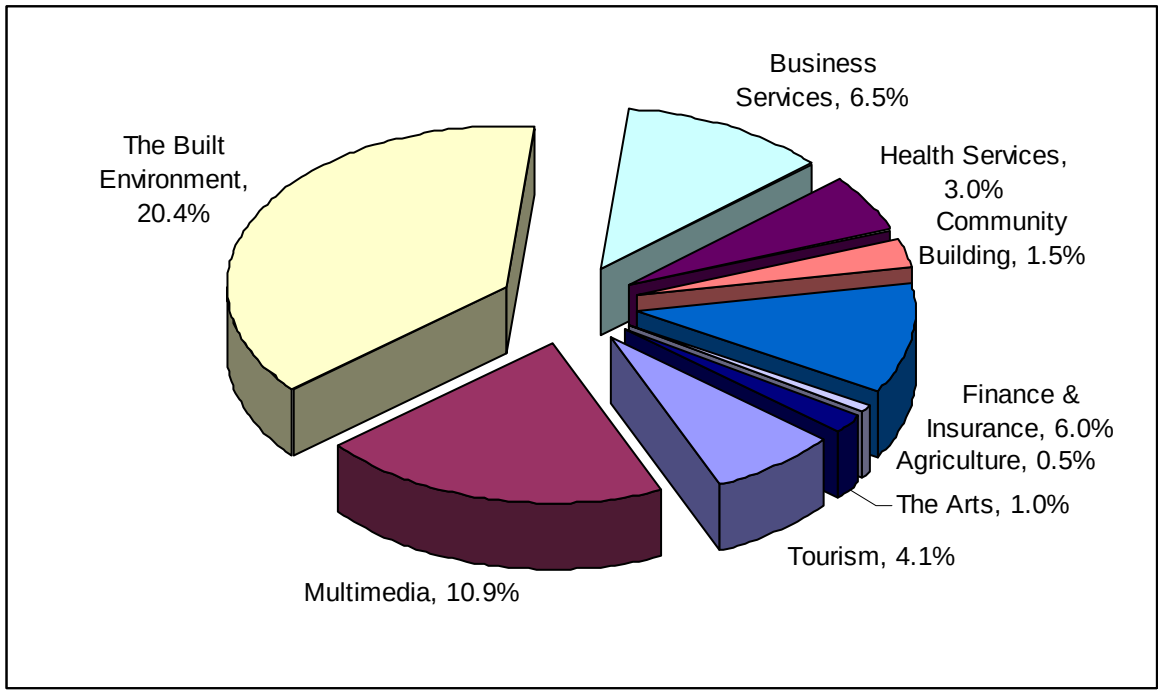
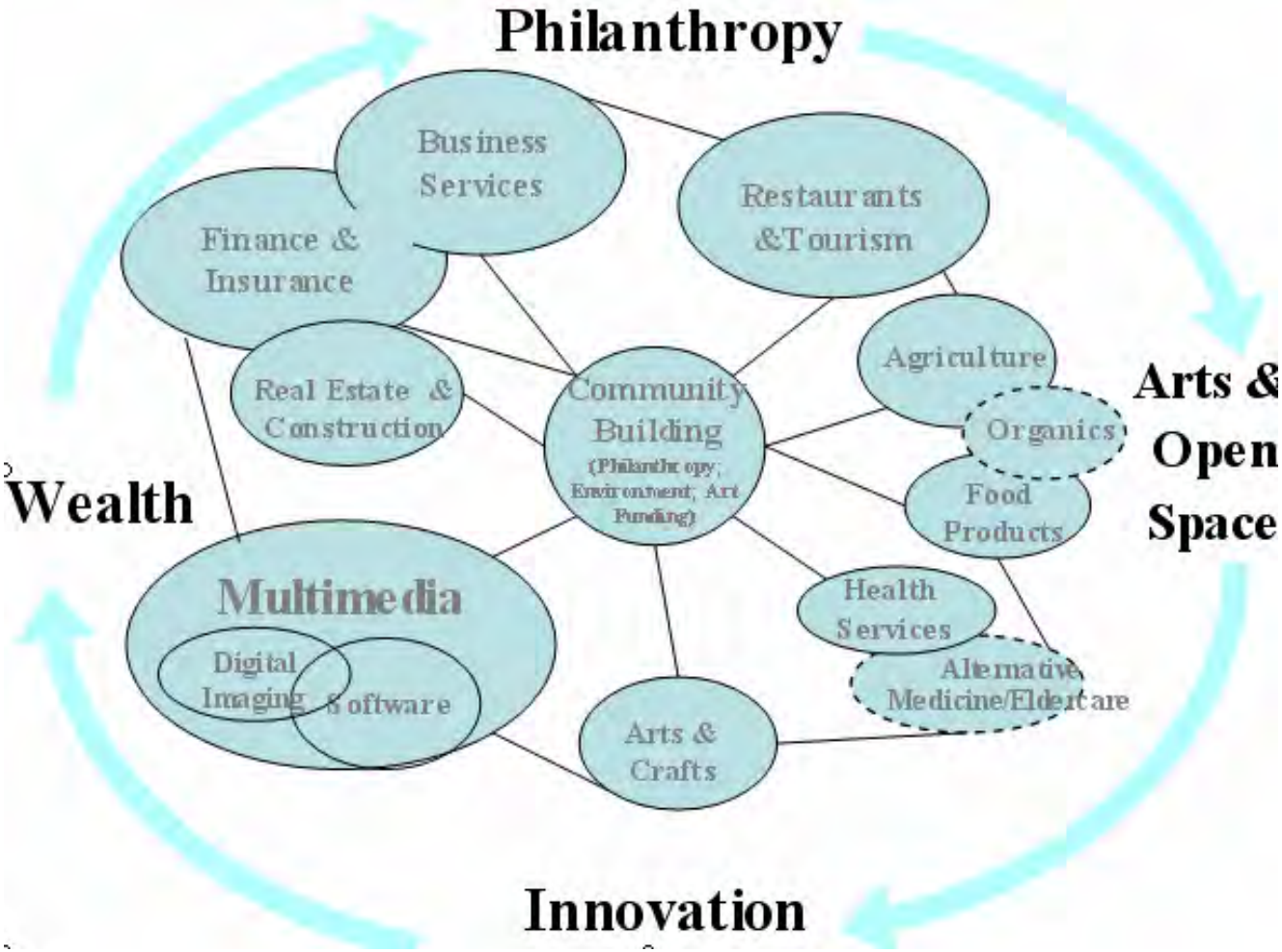


Figure 16: Linkages among Marin Clusters



A cluster called "community building" is placed in the center, or hub, of this diagram to illustrate the point that has become very clear from the research, interviews, and focus group discussions conducted by this Study: Marin County's core values of charity, nurturing the environment, and funding the arts, drive much of what is unique and profitable in its economy today.

In addition, the County's legacy as an artistic community -- a haven for alternative thinking and practices -- is captured in the bubble (cluster) labeled "Arts & Crafts." A qualitative cluster more than a quantitative one, its role in providing the fertile soil from which innovators in technology, alternative healing practices, and organic food production, is an important one. Some of these "emerging clusters," like Organic Food Production and Alternative Medicine, are depicted here as dotted ovals. The nature of their emergence from Marin's network of clusters and its relationship to the *virtuous cycle* will be discussed in the next section.

Certain clusters, such as Finance & Insurance, Business Services, Multimedia, and, to some extent, Real Estate & Construction, are highly productive, highly profitable clusters that fuel the "wealth" component of the cycle. That wealth, in turn, allows businesses (as well as wealthy residents) to contribute to the community through philanthropy and other vehicles. This giving allows for organizations such as the Marin Community Foundation and Marin Agricultural Land Trust to preserve open space, fund the arts, as well as provide essential social and other community services. These, in turn, perpetuate a lifestyle in Marin that attracts and nourishes the entrepreneur. Entrepreneurs, in turn, help generate the wealth that keeps the cycle going.

Each of these clusters and each aspect of the *virtuous cycle* are critical. In this sense, a balance between certain private sector industrial and commercial activities and certain community activities should, optimally, be maintained. This is what is captured in the selection criteria, which will be applied in the next section.

In the next Section, each of these clusters will be discussed in greater detail. Their performance in Marin will be compared to that at the U.S. and state level. Market trends that may have implications for these industries in Marin are discussed. And, through an application of the selection criteria, a sense of which industries may become or may produce "target" industries emerges.

VI. A Cluster-by-Cluster Application of the Criteria

In seeking to answer the question, "What kind of businesses can thrive in the Marin environment and which of them meet the County's criteria," the previous sections sought to make the case that Marin has been and continues to be a highly productive center for creativity and innovation. The types of industries currently found in Marin are therefore the best indication of the types of industries that will pay a premium for operating there. This section analyzes each cluster of industries to determine why they are operating in Marin, what makes them successful or not, and what types of other industries and activities may be spawned from them.

To evaluate each of Marin's seven core clusters, the project team utilized a set of quantitative and qualitative analytical tools that benchmarked Marin County against the forecasted average U.S. sales growth rate for each cluster and compared Marin to national and regional trends. Our findings identified the clusters that most reflect value-added potential and are consistent with the County's social and environmental criteria.

Table 8 demonstrates that when screening Marin's emerging clusters with the Three E's-based criteria detailed in Section II, their scores equal or surpass the score for the County's existing clusters. The quantitative methodology leading to this assessment is shown cluster-by-cluster and in great detail in the attached Cluster Template supplement.

Table 8: Comprehensive Core Cluster Criteria Screening Results

Clusters	Number of Matching Criteria	
	Existing Cluster	Emerging Cluster
Business Services	15	15
Finance & Insurance	14	14
Multimedia	13	13
Real Estate and Construction	5	11
Agriculture	8	9
Health Services	7	9
Restaurants & Tourism	7	7

REAL ESTATE & CONSTRUCTION (THE BUILT ENVIRONMENT)

Despite the recent economic slump, real estate and construction have been two of the Bay Area's only post-bubble growth industries. This is especially true for Marin where the County trails only New York City as the top seller market and the median price of a single-family home is up to more than

$630,000, [27] far exceeding the state average which itself, is forecast to jump 13% to $414,100 in 2004. [28] Considering the strong condition of this sector relative to other Bay Area industries, it is not surprising that it employs nearly 11,000 people or 12.10% of the County's total employment. [29]

Given the "built out" nature of Marin's residential and construction real estate environments, it is likely that this cluster will continue to be focused on residential remodeling as opposed to new construction. This will likely limit its growth over time. This cluster will remain strong as long as local demand for re-modeling and real estate services is strong. There is growing concern, however, that real estate value increases will no longer be able to outpace general economic and wage growth.

Opportunities do exist in providing elderly housing and using environmentally sound construction practices, or "Green Building." David Bernardi, General Manager of the Marin Builder's Association noted, "Green Building? We are working on it. Whether this will be significant remains to be seen. It fits into our self-image as environmentalists, but what are we going to see at the end of it? I don't know. As long as outside Marin potential buyers are willing to buy our product, there may not be as much interest in green building outside the area as there is within it."

[27] http://beta.kpix.com/news/local/2003/07/25/State_Housing_Prices_Jump_Up_Again.html
[28] Reuters "Calif. home prices seen up 13 pct in 2004-report." October 2, 2003. http://www.forbes.com/business/newswire/2003/10/02/rtr1097968.html
[29] Global Insight

MULTIMEDIA

The Bay Area continues to be the preeminent leader in this deflated, yet still vibrant sector and workers in this sector, by and large, match Marin's desired employee profile. During the 1990s, explosive growth in the hi-tech sector led many communities to try recruiting hi-tech companies by offering tax breaks and other incentives due to the industry's ability to produce high value-added and high-paying jobs. It would not be surprising were Marin to consider utilizing tactics to entice hi-tech businesses similar to those used by neighboring communities in Napa and Solano Counties and the cities of Emeryville and Pleasanton.

But the scale in terms of skilled labor and sheer number of hi-tech firms that regions like Santa Clara and San Mateo Counties can offer offset any tax or other advantages Marin County could offer. Rather than compete with other hi-tech regions on their terms, Marin County may be better operating on its own terms: first, by recognizing the initial confluence of forces (like the virtuous cycle) that allowed Marin to become a leading center of digital arts and multimedia technology in the first place; and, second, marshalling the creative energies and structural processes necessary to sustain the industry in Marin and project it into the future.

Marin has a tremendous existing competitive advantage in multimedia, digital imaging and game development activities. Firms, such as Factor Five, have located in Marin specifically

to collaborate with George Lucas' various companies.[30] Autodesk's success in computer-assisted design (CAD/CAM) products is also pivotal to attracting like-minded firms to the region's cluster.[31]

In 2003, Al Coppin, President of Keegan and Coppin, noted, "Marin has a nucleus of software companies. Software companies are going to look real hard at Marin, despite its costs, because of its intellectual capital. Marin has a real attractiveness for software and I think it will continue to retain that." When interviewed for this study, Chris Glennon of Lucas Arts Companies maintained, "We see ourselves as a key part of the fabric of the Bay Area film community."

The challenge facing the County lies in better understanding, appreciating, and working with members of this cluster to nourish the cluster's development. The multimedia cluster in the County exists due to the physical concentration of firms, skilled individuals, and services dedicated to this industry. How to keep them and make the most of global market trends (the worldwide market for video games, computer games and interactive entertainment hardware and software should grow from $20.7 billion in 2002 to as much as $30 billion by 2007), is the task at hand.[32] While many of these firms can afford to pay higher wages and engage with the County in pursuing its social, environmental and equity goals, these firms, in turn, need a clear policy commitment from the County that the County wants them. This does not mean tax incentives or any giveaways. It means merely making the industry a priority in terms of how the County thinks about them and engages with them.

For example, based on focus groups discussions held in the context of this report, it appears there are many unlicensed, home-based software developers operating in Marin. One of our respondents thought that the County did a very poor job of marketing Marin County as a source of high-tech innovation and skilled labor. The challenge for the County would be to welcome and help incorporate this part of the hi-tech cluster and then market Marin as a leading hi-tech center. The North Bay Multimedia Association could be a potential collaborative partner for promoting growth initiatives in these areas.

The multimedia and digital imaging industries in Marin represent a clear, existing competitive advantage for the County that should be appreciated, retained and nurtured. On the other hand, industries like Environmental Technology represent newer, emerging industries that, also with the proper nourishment, could become a pillar of the region's economy. What is most striking about Environmental Technology is its consistency with the County stated goals and principles.
This cluster includes those industries dedicated to the research, manufacturing and marketing of technologies related to recycling, energy saving, material testing, physical and biological research. While this cluster comprises a wide range of sectors, the ones most relevant to Marin County include Green Building construction, water treatment and waste

[30] An Interview with Chris Huelsbeck http://remix64.phatsites.de/main_interviews.php?task=1&inter_id=67
[31] San Rafael Chamber of Commerce. High Tech Directory: A List of Marin County Technology Companies. January, 2003.
[32] DFC Intelligence. "Worldwide Market Forecasts for the Video Game & Interactive Entertainment Industry." http://www.mindbranch.com/listing/product/R143-013.html

generation and recycling. Marin County's land use policies correspond well with green building's objectives to maximize the efficiency of existing building spaces and increase the use of less resource-intensive building materials and systems with products that have a minimal environmental impact.

Today, this cluster is relatively small, employing only 432 people. To nourish this cluster, the County could strengthen linkages between Marin-based research centers, contractors, architects, scientists, engineers and green-technology firms to better serve the sophisticated local demand for high-quality, indoor environments and other environmental technology products. In this respect, Environmental Technology could be the next mountain bike or *Star Wars* for Marin.

BUSINESS SERVICES

Business Services is typically a broadly defined cluster that includes everything from the local copy shop to prestigious private law firms. In this respect, income and growth trends in the industry must be tempered with the recognition that the industry is large and diverse.

In Marin, however, the vast majority of the more than 6,000 employees in this industry work for higher value-added, professional service firms in advertising, graphic design, law, accounting, engineering, and management and business consulting and earn a higher-than-average wage. Nationally, Business Service professionals earn 13% more than individuals working in other industries. The industry is projected to be one of the fastest growing in terms of employment and sales through the year 2010. The vast majority of establishments in this industry are fairly small, employing fewer than 5 workers and nearly one-fifth of all workers are self-employed. Nearly 70% of workers in this industry have a bachelor's degree or higher as well.[33]

This cluster serves an important supporting function in Marin County's *virtuous cycle*. Not only does the cluster employ 5.33% of the County's workforce,[34] it also manages and generates wealth that is then propelled throughout the cluster network and *virtuous cycle*. In fact, Marin County's Business Services productivity rate far outpaces both the Bay Area and national averages, exceeding the national average by more than $45,000 per worker.[35]

Given Marin County's competitive advantage in terms of productivity and access to financial resources, the Business Services cluster is a natural center for innovation and growth with significant opportunities in boutique consulting for the IT, engineering and telecom industries. Countywide coordination and cluster-level development are the keys for competing in the increasingly important, yet competitive Business Services industry.

FINANCE AND INSURANCE

The Finance and Insurance cluster has historically been one of the vital lynchpins in Marin's local economy. Indeed, from the

[33] United States Department of Labor – Bureau of Labor Statistics. http://www.bls.gov/oco/cg/cgs037.htm
[34] Global Insight http://www.globalinsight.com/
[35] Global Insight http://www.globalinsight.com/

Fireman's Fund to small, boutique capital and wealth management firms, this cluster has served as a critical driver in the *virtuous cycle's* wealth generation and reallocation processes.

In Marin, the bulk of activity in this cluster has been driven by insurance. New niches for real estate investment trusts, pension fund managers, and small, boutique investment advisors are growing. Trends in the industry indicate that finance-related occupations will benefit as baby boomers save for retirement and the generally better-educated and wealthier population requires investment advice.[36] Marin's banking sector's current strong condition reflects this reality. The County's deposits grew by a third over the last five years -- to $5.8 billion as of June 30, 2002 triggering local banking concerns such as Tamalpais and the Bank of Marin to post impressive returns and pursue aggressive expansionary plans. [37] A recent study, found that the Bay Area's productivity level for the banking and finance sector is over $200,000 per worker, the third highest among all U.S. comparison regions analyzed.[38]

[36] United States Department of Labor – Bureau of Labor Statistics http://www.bls.gov/oco/ocos259.htm#outlook

[37] Calvey, Mark. "Tamalpais Bank pursues larger presence in tony Marin County." San Francisco Business Times, April 14, 2003. http://www.bizjournals.com/sanfrancisco/stories/2003/04/14/newscolumn5.html

Calvey, Mark. "Bank of Marin posts record earnings, stock dividend." San Francisco Business Times, April 11, 2003. http://sanfrancisco.bizjournals.com/sanfrancisco/stories/2003/04/07/daily48.html

[38] Bay Area Economic Forum "After the Bubble: Sustaining Economic Prosperity, Appendix B." January, 2002 Page 1.

Much of this industry's job growth is occurring because of the significant redefinition of the financial services business system, resulting in the tightening of linkages between the traditional banking community and the Bay Area's growing information and computing services industries.[39] Consequently, job growth is projected to be in smaller consulting firms specialized in areas such as biotechnology, healthcare, information technology, human resources, engineering and telecommunications. [40] Furthermore, recent accounting and corporate governance scandals have further raised the stature of these smaller, boutique firms that are not involved in investment banking activities.

The Finance and Insurance sector both globally and locally is a significantly traded sector. There is opportunity for Marin to expand this sector and attract resources from outside the County to promote local economic growth. Given Marin's access to capital, expertise in wealth management and the current trend towards boutique investment firms, the County is well positioned to take advantage of its proximity to this banking-informational technology nexus. To do so, the County should market its financial and banking sector expertise, leverage its linkages to the Bay Area's productive sectors and banking community and encourage this cluster to continue its major role in both the *virtuous cycle* processes.

[39] Bay Area Economic Forum "After the Bubble: Sustaining Economic Prosperity, Appendix B." January, 2002 Page 1.

[40] United States Department of Labor – Bureau of Labor Statistics http://www.bls.gov/oco/ocos019.htm#outlook

RESTAURANTS & TOURISM

Tourism growth has become a particularly contentious topic for Marin County. The general question is: How should the County increase tourism revenue without augmenting the traffic and congestion problem which negatively affects citizens' quality of life? But more specifically, Point Reyes National Seashore already receives 2.5 million annual visitors alone.[41] How should the County capture more of these existing visitors' dollars while simultaneously enhancing the prospects for growth in Marin's other emerging clusters?

Travel and Tourism is a high growth industry that is forecast to more than double in size nationally over the next decade. [42] California was the most visited state in the United States in 2002, securing 11.5% (preliminary) of the domestic travel market. [43] On the average, each county in California earns approximately $1.3 billion in direct travel expenditures by visitors. Marin lies at the lower end of the revenue-generating spectrum, garnering $34 million in 2001. [44]

According to our Focus Groups, local government support exists to continue Marin's role as the "Parkland to the Bay Area." For example, the Marin Visitors Network is already operational and working to capture some of the high-volume tourist traffic between San Francisco and the Sonoma/Napa valleys.[45] Also, the increasing popularity of the farm experience is driving a new agri-tourism movement in California and providing a source of revenue that can help sustain small, family farmers. The University of California is at the forefront of agri-tourism development, helping to identify opportunities and extending agri-tourism to support other producers. [46] And the Marin Agricultural Land Trust (MALT) already offers a variety of agri-tourism-themed events and tours. [47]

This existing infrastructure creates an opportunity for cross-marketing to develop the overall "Marin Brand" or what the County refers to as the "Marin Lifestyle." And tourism can be used both as a mechanism for coordination and as a vehicle to develop the Marin brand by incorporating Marin's emerging agri-tourism, alternative health and arts and crafts clusters and the County's considerable outdoor recreation and equipment heritage into a comprehensive county-wide tourism marketing strategy. The role of the Tourism cluster in spawning new industries such as agri-tourism has significant potential. Marin

[41] Marin County Community Development Agency Planning Division Memorandum, March 24, 2003 http://www.future-marin.org/cwpdocs/PC_Staff_report.pdf
[42] California Division of Tourism. "California Tourism's Contributions to the California Economy: 1998-2002" http://www.gocalif.ca.gov/state/tourism
[43] California Division of Tourism. "California Tourism's Contributions to the California Economy: 1998-2002" and
California Division of Tourism. "Travel Industry: Research and Statistics – Highlights: California Tourism Statistics." http://www.gocalif.ca.gov/state/tourism
[44] Dean Runyan Associates http://www.deanrunyan.com

[45] San Rafael Chamber of Commerce - San Rafael Business. "Chamber helps create organization to promote tourism in Marin." August 2003, Volume XIII, Issue 8, Page 3. http://www.sanrafael.org/03aug.pdf
[46] University of California Agriculture and Natural Resources News and Information Outreach. "Agri-tourism Offers New Opportunities to California Farmers." July 23, 1999. http://news.ucanr.org/storyshow.cfm?story=244&printver=yes and ACF Newsource, "Farm vacations help preserve America's farmlands for the future." http://www.acfnewsource.org/environment/agritourism.html
[47] Marin Agricultural Land Trust http://www.malt.org/hp/hikestours.html

already receives a substantial level of tourism. Collaborative efforts between the Tourism and Agriculture clusters could potentially increase the economic benefits from low-impact tourism to Marin by tapping existing tourists.

HEALTH SERVICES

The Health Services industry is projected to increase nationally by more than 25% through 2010, compared with an average of 16% for all industries. [48] Marin County is also forecasted to register a significant increase of 6.6% in Health Services employment between 1999 and 2006. [49] Marin County's growing elderly population should generate further demand for health-related services, signaling that this existing cluster should enjoy good growth prospects.

However, health-related cluster development is constrained by several conditions. First, Marin's mainstream health sector is primarily local-serving and non-traded, and thus should not be considered a main economic driver. Second, Marin lacks the large educational research institutions that commonly serve as catalysts for health-related cluster development. Finally, Focus Group participants noted that it is extremely difficult to find entry level health care workers in Marin because of the high cost of living. In fact, one respondent noted that Marin General has had to develop subsidies for young *doctors* who could otherwise not afford to live in the County.

Notwithstanding, Marin has certain attributes that make it possible for new health-related clusters to emerge from the existing health-services industry. The two primary sources of innovation that offer the greatest potential to become traded sectors are the Monterey Community Foundation and the Alternative Health/Alternative Healing and Meditation communities.

Similar to the hi-technology cluster that emerged from Stanford University's research into computer science and electrical engineering or the increasing cluster of biotechnology firms near UC San Diego, Marin County, as home to the Buck Institute, possesses a unique opportunity to become a main center of innovative research into the science of aging. With sustained support from the Leonard and Beryl Buck Foundation and the County, the Buck Center can become both the core of a new nexus of health related research entities, and a potential economic driver.

According to the Journal of the American Medical Association, 40% of American adults tried at least one form of complementary alternative medicine last year.[50] A recent survey also showed that the number of employers offering acupressure/acupuncture in PPOs increased from 19% to 35%

[48] United States Department of Labor – Bureau of Labor Statistics http://www.bls.gov/oco/cg/cgs035.htm#nature

[49] Employment Development Department. Marin County Industry Employment Projections, 1999-2006 http://www.calmis.ca.gov/file/indproj/marintb2.htm

[50] Nashville Business Journal "BlueCross to offer alternative medicine options." September 2, 2003 http://nashville.bizjournals.com/nashville/stories/2003/09/01/daily4.html

between 1998 and 2002, and from 9% to 27% in HMOs and chiropractic care also increased from 65% to 88% in PPOs and 45% to 70% in HMOs.[51]

Marin is already home to a variety of alternative medicine sector businesses including the Green Gulch Farm Zen Center, Alternative Medicine Magazine, the Acupuncture Herbal Center and the Diamond Light School, not to mention numerous practicing chiropractors, massage therapists and osteopaths. But most importantly, Marin's sophisticated local demand with respect to alternative health is in line with one of the main principles of cluster-based methodology.

Sophisticated local demand allows innovation to move more quickly to meet changing consumer preferences enhancing time to market and creating the conditions necessary for regions to become leading innovative centers. [52]

Presently, alternative health's compatibility with popular Marin sentiment makes the industry just another piece in the local-serving service portion of the *virtuous cycle.* The challenge is to convert this uncoordinated and scattered group of small businesses into a cohesive cluster that would allow Marin to transition into a leadership role in this growing and increasingly mainstream industry.

Establishing a reputation for leadership in this sector could translate into Marin becoming a major tourist destination for alternative health services. This is exactly the low-impact, high-end type of tourism the County is seeking and represents an opportunity to develop synergies with the emerging tourism cluster.

AGRICULTURE

The agricultural industry nationwide has seen and continues to see tremendous consolidation. This goes for both mainstream agricultural and organic producers as well. In order for primary commodity producers to be profitable, they need to operate at a very large scale. The role of small, niche producers in a large, consolidating industry remains to be seen.

Given Marin County's geographical and regulatory constraints, the opportunity for growth in the agricultural sector is rather limited. Achieving scale economies is not an option, but several smaller value-added agricultural operations are thriving and penetrating new markets.

Their success is due in large part to the fact that many consumers are changing preferences towards healthy and organic products. In the U.S., total organic food sales have grown at a rate of about 20% per annum for more than a decade, with organic milk and dairy products the major growth drivers, and in 2000, more than half of the $7.8 billion spent on organic food was purchased in conventional supermarkets and over 800 new products were introduced. [53] Moreover, the organic sector is evolving into a profitable niche. According to the 4th Organic Farming Research Foundation survey, 44% of

[51] Edlin, Mari. "Demand for CAM grows, but belongs in a separate benefit category." Managed Healthcare Executive, June 2003, Vol. 13, Issue 6, Page 38.

[52] Fox, James W. "Report on Competitiveness Promotion in Colombia and El Salvador." Louis Berger Group, Inc. July 20, 2003.

[53] Recent Growth Patterns in the US Organic Foods Market - USDA

respondents reported a market expansion for their products while 92% were able to obtain organic price premiums. [54]

Parallel to the organic industry's expansion, the U.S. gourmet specialty foods market has grown annually at a solid 7% for several years and passed the $20 billion mark in 2000. According to Packaged Facts, this tremendous growth is expected to continue, propelling the U.S. gourmet specialty foods market to top retail sales of $27 billion in 2005. [55]

Fortunately, Marin County has been at the forefront of the organic movement and comparable to Marin residents' relatively advanced familiarity with the Alternative Health industry, Marin's sophisticated local demand for organic products gives the County an advantageous position from which to potentially grow the sector.

Marin's agricultural sector's capacity to innovate and adapt can be observed by noting the evolution of West Marin dairy ranches. Being small by national standards, Marin dairy ranches' ability to compete came into question. One such operation, Tomales Bay Foods, started to add more cows per acre in an effort to emulate the winning formula of large-scale producers. But not only did the dairy operation quickly exhaust local grazing opportunities; it also began to increase the non-point source load on local estuaries threatening ecologically sensitive activities. Tomales Bay Foods switched its strategy and found it advantageous to go against the commonly-held "winning formula" and instead, reduce the density of its herds in order to *preserve quality, not quantity*.

Not surprisingly, small, craft manufacturing facilities generally have a strong social commitment and high quality standards. This is especially true in Marin where according to a July 2002, 86% of Marin's agricultural sector reported that between one and four family members were involved the businesses and 46% indicated that they farmed all or part of their operation organically. At the same time, 64% reported that their agricultural operations were unprofitable or marginally profitable. [56]

The niche agricultural businesses that have succeeded have strong marketing programs that stress the healthiness of their products. Sonoma County-based Clover Stornetta Company successfully markets to Whole Foods stores throughout California utilizing its *North Coast Excellence program*, which touts the quality of Marin and Sonoma milk. [57] The Tomales Bay Foods dairy initiative, Cowgirl Creamery, launched an effort to increase quality resulting in award-winning dairy products and national recognition. Robert Giacomini Dairy sells its dairy products nationally and Straus Family Creamery products are presently available in nineteen states. [58] These success stories coupled with the reality that US agricultural subsidies are under fire in international free trade negotiations,

[54] http://www.ofrf.org/publications/survey/GMO.SurveyResults.PDF
[55] Tree of Life: Specialty Products Overview
http://us.treeoflife.com/Content/Business/default.asp?qsSectionId=62

[56] Status of Marin County Agriculture – February 2003
[57] Status of Marin County Agriculture – February 2003
[58] Status of Marin County Agriculture – February 2003 and
http://www.strausmilk.com/pages/where/retailoutside.html

highlight the growing importance of product diversification and niche marketing.

Considering the consolidation trend and the inability of Marin-based agricultural businesses to achieve scale economies, one way to simultaneously protect Marin's small family businesses, and potentially penetrate new markets would be for Marin producers to collaborate in terms of marketing and brand recognition. The "Marin Organic" concept has already been developed and is gaining brand equity.

Marin County can leverage its "outdoors, holistic, healthy, alternative medicine" image to develop the "Marin Organic" brand and use this brand equity to advance synergies between the Agriculture and Tourism, with connections to the arts, craft-based manufacturing, outdoor recreation and alternative medicine sectors. Agricultural Tourism (or agri-tourism) is rapidly gaining popularity as a way to increase farm income by tapping existing tourists. Agri-Tourism is defined as "a business conducted by a farm operator for the enjoyment and education of the public, to promote the products of the farm, and thereby generate additional farm income."[59] Agriculture experts at the University of California's Small Farm Center are actively engaged with farmers in West Marin on this issue. Their mission is to improve the incomes and potential economic viability of small farms and rural communities by providing a bridge between urban and rural dwellers. This is discussed further in the Tourism section below.

[59] G. Beall, 1996.

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The Arts & Crafts and Community Building clusters are much more qualitative, abstract and difficult to define than the existing clusters just discussed. However, these clusters are critically important to Marin's past and future economic success. The Arts & Crafts and Community Building clusters are the foundations upon which Marin's existing economic cluster network and overall principles are built and act as both the primary engines fueling the *virtuous cycle*, and the bridges to the County's future traded-sectors.

ARTS AND CRAFTS

Another "emerging" industry, arts (and crafts), in a sense, drive all of Marin's existing and emerging clusters and *permeates every station of the virtuous cycle*. Marin County's current affluence is derived in large part, from creative and successful, arts-based business ventures. This affluence affords Marin's inhabitants the luxury of protecting open space and nurturing an environment in which arts and crafts can thrive. Support for the Arts in turn, gives Marin residents the creative freedom to be innovative which often results in innovative, new industries that in the past have been great economic drivers.

As previously noted, Marin County's success in the area of the Arts is well-documented. In fact, it can be argued that Art is one of Marin County's "core competencies." Where Silicon Valley has converted technological expertise into marketable products that drive the world's technological infrastructure, Marin County has translated artistic creativity into a world-

renowned cluster of arts-based innovation, from digital imaging to mountain bikes to Birkenstocks to small, craft-based specialty products.

The problem is it is extremely difficult to quantify art's impact on economic development. On one hand, we know that for every dollar the government invests in non-profit arts, $8 is returned to the economy in the form of food and beverages, accommodation, tickets etc. [60] However, directly correlating funding for the arts to economic advancement is more problematic outside of Hollywood or Nashville.

But when you look at the industries in which Marin County has been successful historically, Art is generally a common denominator. Richard Florida's compelling hypothesis maintaining that there is a strong correlation between creativity and productivity and innovation only furthers this argument.

Marin County is well-represented by what Richard Florida refers to as, "The super-creative core of this new class [which] includes scientists and engineers, university professors, poets and novelists, artists, entertainers, actors, designers, and architects, as well as the "thought leadership" of modern society: nonfiction writers, editors, cultural figures, think-tank researchers, analysts, and other opinion-makers." [61]

It is imperative to recognize Art's importance to Marin industry and utilize the considerable community-building resources at the County's disposal to enhance the local art community's capacity to innovate and target and support Arts and Crafts endeavors that could transform into future growth sectors. One visible manifestation of Marin's artistic capacity is the growing nexus of gourmet specialty foods businesses.

Marin can no longer compete with low-cost counties such as Solano for manufacturing and assembly businesses. But as a center of creativity, Marin has a decisive competitive advantage that can be leveraged to further innovation and overall economic development and maintain Marin's position along the high points of the *value chain of production*.

COMMUNITY BUILDING

Marin County's community-building cluster is at once one of the County's main assets, a significant competitive advantage and a bridge from the County's existing to its emerging clusters. Community building is the axis of the *virtuous cycle* and its linkages radiate out to all of Marin's economic clusters and infuse the *virtuous cycle* with the energy necessary to keep it evolving.

In 2001, there were more than 1.6 million non-profit organizations nationally with combined revenue of $700 billion and 10.9 million paid employees or roughly 7% of the nation's total work force and 109 million volunteers. [62] The U.S. nonprofit arts industry generates $134 billion in economic activity every year resulting in 4.85 million full-time equivalent jobs, and also includes $24.4 billion in federal, state, and local ($4.2 billion) tax revenues. The $134 billion total

[60] Wines, Larry. "Is California still a state of the arts?" Antelope Valley Journal. July 11, 2003. http://www.theav.com/avjournal/articles%202003/july11-03/article9.htm

[61] Florida, Richard. "The Rise of the Creative Class." The Washington Monthly, May, 2002. http://www.washingtonmonthly.com/features/2001/0205.florida.html

[62] Green, Florence L. and Crabb, Kathy. Facts and Fallacies 2001: Setting the Record Straight on California's Nonprofit Community. California Association of Nonprofits, 2001. http://www.canonprofits.org/about/about-CA-nonprofits.html#distribution

includes $53.2 billion in spending by arts organizations and $80.8 billion in event-related spending by arts audiences reflecting an average of $22.87 per person in spending for hotels, restaurants, parking, souvenirs, refreshments, or other similar costs-with non-local attendees spending nearly twice as much as local attendees ($38.05 compared to $21.75). [63]

Marin County's capacity for community building is enormous. Although Marin County only represents .7% of California's overall 2001 population, [64] the County's percentage of non-profits was 1.6 %. [65] Therefore, there are over twice as many non-profits per capita in Marin County than the state average. Furthermore, the Marin Community Foundation alone, was the 42nd largest foundation in terms of assets in the U.S. in 2002, [66] and currently is the fourth-largest *community* foundation in the U.S., with assets at the close of its 2003 fiscal year of $1 billion. Last year, the Marin Community Foundation made $58.5 million in grants and received $23.19 million in gifts. [67] The Marin Community Foundation provides Marin County with a relatively unique and robust source of economic resources for a county of its size. This substantial resource should be perceived as a mechanism to drive innovation and growth in other clusters. As several of our Focus Group participants commented, there is a strong need for a civic entity that can serve as an incubator for new businesses.

Other participants noted that there are numerous talented, creative and intellectual Marin residents, and a wide array of community support services, but that efforts to build the community in a sustained manner are thwarted by a lack of *coordinated* community involvement.

Marin County's community building cluster has the potential to tap into Marin's considerable intellectual capital in a coordinated manner. It not only acts as a bridge, but also a filter for innovative ideas that can potentially transcend into emerging industries. The community building cluster then, is in a sense, an endowment of venture and human capital that can be utilized to amplify the County's intellectual capital and its propensity to innovate and create.

Marin County's community building cluster's important role in the *virtuous cycle* cannot be overstated. It is the fundamental catalyst for innovation and a key mechanism for expressing the ethos of the County's inhabitants.

[63] "Arts & Economic Prosperity: The Economic Impact of Nonprofit Arts Organizations and Their Audiences." Americans for the Arts. June 10, 2002. http://www.americansforthearts.org/EconomicImpact/
[64] US Census Bureau http://quickfacts.census.gov/qfd/states/06/06041.html
[65] Green, Florence L. and Crabb, Kathy. Facts and Fallacies 2001: Setting the Record Straight on California's Nonprofit Community. California Association of Nonprofits, 2001. http://www.canonprofits.org/about/about-CA-nonprofits.html#distribution
[66] The Foundation Center. "Foundation Growth and Giving Estimates: 2002 Preview."
[67] Marin Community Foundation. http://www.marincf.org/page11999.cfm

VI. Identifying Target Industries

Normally, a region's "target" industries would be those identified in the "Opportunities" quadrant of the Cluster Segmentation Chart (Figure 13). Since Marin County does not have industries in this quadrant, but is concentrated instead in industries that are "Stars," the challenge of identifying industries which the County should "target," focus its efforts, is a bit more challenging. To identify targets for Marin, the project team dug deeper into each of Marin's existing clusters to find out which specific industries have potential not only in terms of growth but, more importantly, in terms of their ability to meet the County's criteria.

In the previous section, each of Marin's existing clusters is described, analyzed, and compared to national and regional trends. The implications of these trends, and the potential for each of Marin's existing clusters to evolve, spin out, or attract new and related economic activity is assessed. This section, the final step in developing a list of "target" industries consistent with the County's guiding principles, identifies these new or "emerging" industries.

This list emerges from a variety of sources:

1. Quantitative information: the cluster segmentation charts for *each cluster* identifies "Star" and "Opportunity" industries. Those industries in the upper right quadrant of these charts are considered "stars": industries in which Marin County is highly concentrated and which are forecast to grow quickly over the next five years. The industry bubbles in the lower right quadrant of the charts are those in which the County is not currently concentrated, but which are growing quickly nationally and therefore represent an opportunity the County should consider. For a complete list of Stars and Opportunities by cluster, see Appendix F.

2. Market research: when Marin's existing clusters are compared to national and regional trends, certain niches and opportunities for growth that are consistent with Marin's criteria become evident. For example, the growing national interest in and demand for organic food products indicate a real market potential for these products that are produced in Marin. This industry is consistent with Marin's goals of protecting agricultural land and sustaining local agriculture. By allowing Marin farmers to produce more value-added products, the County can bring higher value to this key resource while enhancing the County's socio-economic diversity.

3. Qualitative information: there is no better source of information about the future potential and emerging trends of an industry for Marin than those individuals who are currently active in those industries in Marin. The individual interviews both one-on-one and in the

context of the focus groups helped create a sense of the types of industries that are "emerging" and can be considered good targets for Marin.

4. The Criteria: by applying the screening criteria described in Section II to each of Marin's existing "traded" clusters, the project team was able to explore in more depth which activities in each cluster may be more or less appropriate for Marin County. All of the analysis executed in this Study is done at the industry level. Since the performance of individual firms and distinct sub-sectors within each industry may differ and their ability to comply with Marin's vision and guiding principles differ, ECG sought to distinguish "emerging" clusters from each existing cluster that better meet the County's criteria.

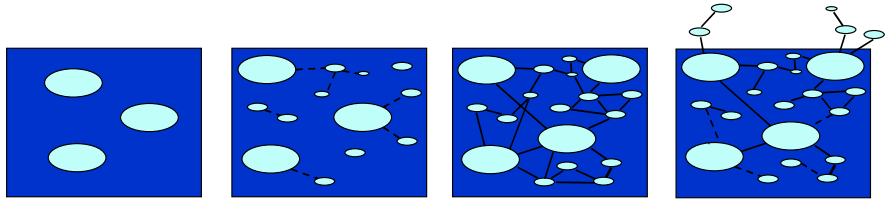
IDENTIFYING LINKAGES BETWEEN CLUSTERS

The power of a cluster framework for identifying emerging and "target" industries lies in its ability to highlight linkages between industries and, therefore, areas where a region is likely to be the most innovative. By identifying those linkages, a region can better understand where its areas of opportunities are and how it can best support those opportunities.

The Role of Linkages

As shown in Figure 17, clusters evolve over time. Several decades ago, before the process of globalization had gained momentum, firms could afford to be highly vertically integrated - essentially operating as enclaves. IBM, Wang, and Digital are examples of such firms. Over time, however, only firms that allowed innovative employees to spin off, and still maintain constructive, positive business relationships with them, could survive. Neither Wang nor Digital understood this lesson, and neither firm is alive today. While this new world of interlocking firms within a region is more competitive, it also brings the challenge of increased trade and specialization, and has created one of Marin's greatest challenges: increased need for transportation of both goods and services.

Figure 17: Stages in the Evolution of Clusters



We believe that by identifying and strengthening the linkages within the County, and assisting in the attraction and start-up of new firms in key areas, many of the environmental and social

upheavals created by a dynamic economy can be addressed or mitigated.

Traded versus Local-Serving Clusters

Clusters that export goods and services out of the region drive a region's economy. Industries who rely on only local customers (such as local-serving restaurants, barber shops, day care centers) are, by definition, limited in the degree to which they can grow and provide a multiplier growth effect for the region. For this region, while this report identified Real Estate & Construction, as well as Community Building, as clusters in Marin County, these are, essentially, not traded sectors and therefore not "drivers" of the economy.

That said, the importance of local demand in the role of innovation and cluster evolution is critically important. In his book, The Competitive Advantage of Nations, Harvard Professor, Michael Porter emphasizes that domestic demand for the products of an industry are an essential characteristic of competitive clusters. Only when the producer is close to the market can innovation respond quickly to changes in consumer preferences. The story of the mountain bike in Marin County is a good example of this point. Were it not for local demand (from Cupertino as well as Marin), the innovations of the industry may never have happened. Individuals responded to local interests and need in order to produce a new product that, ultimately, had appeal far and wide.

In terms of using the cluster framework to identify "target" industries, however, this report focuses primarily on the traded clusters, looking towards those that are non-traded in terms of their ability to nurture and support the others (much the way philanthropy may bolster the Eldercare industry).

Based on this information, the list of target industries for Marin County includes:

- Boutique Consulting
  - Information Technology
  - Engineering
  - Management
  - Telecommunications
  - Other professional fields
- Environmental Technology
- Biotechnology
- Green Building[68]
  - Architecture services
  - Research and development
  - Construction
  - Links to Environmental Technology
- Integrated Wealth Management; [69]
- Personal Financial Advising

[68] Environmentally sound practices in the design and construction of commercial and residential buildings

[69] Ehis industry incorporates innovations in information technology (probability analysis and life events planning capabilities) with financial expertise to assist financial advisors through the ongoing process of assessing, analyzing and maintaining a healthy financial future for their clients

- On-Line Financial Services
- Interactive Media and Game Development
- Engineering and Design Software
- Organic, Value-Added Agriculture Products
- Food Product Manufacturing
- Agri-Tourism
- Outdoor Recreation and Equipment
- Arts & Crafts [70]
- Alternative Healing and Meditation
- Alternative Medicine
- Emergent Care Services [71]

While not necessarily comprehensive, this list is a significant starting point for understanding how the dynamics and evolution of Marin's existing clusters interact to produce "emerging" clusters that could be powerful sources of growth and innovation in the future.

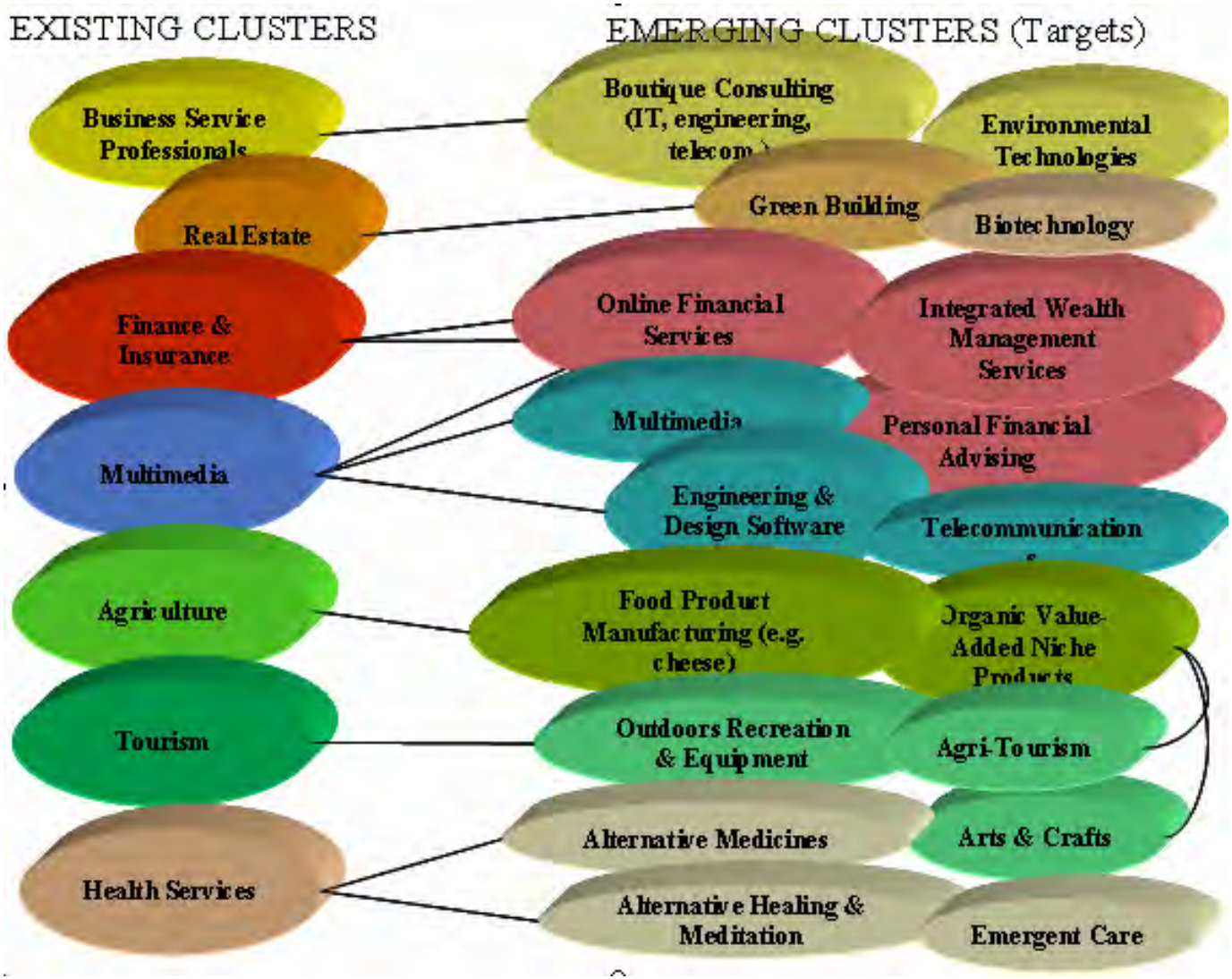
For example, Marin's existing expertise in financial services is beginning to overlap with its expertise in interactive, web-based technology to develop emerging, innovative on-line financial services. Similarly, the synergy between the region's agricultural activities, its tourism sector, and its efforts to launch Agri-Tourism ventures is obvious. The degree to which these three clusters can collaborate in terms of market research, marketing, and product development will determine how well the emerging Agri-Tourism industry can generate new wealth and employment in the region.

These examples and others are discussed in Section V of this report. Figure 18, below, illustrates this dynamic interaction and emergence of new industries diagrammatically.

[70] An existing "cluster" that has potential to both bolster existing industries and provide linkages between industries such as food manufacturing and tourism

[71] Provides high quality medical care and stabilizes patients before being transferred for continuing care i.e. between Urgent and Emergency Care

Figure 18: Marin Existing and Emerging Clusters



VII. Conclusions & Recommendations

CONCLUSIONS

Meeting the County's Goals

The first of two goals in the Economy Section of the County's draft Countywide Plan is to "establish and maintain a diverse and sustainable local economy." To achieve this goal, the Plan proposes a policy of "supporting businesses that contribute to a robust, viable and sustainable economy." This is important because a robust economy relies on a range of commercial activities broad enough to compensate for adversities in any one industry and to weather larger economic cycles.[72]

In stating its goal of establishing and maintaining a diversified and sustainable local economy, the County has highlighted the need for balance between various sectors of its economy. As discussed earlier, there are two kinds of industries in Marin: "local serving" and "traded." The local serving industries provide goods and services to the residents and businesses in Marin but not to consumers outside of the region. Local serving activities include most retail outlets and personal service firms (barber shops, pet grooming, maid services, for example). In general, local serving firms are doing very well in Marin County, in part because they sell to a highly affluent customer base.

Traded industries are those that make money by providing goods and services to customers who are, primarily, outside of the region. Not all of these industries are doing well and some may leave the County due to the high cost of doing business. Those traded industries that are doing well and that are likely to stay and thrive, are those that are highly productive, creative and innovative. These industries tend to be on the cutting edge of product development and technology and are therefore able to pay the high costs of doing business in Marin. These firms tend to be small to mid-sized and have chosen to locate in Marin, in large part, because of the lifestyle choices of the founders, key partners or employees.[73]

While the market is likely to bring to Marin the types of industries that are consistent with the County's stated goals, it is also likely to bring industries that cater only to Marin in its capacity as a wealthy suburb. The tension between "local serving" and "traded" industries will always be present. A healthy, well-diversified regional economy should have both. *The first conclusion of this report, therefore, is that vigilance on the part of the County to ensure that one kind of industry does not dominate the landscape, forcing out the other, is essential.*

[72] *Marin County Draft Countywide Plan*, October 2003, Section 4.

[73] Marin Economic Commission, *Economic Alert*, 2003.

Threats to a Diverse, Sustainable Economy

This Study was commissioned, in part, due to a growing concern on the part of the Marin Economic Commission that a number of prominent, traded-sector firms have left or may leave Marin County. With their departure, Marin's economy may become unbalanced and less diversified. To address this concern, the Commission instructed ECG to develop a set of criteria that reflect the economic, environmental and social equity goals of the County. These criteria, when applied to potential industries, were meant to ensure that companies that work with the County to address certain threats to its economic, environmental and social health, would be embraced and supported and that challenges such companies face in operating in Marin might be addressed so that they would not leave.

The threats facing the County's health can be summarized as:

- **Jobs/Housing Imbalance**. Housing costs have risen much faster than income over the past decade. As a result, many people who work in Marin County can't afford to live here. Residents who live here must commute to other areas where higher-wage job opportunities exist.
- **Traffic Congestion**. Traffic congestion is among the top concerns of Marin County residents and business operators alike. Due to a limited number of arterial routes through the County and an increasing number of vehicle trips per year, this problem is worsening. Public support for infrastructure changes (such as highway or rail improvements) has not been strong.
- **Land Use Constraints.** Both a challenge and an opportunity. Due to the physical constraints of developing real estate in Marin, commercial space is limited, rents are higher than average, and small companies can face challenges if they want to grow and stay in Marin. As a benefit, the constraints on land use and the legacy of decades of open space preservation have made Marin a unique place where people, including prospective entrepreneurs, are drawn for serenity and creativity. Most Marin residents and business owners alike value preserving the physical landscape and limiting the negative impacts of economic activity on the environment.
- **Social Inequities**. As Marin evolves as a place for wealthy homeowners and lifestyle entrepreneurs, there is a threat that the community's core values of preserving socioeconomic diversity and equity of opportunity may not be met.

To address these threats, the project team, with the guidance of members of the Marin Economic Commission, developed a set of criteria that could be applied to existing and prospective industries. If an industry, or sub-sectors within an industry, met all or most of these criteria, they could be considered to operate in the nexus of the Three E's. These criteria include quantitative and qualitative measures such as wage levels, profitability, community mindedness, propensity for operating "green," ability to employ local residents and offer flexible work schedules. These measures are discussed in more detail in Section II and Appendix A of this Study.

Some industries like Finance & Insurance, Multimedia, and Business Services are nearly an exact match with the criteria. Some are less so. Agriculture and Tourism are consistent with some of the criteria but not all. However, industries emerging from these industry clusters (such as Agri-Tourism and Organic Food Production) do meet most of the criteria,

while providing additional demand and support for other County goals. For example, while dairy farming, as an industry, is only marginally profitable, new value-added activities such as niche or organic cheese production can allow Marin farmers to stay in business, thereby helping meet the overarching County goals of preserving Agricultural Land.

Other industry clusters, like Health Services and Real Estate & Construction, primarily provide services to local firms and residents, but in doing so, are generating new, more innovative industries that may be traded. For example, Alternative Medicine, Healing and Meditation are new industries that, due to a highly sophisticated and progressive local market, are able to grow quickly in Marin and potentially reach a larger market. Similarly, the "Green Building" services provided by local architects and builders may ultimately be sought by a wider market as demand for and interest in these services grows.

By applying these criteria to Marin's existing industries, the project team was able to determine the degree to which different sub-sectors of each industry met these criteria. Those activities, which were more likely to meet a greater percentage of them, became the "target" or emerging industries identified in this report. *The second conclusion is that companies in the industries identified as targets in this report, stand a greater than average chance of helping the County address the threats summarized in this section.*

How the County can maintain a Diverse, Sustainable Economy

Now that these industries and, more importantly, a framework for identifying additional "ideal" industries in the future, have been identified, the question remains as to what the County can do to "target" firms in these industries. What can public policy do?

To achieve the goal of a diverse and sustainable economy, the draft Countywide Plan identifies a number of implementing programs. The first of these is: "Target Appropriate Companies." This program will work with local cities, chambers of commerce and other business groups to ensure that business retention and attraction efforts are directed towards companies that will be consistent with the county's goals for economic growth, environmental preservation, and social equity.[74]

The implementation of this program raises two questions:

1. What is an "appropriate" company; and
2. How should the County "target" these companies?

The first question, as to what kinds of industries are appropriate, has been answered in the previous section. Companies that satisfy the criteria developed in this Study can be considered to operate in the nexus of the three E's and, therefore, be appropriate for the County. To re-iterate, the major benefit to the County of selecting and assisting firms in

[74] Ibid., p. 4-9.

these industries is that these companies will help assess the threats discussed in the previous section.

The second question, "how should the County "target" these industries and companies in these industries," is more challenging. Earlier in this report, two approaches to public policy that had come up in the focus group discussions and interviews were summarized: let the market determine what kinds of industries operate in Marin (*laissez faire);* or, establish policy that articulates a clear vision (*clear vision)* as to what kinds of industries the County wants and why.

Businesses generally respond well to a region's clarity about what it wants because it provides them with the sense of assurance they need in order to make long-term investment decisions. *For this reason, the final conclusion of this Study is that a good balance between the laissez-faire and clear vision approaches is the best way for the County to achieve its goals.* It is true that the market will bring economic activity to Marin that is consistent with its public policy framework. On the other hand, the public sector must remain aware of the dual role all economies play: home to residents and home to businesses. When one of these roles begins to dominate the other, an imbalance can occur that has unintended consequences such as traffic congestion.

The mechanics of shaping public policy and selecting concrete actions that help support and nourish, or target, selected industries, is the subject of the Recommendations section of this report. It should be noted however, that in its draft Countywide Plan, the County has already identified a number of programs it intends to implement in targeting selected industries. These are listed in the Figure 19 below.

Figure 19: Programs the Draft Countywide Plan Intends to Implement to Target Appropriate Industries

Partner with the Private Sector. Evaluate the prospects for a business mentoring and incubation program to be undertaken in cooperation with the private sector.

Facilitate Review for Targeted Uses. Amend the County Development Code as necessary to facilitate project review for lodging and other desired uses targeted in program EC-1.a, such as to add a pre-application step that helps proponents understand and navigate the review process.

Streamline Minor Project Review. Amend the Development Code to streamline review for minor projects, such as interior tenant improvements, that enhance development for businesses targeted in program EC-1.a.

Facilitate Digital Infrastructure. Amend the County Development Code as necessary to facilitate installation of digital communications infrastructure for businesses.

Involve the Economic Commission. Support the work of the Marin Economic Commission to inform decision-makers regarding economic policy.

Inventory Available Space. Work with local cities, chambers of commerce and real estate representatives to inventory existing business space and vacant and underutilized commercial sites.

Intensify Uses. Encourage the Redevelopment Agency to pursue intensification and re-use of underutilized sites.

Encourage Transit-oriented Development. Work with local cities to encourage patterns of commercial development that support use of public transit, including by modifying development regulations to facilitate commercial and/or mixed use projects at sites near transit stops.

Buy Green and Low-packaging Products. Purchase products from local green businesses (certified by appropriate authorities) and that have minimal or no packaging and high recycled-material content; use renewable energy and printing resources whenever possible.

Promote Green Purchasing. Encourage local cities and other public agencies to establish sustainable procurement programs.

Provide Assistance with Green Practices. Expand the Green Business and Energy Efficiency Programs to provide technical and permitting assistance to businesses seeking to comply with environmental regulations (such as non-point pollution source water quality controls).

Copied with permission from the October 2003 Draft Countywide Plan, Section 4, pages 4-9 through 4-10.

RECOMMENDATIONS

Given these conclusions, this Study makes the following recommendations regarding the appropriate public sector response to the economic trends facing Marin County:

1. **Recognize and Reinforce the Virtuous Cycle.** Marin County is fortunate to be home to a unique set of mutually reinforcing phenomena that allow Marin to be a highly productive, highly prosperous place. These include the engines of wealth creation (highly productive industries and individuals), the core value of philanthropy (the Marin Community Foundation and others), a shared desire to preserve open space and encourage the arts (something afforded by the previous two elements of the cycle), and a culture that values creativity and on-going innovation. In recognizing the relationship between these four elements, the County may want to take steps to reinforce them over time. Should one weaken, the others will surely be affected, as will the ability of the County's key industries to function as well as they do today.

2. **Shift Gears.** Given the shifting trends in economic development thinking, Marin County officials may want to reconsider the conventional, *buffalo hunting,* approach to industry development and move toward a more holistic, comprehensive approach that focuses on growing industries from the rich soil of the region's existing clusters. This shift involves moving away from the idea of target industry recruitment and towards the idea of *economic gardening*. There is still room for industry attraction here, but it becomes just one tool among many

3. **Support Stars and Nourish Seeds.** Marin County has the tremendous good fortune of having a disproportionate number of its industries in the "Star" category, meaning that the industries in which it is currently highly concentrated are also industries that are forecast to grow rapidly over the next five years. The degree of success and potential of these clusters and their component industries must be recognized, extolled, and supported in terms of public policy. The mechanics of supporting existing "Star" industries will be discussed below. The principal foundation of that support, however, and of what is needed to nourish newer industries that are beginning to emerge from existing ones, *is a healthy business climate, or garden*. As regions move from an awareness that the health of their community is founded more in their ability to tend to the core issues faced by their existing businesses rather than by their ability to attract new ones from outside the region, the importance of maintaining an excellent business environment in which the types of industries the region wants can grow, increases.

   The Marin Economic Commission has already executed the first and most crucial step in establishing a nourishing business climate: it has *identified very clearly, in the context of this Study, the kinds of businesses it wants.* As mentioned earlier, businesses respond well to this kind of clarity in that it helps them decide whether and to what extent they want to invest in the County. In order for the County to attain its goals of engaging with the private sector along issues of workforce training, transportation

improvements, and civic participation, it is crucial that it convey to business owners that it is investing in them as much as it is asking them to invest in the long-term health of the County.

Part of this is beginning to see businesses on an equal footing with residents. A recognition on the part of the County that businesses have made at least as much (and frequently more) of an investment in the County as its residents is required. Then, once a vision for the County is established detailing the kinds of businesses that are desired, the next step in strengthening the business climate is a clear and consistent *communication of that vision.*

Finally, while supporting "Star" industries is essential, nourishing the seeds of new industries is equally important. No economy stands still. Economies are living organisms comprised of individuals making choices on a daily basis. Some stars will fade, and a healthy, well-diversified economy, will see that they get replaced by launching new stars.

Given the results of this Study, it is clear that Marin has fertile soil in terms of sprouting new, entrepreneurial, seeds. The stories of the digital arts, organic cheese, and mountain bikes are only a few examples of the kinds of "new" industries that can sprout from existing ones. These new ones will likely be the "Stars" and "Mainstays" of the future.

Some of these emerging "seeds" have been identified in this Study. Others will evolve over time. By establishing a mechanism for recognizing and nourishing these seeds over time, Marin stands the best chance of breeding the types of companies that will meet its criteria in the future.

For example, George Lucas, one of Marin's "Stars," recently made the decision to establish a Center for the Digital Arts in San Francisco. In the days of *target industry recruitment,* this would have been considered a loss and another, similarly large entity would have been identified and pursued to take his place. In an era of *economic gardening* and nourishing the seeds of new industries, a different response may be more appropriate. This new approach might include an examination of the cluster of industries of which George Lucas is a part. Why was he here to begin with? Why has he chosen to have components of his activity remain? What are all of the elements of the cluster (related sub-industries) and what are the important linkages between them? Once this is understood, Marin will be able to decide whether and how to nourish certain elements of this cluster so that other George Lucas' can grow. One way to do this would be to launch a multimedia cluster initiative, which will be discussed below.

4. **Adopt A Cluster Strategy and Implement it**. One way to focus County economic development priorities and provide the business community in the key industries identified in this report with the active support of the County is a "Cluster-Based Collaborative Approach" to

economic development. This approach uses the clusters defined in this report as a springboard for working with the public and private sectors in a collaborative process aimed at refining the County's overall economic agenda and identifying specific action steps for achieving that agenda.

Regions around the world are realizing enormous benefits when the different parts of each cluster work better together. This means a better dialogue between businesses in the cluster. It also means a more responsive relationship between the cluster, government, and the cluster's support institutions (universities, research centers, etc.). Those regions that have fully developed economic clusters have proven to be the best performing regions in the world. They exhibit higher levels of job creation, higher wages, and higher levels of wealth creation than regions without well-integrated clusters

By working together and taking concrete steps to assist businesses, the County can demonstrate its commitment to creating a positive, supportive business environment. On the basis of the findings of this Study, a collaborative, cluster-based approach to economic development that focuses on nurturing and supporting existing clusters so that innovative, new industries can emerge from them would be well received by the greater Marin County community.

What is a Cluster-Based, Collaborative Approach?

A cluster-based, collaborative approach to economic development is one way to re-shape a region's way of doing business. Some regions (like Las Vegas) are driven primarily by the private sector with few governmental controls; other regions (like the former Soviet Union) are driven primarily by the state. Depending on one's political predilections, it could be argued that scenario is unsustainable and ultimately has enormous impacts on the people who live in those communities.

The challenge of the 21st Century is the creation of urban systems in which public and private interests continually re-assess their goals and orientations and in which these interests have a clear, mutually reinforcing channel of communication which allows for the prosperity of all and the long-term preservation of the environment.

A cluster-based, collaborative approach strives to be just that: It strives to articulate a clear vision for a region that is informed by the market. It is cluster-based in that the private sector is organized around a series of industry clusters, geographically specific groupings of inter-connected companies (specialized suppliers, service providers and support institutions) which, by locating near each other, increase their productivity, accelerate innovation, and stimulate new business formation.

A cluster-based, collaborative approach is collaborative in that it strives to be an inclusive process that allows various groups (public sector, private sector, institutional, or other) to come to the table and work together towards a shared vision

and a set of strategies for attaining that vision. The elements of a cluster-based, collaborative process are:

- A market-orientation (informed by the market)
- Public-private collaboration
- Cluster-driven (private sector driven)
- A series of meetings with working groups formed from each cluster.
    - *Vision Identification*
    - *Problem Identification*
    - *Shaping of Action Initiatives*
    - *Implementing Action Initiatives (taking ownership)*

The most enduring outcomes of a cluster-based, collaborative process is a new paradigm for how the public and private sectors work together to achieve a shared vision of their community. The essential characteristics of the process are a gradual building of mutual trust, identification of specific obstacles to development, and the engagement of local business leaders in creating change strategies that work for them. Some more specific outcomes that take the shape of initiatives launched by each clusters, with the public sector, can include:

- Establishing "Telecommuting Incubators"
- Aligning Workforce Preparation with Cluster Development
- Engaging Clusters in Jobs/Housing Initiatives
- Establishing A Cohesive Marketing Strategy for the County (a message consistent with the Three E's)

The importance of community participation is highlighted in the County's draft Countywide Plan: "Community participation in public decision-making is essential to infusing County governance with the appropriate breadth of perspective. Broad and informed participation creates healthy and just local government and community atmosphere".

During the cluster development process, cluster working group sessions are facilitated by an outside facilitator. Each cluster group then generates a definition of their cluster, a vision statement, and a set of action initiatives containing specific action steps with a timeline, defined leadership, and criteria for success. This very dynamic process continues under local leadership with assistance from outside facilitators, and some of these initiative descriptions may change and grow. From an economic development point of view, this is a positive sign. It means that the community, and particularly the private sector leaders who are most directly affected, embrace this approach and are actively working to shape these initiatives and implement them. As documented in the newly-released book "Civic Revolutionaries: Igniting the Passion for Change in America's Communities", those communities that learn to mobilize their civic entrepreneurs to produce positive change are more likely to enjoy healthy economies and a sustained high quality of life.[75]

[75] Doug Henton, et al. "Civic Revolutionaries: Igniting the Passion for Change in America's Communities," 2003.

Experience teaches us that businesses need to be part of a participatory process that helps guide them to a future of their cluster that is consistent with County goals. They need to be at the table – being informed of county policies and goals – but also to help shape them in the light of their day-to-day economic realities. What does it take to operate a business in Marin? What are the impacts of regional, national, and international trends on the business? Only local business owners know, only they can inform the public-private dialogue about how best to "target" them in an effort to support the stars and nourish the seeds. This can be achieved through the collaborative framework discussed above. A summary of the short, medium and long-term actions involved in pursuing a cluster-based, collaborative process are summarized in Table 9 below.

Table 9: Short, Medium and Long-Term Steps in Launching a Cluster-Based, Collaborative Process in Marin County			
Step	**Short Term Steps** (1-6 months)	**Medium Term Steps** (7-18 months)	**Long Term Steps** (19-30 months)
1	Announce the launch of a cluster-based, collaborative process (with Board of Supervisor Approval). [Note: the results of this report, its interviews and focus groups, would serve as the basis for identifying clusters and prioritizing work under a collaborative framework].	Hold series of cluster working group meetings (normally 4, although some prefer to go on meeting beyond the scope of the formal process). Each meeting with each cluster has a specific purpose.	Create an implementation organization. Creating an on-going implementation mechanism to enable and foster collaborative actions is a key part of the collaborative process. The cluster working groups and public sector work together to define the best possible mode of maintaining and sustaining action. Some regions require entirely new economic intermediaries, while others only require networks of existing and new organizations. The criteria for selecting which organizational design is best will be set by the leadership group working with examples prepared by the consulting team and other participants.
2	Publicize the details of process, its intended outcomes, and the nature of the participants	The first session is used to introduce participants and have them discuss their cluster, using reports and analyses furnished by an outside source (usually consultants to the process), and to work towards prioritizing the challenges facing the cluster.	Support strategy implementation. An outside entity (frequently a consulting team of facilitation experts) must support the cluster working groups in implementing their action initiatives and help them plan and build support. This can involve a number of things including: (1) serving as the principal policy advocate vis-à-vis county and city staff and the Board of Supervisors; or (2) bringing in industry experts to help cluster working groups develop their visions and strategies.
3	Create lists of companies and other individuals that might be appropriate participants in the cluster working groups	The second session focuses on identifying a vision of the future potential of each cluster, based on product/market data and shared views of participants. This session is good stage at which the needs of the cluster and the needs of the larger community can be compared and reconciled.	Publicize results. Convene a forum to announce the results of the cluster working group process. This forum (and other public announcements) should communicate the outcomes of the cluster competitiveness strategy effort, how this effort has focused on collaborative strategies for action to be led by the action champions from each of Marin County's key clusters.

Table 9: Short, Medium and Long-Term Steps in Launching a Cluster-Based, Collaborative Process in Marin County			
Step	**Short Term Steps** (1-6 months)	**Medium Term Steps** (7-18 months)	**Long Term Steps** (19-30 months)
4	Identify and solicit support from candidates for leadership roles (cluster co-chairs; leadership council; advisory council)	The third session explores a range of priority actions that proponents (or "champions") believe would respond to the challenges and requirements for achieving the cluster vision. These action initiatives may focus on business-to-business actions, business collaboration with government, and business-to-institution initiatives. In any instance, individuals who are willing to see the development of the action through at least the early stages of the implementation process must propose these actions. If there is no true champion, the initiatives are not accepted by the group for further development. At this stage, subgroups are often formed to meet independently before the fourth work session to develop the details of action initiatives.	
5	Establish cluster working groups	At the fourth meeting participants refine and finalize the initiatives that will help the cluster achieve its vision. At this time, working groups draft plans for actions that they agree need to be pursued to increase the competitiveness of their cluster. Additional subgroup meetings often take place subsequently to further develop these prior to finalization of each cluster's strategy.	
6	Launch public-private collaborative process		
7	Begin series of cluster working groups		

APPENDIX 1-Q

MARIN COUNTY WATERSHED MANAGEMENT PLAN
ADMINISTRATIVE DRAFT, APRIL 2004

Marin County
Watershed Management Plan

Administrative Draft

April 2004

Marin County
Watershed Management Plan
Administrative Draft

April 2004

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Introduction

The primary purpose of the Marin County Watershed Management Plan is to guide County staff, resource managers and policy makers, and community organizations to protect and where needed restore the beauty and natural function of Marin County's watersheds. The plan is intended to be a practical tool with specific recommendations on practices to improve and sustain a healthy, productive environment.

This plan focuses on the drainages within the Inland Rural and Coastal Recreation planning corridors, the area known as west Marin. Although most of the plan's recommendations are applicable for the entire County, the areas that drain into San Francisco Bay will be specifically addressed by the North Bay Watershed Stewardship Plan being prepared by the North Bay Watershed Association.

The Marin County Watershed Management Plan is intended to support the policies and programs developed during the updates of the Marin Countywide Plan and Local Coastal Program and to encourage implementation of the goals and recommendations of the community-based planning documents developed for Tomales Bay, Redwood Creek, Walker Creek, Stemple Creek, and others.

The plan consists of the following pieces:

- **Chapter 1** provides the context for the recommendations that form the heart of the plan. It defines a watershed, describes watershed management, and presents seven guiding principles to give overarching guidance for land use activities in Marin County watersheds.

- **Chapter 2** describes the watersheds of western Marin County, briefly summarizes current planning and restoration efforts, and identifies major issues in each watershed.

- **Chapter 3** presents objectives for implementing the guiding principles along with specific recommendations to achieve each objective. These objectives and recommendations have been developed within the context of supporting healthy watershed function. Some are taken directly from watershed plans that have undergone a public participation and approval process. Others are presented here for the first time.

- **Chapter 4** explains different types of monitoring used in watershed management and describes the elements of a scientifically sound monitoring plan.

- **Chapter 5** describes a framework to guide community groups and public resource managers in creating plans for individual watersheds.

- **Chapter 6** recommends priority actions, additional studies, and policies for Marin County, other public entities, and private-public partnerships to undertake as next steps.

  Acronyms used in this plan are provided after the Introduction. A **glossary** and a **list of references** cited follow Chapter 6.

- **Appendix A** describes each of the major watersheds covered in this plan. It identifies special habitats and species, describes past and current planning and management work, lists important issues, and identifies priority needs for each watershed.

- **Appendix B** is a collection of practices and references for implementing many of the recommendations identified in Chapter 4.

- **Appendix C** summarizes the regulations and permits pertaining to watershed restoration projects.

- **Appendix D** lists the species of concern identified through the California Natural Diversity Database for Marin County.

- **Appendix E** consists of the "Framework for Watershed Stewardship" taken from the Tomales Bay Watershed Stewardship Plan (TBWC, 2003). More than half of western Marin County drains into Tomales Bay. Appendix E contains the goals, objectives, and action plan developed by the Tomales Bay Watershed Council as part of a three-year, multi-stakeholder effort.

Acronyms Used in This Plan

ACOE	U.S. Army Corps of Engineers
ARS	Agricultural Research Service
BASMAA	Bay Area Stormwater Management Agency Association
BCDC	San Francisco Bay Conservation & Development Commission
BLTAC	Bolinas Lagoon Technical Advisory Committee
BMP	Best Management Practice
CAFF	Community Alliance with Family Farmers
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
CSCC	California State Coastal Conservancy
DHS	California Department of Health Services
DPR	California Department of Parks and Recreation
EA	Environmental Assessment
EHS	Marin County Environmental Health Services
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESU	Evolutionarily Significant Unit
FishNet 4C	Fishery Network of the Central California Coastal Counties
GIS	Geographical Information System
GGNRA	Golden Gate National Recreation Area
Gold Ridge RCD	Gold Ridge Resource Conservation District
JARPA	Joint Aquatic Resources Permit Application
LMER	Land Margin Ecosystem Research
MALT	Marin Agricultural Land Trust
MCCDA	Marin County Community Development Agency
MCOSD	Marin County Open Space District
MCSTOPPP	Marin County Stormwater Pollution Prevention Program
MMWD	Marin Municipal Water District
MOU	Memorandum of Understanding
Marin RCD	Marin Resource Conservation District
NCWAP	North Coast Watershed Assessment Program
NCRWQCB	North Coast Regional Water Quality Control Board

NMWD	North Marin Water District
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Marine Fisheries Service, a part of NOAA
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resources Conservation Service
OWOW	EPA Office of Wetlands, Oceans, and Watersheds
PCI	Prunuske Chatham, Inc.
PL	Public Law
PRBO	Point Reyes Bird Observatory
PRNS	Point Reyes National Seashore
PWA	Pacific Watershed Associates
RCD	Resource Conservation District
RWQCB	Regional Water Quality Control Board
SCA	Stream Conservation Areas
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SFZC	San Francisco Zen Center
SOD	Sudden Oak Death
STRAW	Students and Teachers Restoring a Watershed
SWRCB	State Water Resources Control Board
SWPPP	Stormwater Pollution Prevention Plan
TBA	Tomales Bay Association
TBAG	Tomales Bay Agriculture Group
TBI	The Bay Institute
TBSTAC	Tomales Bay Shellfish Technical Advisory Committee
TBWC	Tomales Bay Watershed Council
TMDL	Total Maximum Daily Load
UCCE	University of California Cooperative Extension
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service

Chapter 1. Guiding Principles

A watershed is all of the land that drains into a given stream or river. It can be as small as the few acres that feed a seasonal creek, or it can encompass nearly half a nation, as does the Mississippi River watershed. In Marin County, the major watersheds are bisected by streams that enter San Pablo and San Francisco Bays to the east and south, and Tomales Bay, the Pacific Ocean, and Bodega Bay to the west (Figure 1).

Watersheds are an intricate and fine-tuned expression of the interaction between the climate, the earth itself, and the local plant and animal communities. They can be read like stories. Century-old gullies in western Marin County are remnants of the era when coastal prairies were plowed and rain poured off the hills instead of soaking into sod-protected soil. Alluvial soils in the valley floors of eastern Marin County were deposited by the slow wandering of creeks across their floodplains before they were confined by streets and backyards.

Watersheds move and store water, carve stream channels, carry sediment from the mountains to the beaches, provide year-round habitat for some wildlife species, and meet critical needs of others during annual migrations. Watersheds also provide people with the basic materials we need to sustain our communities—food and water, building supplies, places to call home.

A change in one watershed element affects the shape and function of the entirety. Together, small impacts can add up to major changes. One new roof, for example, may not make much difference, but a subdivision full of pavement and buildings can speed up the delivery of rainfall into the neighboring stream and ultimately lead to severe bank erosion, flooding, and habitat loss if it is not thoughtfully designed. Watershed management is the art and science of adjusting human activities so that they can co-exist with, and even support, natural systems. It calls for imagination, openness, and cooperation—imagination to be able to see complex and often delayed connections, openness to adapting policies and practices as new scientific information becomes available, and cooperation because no one person has all of the skills needed to understand or manage a watershed. The task requires well-informed and actively participating watershed residents, collaboration between a wide range of scientists, and public servants who are resolved to leave behind a healthy, productive environment.

As the demands on remaining natural resources continue to grow, management from a watershed perspective becomes urgent. It is no longer a luxury to consider the long-term repercussions of our actions; it is a necessity. The County's economy, quality of life, and its role of providing some of the most beautiful and biologically rich landscapes on the West Coast depend on integrative, scientifically-based management.

The following principles form the foundation for integrating the basics of watershed management into all activities that affect land and water use in Marin County. Chapter 3 gives specific recommendations for implementing the guiding principles.

Watershed Guiding Principles

Everything is connected.
All elements of a watershed—the hydrologic cycle, the biotic community, human activities, and the land itself—are connected through a complex web of relationships. Changes in one part affect the health and function of the whole watershed.

Scientific understanding underlies effective watershed management.
The more we understand about watershed function and relationships, the better we will be able to protect natural processes. Sound management choices need to be based on up-to-date, interdisciplinary science coupled with ongoing assessment.

Long-term watershed management requires continual adaptation and modification.
Monitoring is vital to understanding and continually improving the success of management and restoration actions. Monitoring also allows us to observe and document trends in the health of our watersheds over time.

Everyone has an important role.
With over half of Marin County in private ownership, the leadership and committed participation of the people who live and work in each watershed is essential for effective planning, restoration, and ongoing management.

Collaboration shares skills and resources.
Watershed management requires a vast range of skills, from community organizing to designing water quality monitoring programs to sizing culverts. Interagency coordination and partnerships with local watershed residents bring multiple perspectives and durability into watershed efforts.

Education creates the future.
Education builds enduring connections between people of all ages and their watersheds. Being able to see ourselves as much a part of our local ecosystems as live oaks or salmon provides a deep and compelling sense of stewardship.

Protection and restoration are key to preserving biodiversity.
Zoning, land protection programs, and land use policies can help protect natural resources and balance human needs with healthy watersheds. Restoration can extend, connect, and enhance natural habitats.

Chapter 2. Watersheds of Western Marin County

Physical Setting

This section of the plan focuses on western Marin County—on the lands that are found within the Inland Rural and Coastal Recreational environmental planning corridors (Figure 1). With the exception of the Stafford Lake drainage, these watersheds drain into Bodega Bay, Tomales Bay, Bolinas Lagoon, and directly into the Pacific Ocean. Appendix A describes the individual watersheds in greater detail.

Marin County is renowned for its beauty and biological diversity. The Tomales Bay watershed alone has nearly 900 species of plants and 490 species of birds (TBWC, 2003). With almost half of western Marin County publicly managed for resource protection, this area of small rural communities, grazing cattle, and vast stretches of undeveloped land stands in sharp contrast to the busy eastern part of the County. Its proximity to the San Francisco Bay area helps draw millions of visitors each year (MCCDA, 2003).

Geology and Climate

The dominant geological feature of western Marin County is the San Andreas Fault, which separates the Pacific and North American tectonic plates. Tomales Bay is a submerged valley directly over the fault. On the west side, the bedrock consists of granitic rocks and overlying sedimentary rocks (MCCDA, 2002b). On the east side, the parent material is composed of Franciscan Formation rock, an assemblage of sandstone, shale, chert, and submarine basaltic volcanic rock (Wahrhaftig and Wagner, 1972). Areas of serpentine rock occur in the Franciscan Formation, particularly in the upper Lagunitas Creek watershed. In the top corner of the County in the Stemple Creek and Estero Americano watersheds, the Franciscan rocks are overlain by the Wilson Hill Formation.

The parent rock determines the type of soil that develops over it and affects characteristics such as landslide potential, erosion potential, and availability of groundwater. Soils in the Franciscan Formation are particularly susceptible to landslides. Most have a high erosion potential. They hold very little groundwater and make poor candidates for water supply wells. Many Wilson Hill Formation soils are also highly erodible and subject to deep gullying, although they appear to have a lower landslide potential than Franciscan soils (Wahrhaftig and Wagner, 1972). The soils west of the San Andreas Fault zone are very weathered and create the beaches, dunes, and steep topography of Point Reyes. The Marin County Soil Survey (SCS, 1985), available at the Petaluma Office of the USDA Natural Resources Conservation Service (NRCS), gives detailed soil maps for the entire County and provides excellent information on the characteristics, problems, and best uses of individual soil types.

Because of soil composition, steep slopes, and heavy winter storms, landslides are common in Marin County soils. After the January 4, 1982, storm, 4,600 debris flows were mapped within the County (Ellen, et al., 1988). These events not only have a profound economic and safety impact, they are a significant force in shaping the landscape.

Marin County has a mild Mediterranean climate with long dry summers and rainy winters. Rainfall averages from 30 to 61 inches per year (Fischer, et al., 1996). Coastal fog is common, especially in late summer when it provides an important source of precipitation.

Plant and Animal Communities

Marin County has a rich diversity of habitat types. The Marin County Community Development Agency (MCCDA) maintains detailed Geographical Information System (GIS) maps of habitat types based on surveys conducted by the U.S. Forest Service and the California Department of Forestry.

Marin's extensive shoreline with its many bays and lagoons creates the topography and tidal circulation needed to support dune habitat, mud flats, and both salt and freshwater marshes. Eelgrass beds, which provide nursery habitat for many species including Pacific herring and Dungeness crab, grow submerged in Marin bays and lagoons.

The rolling grasslands of the west County are the foundation of Marin's dairy and livestock industry, but they also provide vital habitat for many wild herbivores and their predators. Badgers, deer, elk, pond turtles, songbirds, golden eagles, and many other hawks are among the species that depend on grassland habitat for at least part of their life cycles. Although introduced grasses and forbs dominate most Marin grasslands, native grasses and wild flowers still flourish in many areas. Point Reyes and the Dillon Beach area have extensive areas dominated by native grassland plants.

Interspersed with the grasslands and closely hugging the slopes are the oak woodlands. Coast live oak is the dominant plant in this community growing along with bay laurel, California buckeye, madrone, and a host of understory plants. Sudden Oak Death (SOD), a fungus-like disease, is a serious threat to this habitat. (See Appendix B for more information on SOD.)

The Douglas fir-redwood forest is another major forest habitat in the west County. Extensively harvested in the 1800s and into the early 1900s, these forests have been significantly altered, and most are riddled with networks of old logging roads. Stands of old growth redwoods remain, notably in Roy's Redwoods in San Geronimo Valley and Muir Woods. In Samuel P. Taylor State Park, mainstem Lagunitas Creek flows through a spectacular stand of second-growth redwoods—their tall, straight trunks hinting at the stature of the pre-harvest trees.

Riparian forests line many Marin County streams. In the upper tributaries, these forests often consist of coast live oak and bay laurel. In the watersheds south of Walker Creek and east of Tomales Bay, redwoods are a common riparian tree as slopes begin to flatten. Nearer the coast or throughout some grassland streams, alders and willows are the primary constituents of the riparian forest. However, not all riparian plants are trees. Grasses, sedges and rushes, and many shrubs are important components of riparian systems. In California, over 225 species of birds, mammals, reptiles, and amphibians depend upon riparian habitat (Riparian Habitat Joint Venture, 2000). It provides an essential link from upland habitats to food and water sources. The shade, soil stabilization, and organic matter it provides are key ingredients to healthy stream systems.

Other Marin County habitats include the Bishop pine forests of Point Reyes, dense thickets of coastal scrub in undisturbed slopes along the coast, and chaparral on Mt. Tamalpais and the Carson Ridge area. Another feature of the rural Marin landscape is the lines of eucalyptus trees planted as windbreaks in the early and mid 1900s.

With its varied habitats and large areas of protected land, Marin County has 52 plants and 41 animals identified as special status species[1] by the California Natural Diversity Database (CNDDB) (CDFG, 2003)—an exceptionally high number given the County's relatively small size (Figure 2). Appendix D lists these species. Lagunitas Creek alone is a major force in wild coho salmon production, annually producing 500 to 800 of California's estimated total population of 5,000 spawning adult fish. Table 1 shows the number of coho redds (spawning nests where the salmon deposit their eggs in the stream) in the Lagunitas Creek system since the early 1980s. Figure 3 identifies the Marin streams with steelhead trout and coho salmon.

Point Reyes National Seashore (PRNS) supports nearly 15% of California's plant species, 30% of the world's marine mammal species, and 45% of the North American bird species (MCCDA, 2003). An estimated 20,000 shorebirds and 25,000 waterbirds winter in or along Tomales Bay (TBWC, 2003). In the spring of 2003, many people observed the first black bear in Marin County in 134 years (Schlesinger, 2003a, 2003b).

[1] Special status species are taxa listed as endangered or threatened by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NOAA Fisheries), or California Department of Fish and Game (CDFG); taxa designated as candidates for listing; or any species of concern or local concern by USFWS, NOAA Fisheries, and/or CDFG. In addition, the California Native Plant Society (CNPS) has compiled a list of plant species that it considers to be rare, threatened, or endangered. These plants must be included for consideration during project evaluation in order to comply with the California Environmental Quality Act (CEQA) Guidelines concerning special status species.

Table 1.
Total Coho Redds in Lagunitas Creek Watershed, 1995-2003

Years	Lagunitas Creek mainstem[1]	San Geronimo Creek[2] (mainstem + tributaries[3])	Devil's Gulch[4] (+ Cheda Creek[5])	Olema Creek mainstem[6] (+ tribs[7])	Total Redds
1995/96	70	6	10	No Data	86
1996/97	98	115	42	No Data	255
1997/98	80	107 + 14	46	126 + 7	380
1998/99	92	46 + 14	31	42 + 1	226
1999/00	139	58 + 3	3	10 + 17	230
2000/01	119	56 + 18	11	86 + 48	338
2001/02	79	102 + 43	59 + 3	58 + 31	375
2002/03	71	39 + 22	24 + 2	5 + 12	175

1 Lagunitas Creek is surveyed from Tocaloma to Peters Dam.
2 San Geronimo Creek is surveyed from its mouth to its confluence with Woodacre Creek.
3 San Geronimo tributaries include Arroyo Road Creek, Larsen Creek, Evans Canyon, Woodacre Creek, San Geronimo Creek above Woodacre Creek, and Cheda Creek.
4 Devil's Gulch is surveyed from its mouth to an impassable cascade roughly two miles upstream by MMWD.
5 Cheda Creek is surveyed from its mouth, 1.5 km upstream by the NPS.
6 Olema Creek is surveyed from the Bear Valley Road Bridge to its confluence with Randall Gulch by the NPS

Source: Marin Municipal Water District and PRNS

Past and Current Land Use

For thousands of years, indigenous people lived along Marin streams and in coastal areas. Over 120 Coast Miwok village sites are known on Point Reyes alone (PRNS, 2003). By the early 1880s, the land had been parceled into ranchos through the Mexican land grant system. After the Bear Flag revolt in 1846 and the discovery of gold in 1848, American settlers poured into the area and established a thriving agricultural economy. In 1850, Marin County was among the ten leading cattle counties in the state with 6,981 head. By 1862, it was fourth in the state for producing potatoes. From 1862 until about 1910, Marin County led the state in dairy production, primarily through butter shipped into San Francisco. Wheat, barley, and sheep were also important products (UCCE, 1995). Since the first eastern oysters were planted in Tomales Bay in 1875 (TBWC, 2003), mariculture continues to be an important contributor to the local economy.

Today, animal agriculture still dominates western Marin. Of the 133,444 acres of land used for agriculture in the County in 2000, 94 acres were planted to vineyards, 177 were farmed for vegetables and other crops, 6,065 acres grew livestock feed crops such as hay and silage, and the remaining 127,128 acres consisted of pasture for livestock grazing (MCCDA, 2003). Beef production and dairies account for most of the livestock production, with sheep dwindling in number over the last 40 years. A strong trend in Marin County agriculture is the growth in value-added products and agricultural diversification (MCCDA, 2003). The increased production of organic vegetables and milk, local cheeses, and grass-fed beef demonstrate this trend. The Marin Agricultural Land Trust (MALT) holds agricultural conservation easements on 32,000 acres of land on 47 farms (MALT, 2003). Figure 4 shows current MALT easements.

Close to shipping and San Francisco, Marin County's forests provided a ready supply of redwood and Douglas fir beginning in the 1850s. Samuel P. Taylor built the West's first paper mill on Lagunitas Creek in 1856 (UCCE, 1995). The last significant commercial logging in the County occurred in the early 1960s in the Olema Creek and the Pine Gulch Creek watersheds.

Mercury mining left a lasting impact on western Marin County, especially at the Gambonini mine in the Walker Creek watershed. The mine was closed in 1970, but the severe January 1982 storm demolished stabilization measures and released a huge amount of mercury-laden sediment into Walker Creek. During the much milder storm season of 1997-98, 1,300 tons of mercury-rich suspended sediments and an undetermined amount of bedload were washed from the mine site (Whyte and Kirchner, 2000). Sediment samples collected 3 miles downstream from the mine and at the mouth of Walker Creek where it enters Tomales Bay contain high concentrations of mercury (Smelser and Whyte, 2001). Declared a Superfund site in 1998, the area has been stabilized through a joint effort between the federal Environmental Protection Agency (EPA) and the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB).

With nearly 110,000 acres in parklands and another 50,000 protected by water districts and open space easements, Marin County has more protected public land than any of the nine Bay Area counties (Figure 5). Approximately 500 miles of trails access this land. Tourism and recreation have become a major industry, bringing $500 million per year into western Marin County (MCCDA, 2003).

Common Watershed Issues

Table 3 summarizes recent planning and restoration activity, major issues, and priority needs for watersheds in western Marin County. Although each watershed has its own unique challenges, the following issues and needs are held in common by many areas. Chapter 3 provides recommendations for addressing these issues.

Water Quality

Section 303(d) of the federal Clean Water Act requires that states identify water bodies that do not meet water quality standards. Nine Marin streams and Tomales Bay are on the 303(d) list. Others, while not listed, are nonetheless impacted by excessive sedimentation or other problems. The SFBRWQCB has begun or scheduled the development of Total Maximum Daily Loads (TMDLs) for all of the watersheds on the 303(d) list. TMDLs identify sources of pollutants and specify actions to address them. Public participation is very important in setting effective and achievable TMDLs and attainment strategies. (See Table 2, below.)

Table 2. TMDL Development Schedule for Marin Watershed Management Areas

Waterbody	Stressor(s)	Basin Plan Amendment	Comments
All San Francisco Bay Segments	Mercury	2002	TMDL Report due April 2000. TMDL and Implementation Plan due June 2001.
	Exotic Species	Unknown	TMDL Report due April 2002. No further work is scheduled at this time due to AB 703 constraints.
	Copper	2004	TMDL Report due June 2002. TMDL and Implementation Plan due June 2003.
	PCBs	2004	TMDL Report due June 2002. TMDL and Implementation Plan due June 2003.
	Nickel	2004	TMDL Report due June 2002. TMDL and Implementation Plan due June 2003.
	Diazinon	2006	TMDL Report due June 2004. TMDL and Implementation Plan due June 2005.
	Selenium	2010	TMDL Report due June 2008. TMDL and Implementation Plan due June 2009.
	Dioxin line compounds including Furans	Unknown	U.S. EPA currently developing strategy.
	Chlordane, DDT, Diedrin	Unknown	U.S. EPA currently developing strategy.
Urban Creeks	Diazinon	2004	TMDL Report due June 2002. TMDL and Implementation Plan due June 2003.
Walker Creek/ Tomales Bay	Metals (Mercury)	2005	TMDL Report due June 2003. TMDL and Implementation Plan due June 2004.
	Siltation, Nutrients	2007	TMDL Report due June 2005. TMDL and Implementation Plan due June 2006.
Lagunitas Creek	Nutrients, Pathogens, Siltation	2007	TMDL Report due June 2005. TMDL and Implementation Plan due June 2006.
Richardson Bay	Pathogens	2008	TMDL Report due June 2006. TMDL and Implementation Plan due June 2007.

Source: EOA, Inc.

The following water quality issues are particularly important to western Marin County watersheds:

Degradation of aquatic habitat. Poor water quality has an immediate impact on aquatic wildlife. Coho salmon and steelhead have been of special concern in many west County watersheds because of the dramatic decline in their populations during the 1970s and 1980s. Sedimentation of spawning gravels and rearing pools has been identified as a population constraint throughout the greater Tomales Bay watershed, Bolinas Lagoon, and Redwood Creek. High water temperatures from loss of riparian habitat are a concern in parts of the Walker Creek watershed. Elevated levels of nutrients and pathogens have been identified as issues in Tomales Bay and its tributaries, as well as in Stemple Creek and the Estero Americano. Mercury from the Walker Creek watershed impacts aquatic habitat in Walker Creek and in Tomales Bay.

Clean domestic water. The Lagunitas Creek and Stafford Lake watersheds supply most of Marin County's domestic water. Controlling the amount of sediment entering the storage reservoirs is important to maintaining their capacity. North Marin Water District (NMWD) is working on a cooperative program with watershed landowners to reduce the possibility of microbial contamination from agricultural operations in the watershed.

Sub-standard septic systems. Inadequate septic systems along Tomales Bay and in the San Geronimo Valley have been identified as possible sources of pathogens to Lagunitas Creek and Tomales Bay. Efforts are underway by Marin County to assist rural landowners in developing small-scale, neighborhood treatment facilities along the east shore of Tomales Bay.

Agricultural impacts on water quality. Water quality concerns from Marin's farms and ranches include sedimentation, mostly from ranch roads and historic farming practices that opened the soil to gullying, pathogens and nutrients from animal waste, and degradation of riparian habitat leading to increased surface water temperatures. The Marin RCD, UC Cooperative Extension (UCCE), NRCS, and, more recently, the Tomales Bay Agricultural Group (TBAG) have been working diligently with farmers and ranchers to address these impacts through education, monitoring, and implementation projects that eliminate or reduce sources of pollutants.

Habitat Loss and Fragmentation. Fragmentation is the breaking of large areas of habitat, such as an oak woodland or a riparian forest, into smaller pieces. Many wildlife species cannot adapt to this change because of increased vulnerability to predation and a reduction in the size of the home range they need to complete their entire life cycles. Restoration of continuous riparian habitat has been a major goal in many west County watersheds. Additional work is needed to identify important terrestrial

and wetland habitats throughout the County, as well as opportunities to protect and reconnect them.

Barriers to Fish Passage. Anadromous fish passage is an important issue in the Bolinas Lagoon and Lagunitas Creek drainages. Barriers can block adult access to spawning areas and the migration of young fish back to the ocean. Often these barriers occur at culverts and road crossings. A draft study commissioned by Marin County Department of Public Works identified barriers to anadromous fish passage throughout the County (Taylor, 2003).

Water Quantity. The amount of stream flow is a critical factor in maintaining the viability of aquatic habitat. It impacts water quality, the movement of sediment through the streambed, and the basic functions of many organisms including salmonid fish and the insects that support them. The Marin Municipal Water District (MMWD) reservoirs now capture about 40% of the freshwater that historically flowed into Tomales Bay (TBWC, 2003). State Water Resource Control Board Order 95-17 set flow limits from Kent Reservoir, but concern remains about long-term effects on Lagunitas Creek and Tomales Bay as well as additional impacts as new, small water impoundments are developed. Balancing the needs of residential and agricultural use with healthy aquatic habitat has also been an important issue in the Bolinas Lagoon watershed.

Invasive Exotic Species. Many watershed plans and resource managers identify invasive non-native plant and animal species as a major threat to native habitats and watershed function. Problem species include gorse, broom, goat grass, star and distaff thistle, domestic cats, starlings, and nearly 100 exotic marine invertebrates. A coordinated program between agencies, land managers, and private landowners is vital to controlling these threats.

Regulatory Permit Simplification. Agricultural operators have long expressed their frustration with the difficult and time-consuming process of securing multiple permits for many regular maintenance or improvement activities, such as removing sediment from a stock pond, repairing a headcut in a pasture gully, or building a barn. Such actions can require consultation and/or permits from the Army Corps of Engineers (ACOE), NOAA Marine Fisheries, or USFWS if endangered species are present, CDFG, the Regional Water Quality Control Board (RWQCB), and Marin County. If the project is in the Coastal Zone, additional review by the Coastal Commission is often required. Marin Resource Conservation District (Marin RCD) has been working with Sustainable Conservation, a non-profit organization, and state, federal, and local

agencies to simplify this process for many standard conservation practices.

Agricultural Viability. Although agriculture continues to be an important part of the Marin economy, a recent survey of Marin County farmers and ranchers indicated that only 37% considered their overall operation profitable (UCCE, 2003). High land values in Marin County have contributed to the cost of agricultural production, often exceeding the revenues it generates (MCCDA, 2003). Support with agricultural permitting, product diversification, marketing assistance, and easements that protect agricultural use are among the tools available to support the agricultural industry in Marin County.

Monitoring. Monitoring is a key need for all watershed management programs. Baseline monitoring establishes the starting conditions, and trend monitoring tracks how restoration activities and changes in management are affecting these conditions over time. Effectiveness monitoring documents whether or not specific practices are achieving desired goals. Monitoring is a fundamental component of adaptive management, the process of refining objectives and implementation strategies over time to improve overall success. Chapter 5 describes the basic elements of a scientific watershed monitoring program.

In the past twenty years, state and federal watershed grant programs have focused on planning and implementation. Funding for monitoring has been difficult to obtain, primarily because it does not fit into the 2 to 3-year timeframe of most non-profit or agency grants. Specific west County needs include baseline and trend monitoring of water quality, fish, and other sensitive species populations, as well as effectiveness monitoring of completed restoration efforts.

Watershed Assessments. Assessment is the first logical step for developing a sound watershed plan. Often, however, urgent problems and community concerns drive implementation projects to occur before assessments are undertaken. Assessment is defined by California's North Coast Watershed Assessment Program (NCWAP) as a process that characterizes current watershed conditions on a coarse scale using an interdisciplinary approach to collect and analyze information. Assessments identify issues and help focus the planning and restoration process. Although a great deal of assessment work has been done on several west County watersheds, Stemple Creek is the only one with a completed comprehensive watershed assessment (Marin RCD and Southern Sonoma County RCD, 2002). Many of the smaller watersheds have virtually no known assessment information. Table 3 and Appendix A identify specific assessment needs for each watershed.

Outreach and Education. Getting effective information to homeowners, land managers, and agricultural operators about conservation practices, septic systems maintenance, invasive species, and other issues is a critical need throughout the County. Park and public open space visitors also need information on what they can do to protect the resources they have come to enjoy. The education and outreach component of watershed management offers fine opportunities for coordination between watershed groups and for cost-effective agency support of local efforts.

Agency and Private Landowner Coordination. Marin County watersheds range from those that are completely owned by one public entity, such as most of the small drainages on Point Reyes, to those that are almost entirely in private ownership, such as the Stemple and Walker Creek watersheds. Most, however, have a mélange of landowners—public park agencies, water districts, school districts, private residents. Several watersheds, including Redwood Creek, Bolinas Lagoon, and the greater Tomales Bay watersheds, have councils or similar working groups that bring together multiple public agencies, watershed residents, and community groups. Others, such as Lagunitas Creek, have less formal coordinating mechanisms. Forums for effective agency coordination are needed in every watershed with multiple- agency management.

Support of Ongoing Community Watershed Efforts. Most of the west County watersheds have some level of community-based planning or restoration occurring. Some are well-established and coordinated; others are more opportunistic and limited in their scope, springing to life in response to new concerns or funding. Groups such as TBAG or the Marin RCD operate in many watersheds. Community efforts are essential to achieving and maintaining watershed health. Public agencies and elected representatives can help sustain these efforts by providing funding and letters of support, participating in meetings and restoration activities, and helping with outreach and technical advice.

Table 3 Summary of Planning and Restoration Efforts, Issues, and Needs in Western Marin County Watersheds

Watershed	Recent Planning and Restoration Efforts	Important Issues	Priority Needs
Estero Americano	Enhancement Plan with focus on erosion control completed in 1987. Gold Ridge RCD undertaking erosion control, habitat protection and water quality improvement projects with private landowners.	• Water quality: nutrients and sediment. • Agricultural viability. • Invasive non-native plants. • Estero function.	• Ongoing funding for landowners to implement habitat restoration and water quality improvement projects. • Effectiveness monitoring and maintenance of completed projects. • Regulatory permit simplification and assistance.
Stemple Creek	Enhancement Plan completed in 1994. Draft Watershed Project Plan and Environmental Assessment and Historical Sediment Study completed in 2002. Steering Committee in place to advice NRCS. Marin RCD and Southern Sonoma County RCD. Restoration projects underway with private landowners.	• Water quality: nutrients, sediment, leachate from Sonoma County landfill. • Groundwater quality. • Habitat restoration. • Estero function. • Agricultural viability.	• Support for the PL566 application for federal cost shares for water quality improvement projects. • Ongoing funding to implement habitat restoration and water quality improvement projects. • Effectiveness monitoring and maintenance of completed projects. • Further investigation and monitoring to determine if the Estero is filling with sediment, or if scouring is occurring. • Monitoring of groundwater quality. • Regulatory permit simplification • Development of a Safe Harbor program.
Tomales Bay: Walker Creek	Walker Creek Watershed Enhancement Plan completed in 2001. Tomales Bay Watershed Stewardship Plan completed in 2003. Marin RCD sponsors occasional community watershed meetings. Restoration projects underway.	• Water quality: sediment, mercury, nutrients, pathogens and high temperature • Riparian habitat restoration. • Range management. • Agricultural viability.	• Ongoing funding to implement and manage habitat restoration and water quality improvement projects. • Effectiveness monitoring and maintenance of completed projects. • Regulatory permit simplification • Limiting factor analysis for coho salmon and steelhead. Monitoring of habitat and populations.

Watershed	Recent Planning and Restoration Efforts	Important Issues	Priority Needs
		• Landowner participation. • Invasive non-native plants. • Recovery of salmonid populations.	• Fluvial geomorphic analysis to guide restoration efforts. • Monitoring program for sediment, water temperature and other water quality indicators. Continuing monitoring of neotropical songbird use of restored riparian corridors. • Support of outreach and education efforts. • Regularly updated GIS mapping of restored riparian habitat. • Development of practical and effective TMDLs and attainment strategies. • Control of invasive exotic plants.
Tomales Bay: small east and west shore tributaries	Tomales Bay Watershed Stewardship Plan completed in 2003. TBAG (Tomales Bay Agricultural Group) and many local organizations, including the Inverness Foundation, Tomales Bay Association, the Environmental Action Committee and the East Shore Planning Group, have undertaken planning, education and restoration projects.	• Water quality: pathogens and sediment • Habitat protection and restoration • Improvement of septic systems • Outreach and education, especially for tourists visiting Tomales Bay • Agricultural viability • Visitor impacts	• Habitat mapping and assessment. • Ongoing funding to implement and manage habitat restoration and water quality improvement projects. • Improvement of septic systems. Coordinated outreach program on septic system maintenance and repair. • Control of invasive exotic plants, especially gorse. • Support the efforts of the Tomales Bay Watershed Council to provide community based-planning and coordination. • Regulatory permit simplification • Development of practical and effective TMDLs and attainment strategies. • Outreach to rural residential landowners on good stewardship practices.

Watershed	Recent Planning and Restoration Efforts	Important Issues	Priority Needs
Tomales Bay: Lagunitas Creek	Tomales Bay Watershed Stewardship Plan completed in 2003. Salmonid and sediment studies completed by MMWD and PRNS in the 1980s and 1990s. State Water Board Order WR 95-17 set flow and temperature requirements. Lagunitas Creek Sediment and Riparian Management Plan completed for upper watershed in 1997. Monitoring, restoration and planning efforts underway. Strong community involvement from various groups including local schools, SPAWN and Trout Unlimited.	• Water quality: sediment, nutrients and pathogens • Streamflows • Health of aquatic habitat • Fish passage • Domestic water supply • Agency and community coordination • Community participation	• Development of restoration priorities based on limiting factors analysis for salmonids and freshwater shrimp • Ongoing funding to implement erosion control and habitat improvement projects. • Effectiveness monitoring and maintenance of completed projects. • Coordinated water quality and quantity monitoring program involving state, federal, County and private landowners. • Outreach to rural residential landowners on good stewardship practices. • Development of a comprehensive habitat management plan for the Olema watershed. • Development of practical and effective TMDLs and attainment strategies • Septic system evaluation and improvement. • Development of a watershed forum to facilitate coordinated planning, monitoring and implementation. • Implementation of the multi-agency MOU for maintenance and management of unpaved roads. • Restoration of natural hydrologic processes at the Giacomini Ranch at the mouth of Lagunitas Creek • Implement restoration recommendations based on fish passage evaluation.

Watershed	Recent Planning and Restoration Efforts	Important Issues	Priority Needs
Stafford Lake	North Marin Water District is currently working with local landowners to reduce microbial contamination of Stafford Lake.	• Domestic water supply • Habitat restoration	• Development and implementation of a landowner-supported plan to protect water quality in Stafford Lake.
Bolinas Lagoon	Bolinas Lagoon Management Plan revised in 1996. Historical perspective and sediment budget completed in 2001. Fisheries assessment of tributaries conducted from 1995-2000. The Bolinas Lagoon Technical Advisory Committee established in 1974. NPS coho and steelhead population monitoring since 1997. Many agencies and community-based organizations are active in planning, monitoring and restoration projects.	• Habitat restoration • Viability of Easkoot Creek salmonid habitat • Flood control • Streamflow and water supply for agricultural and domestic use. • Lagoon sedimentation	• Monitoring program for water quality, flow and fish habitat. • Water management plan to protect aquatic life and provide water for residential and agricultural use. • Investigation of low dissolved oxygen in Easkoot Creek • Aquatic habitat restoration and enhancement. • Feasibility assessment for long term riparian and channel improvements in Stinson and McKinnon Gulches. • Education for private landowners along Easkoot Creek about protecting stream habitat. • Control and replacement of invasive, exotic plants. • Implement restoration recommendations based on fish passage evaluation.
Webb Creek (Steep Ravine)	No known planning or restoration efforts specific to this watershed.	• No data available.	• General assessment.
Lone Tree Creek and Cold Stream Creek	No known planning or restoration efforts specific to this watershed.	• Large landslide at Highway 1.	• General assessment.

Watershed	Recent Planning and Restoration Efforts	Important Issues	Priority Needs
Redwood Creek and Big Lagoon	Redwood Creek Watershed Vision (NPS, 2003) created by public and private landowners and resource managers. Sediment source assessment and prevention plan completed in 2002. Sediment budget and restoration plan for Big Lagoon underway. Comprehensive Transportation Management Plan also currently underway to develop options to reduce visitor impacts.	• Habitat loss and subsequent decline in aquatic species. • Invasive non-native plants • Change in vegetation and increased risk of fire from alterations in historic fire regime. • Impacts on natural resources, traffic and neighboring communities from visitors and related facilities. • Balancing multiple uses of trails and parks. • Sedimentation of creek channels and Big Lagoon. • Recurring flooding on Pacific Way.	• Continuing support of and implementation of the Vision Project by the watershed stakeholders. • Comprehensive watershed assessment. • Development and implementation of an adaptive management program. • Restoration of salmonid habitat in Redwood Creek. • Restoration of functional, self-sustaining wetland, aquatic and riparian habitat at Big Lagoon. • Erosion control • Removal and replacement of invasive, exotic plants. • Implementation of measures to reduce visitor and traffic impacts on resources. • Continued support for and expansion of public education activities.
Tennessee Creek and Rodeo Creek	No known planning or restoration efforts specific to this watershed.	• Invasive, non-native plants. • Water quality: sedimentation.	• General assessment • Identification of cause of recent fish kills in Rodeo Lagoon.

Chapter 3. Objectives and Recommendations

The following objectives outline a strategy to sustain stable, well-functioning watersheds in Marin County:

Objective 1: Protect and where possible restore the natural structure and function of stream systems (pg. 22).

Objective 2: Protect and where possible restore native plant and wildlife communities (pg. 28).

Objective 3: Protect and where possible restore connectivity between habitats (pg. 34).

Objective 4: Maintain levels of water quality in streams and major waterbodies sufficient to provide healthy drinking water and support natural resources (pg. 36).

Objective 5: Provide a sustainable water supply for Marin County residents (pg. 39).

Objective 6: Support land uses that co-exist with natural watershed function (pg. 40).

Objective 7: Incorporate monitoring into restoration and management programs (pg. 42).

Objective 8: Support local watershed management efforts (pg. 43).

Objective 9: Coordinate public agency management of watershed lands and resources (pg. 45).

Objective 10: Promote watershed education for all Marin County residents and visitors (pg. 46).

Each objective is accompanied below by recommendations for practices and policies to implement it. Some recommendations help achieve more than one objective; these are explained fully where they best fit and are referred to briefly in other locations.

The recommendations are followed by a symbol or a group of symbols representing who has the authority or capacity to best execute them.

 Residents and businesses

 Marin County

 Community groups and watershed organizations

 State and federal government agencies

 City governments

 Academic institutions

Boxes below the recommendations contain additional information or provide more specific direction. Appendix B contains specifications, sources of additional information, and more extensive guidance for many of the recommendations. **Bold words** are defined in the Glossary.

Objective 1: Protect and where possible restore the natural structure and function of stream systems.

Streams are the most visible expression of the dynamic processes that create a watershed. They collect water and transport it through the watershed. They sort, store, and move sediment to create valleys, floodplains, wetlands, and beaches. They collect and move nutrients and water quality contaminants. During floods, they cause major disturbance—a vital component to maintaining variety in vegetation type and structure. Naturally functioning, stable stream systems promote the diversity and availability of habitats, which in turn provide the foundation for wildlife diversity, abundance, and resilience.

Stream systems consist of the water flowing through them, the stream channel and its floodplain, and the community of plants and animals living in and next to the water. The water in streams comes from rain and groundwater. Stream flow can change dramatically—from roaring torrents after a big winter storm to a trickle at the end of summer. All of these flows play a role in maintaining healthy streams. **Bankfull** flow, the amount of water from a storm that occurs approximately every 1.5 years, does most of the work of maintaining a stream's shape. High stream flows during the winter rainy season are important for moving stored sediment and reconnecting floodplain wetlands to the channel. Low flows, which are dependent on groundwater, keep the stream system alive in the summer and also allow aquatic wildlife from the tributaries to move throughout the system. The coho salmon is a good example of a species that needs all of these different flows during its lifecycle. Adult salmon wait at the mouth of streams for high enough flows so they can swim up to spawning areas. The **pools**, **riffles,** and **undercut banks** critical for the survival of the young fish are maintained through the bankfull flows. Cool summer pools and a sufficient depth of water are needed for the smolts to move from their spawning gravels out to the ocean in late summer.

Streams are frequently classified as **perennial, intermittent,** and **ephemeral**. Perennial streams flow all year. Intermittent streams flow during the wet season and dry up for at least part of the summer. Ephemeral streams have surface flow only immediately after winter storms and in some dry winters may not flow at all.

The stream channel, **floodplain**, terraces, and other features in the stream corridor are formed primarily through the erosion, transport, and deposition of sediment by stream flow. Although we usually think of erosion as a problem, it is an essential component of a naturally functioning stream system. Stream biodiversity is, in part, dependent on the input of sediment and its downstream transport.

The **riparian** plants that make up and surround the stream corridor play a crucial role in maintaining the ecological integrity of the entire system. They regulate water temperature, create physical habitat for birds and other wildlife, stabilize stream banks with their roots, recycle nutrients, and provide a valuable source of

energy for the biological communities. When riparian trees fall into the channel, they create excellent cover for small fish, perches for basking turtles, and habitat for many other creatures. By slowing and diverting stream flow, they also create complexity in the shape and composition of the streambed—pools, for example, that provide summer rearing habitat for young salmonid fish.

Example of successful stream restoration

Source: Prunuske Chatham photo

Successful stream restoration is based on an understanding of the relationships among physical, chemical, and biological processes at varying time scales. Land use practices have often altered one or more of these processes, resulting in systemic and often profound changes. Addressing these changes without considering how all of the parts of a stream system are interconnected can result in additional problems. For example, for many years, flood control districts and public works agencies routinely removed all fallen trees from stream channels. Although this practice kept the channel clear and open for flood conveyance, it removed a major building block of healthy aquatic habitat.

Many streams in Marin County are deeply incised. Early changes in land use following European settlement caused some channels to erode so deeply that the stream flow could not reach its floodplain except in very severe storm events. Without access to the floodplain to disperse and slow storm flow, the confined water cut down even further into the streambed. Restoring natural structure and function in these reaches is extremely challenging and may not be completely

possible without major reconstruction. However, significant benefits can be achieved through building benches and terraces at floodplain elevations, planning for sinuosity, and otherwise creating a channel geometry that allows sediment from upstream sources to pass through and does not generate additional sedimentation itself.

Marin County has established Stream Conservation Areas (SCAs) on all perennial and intermittent streams, as well as ephemeral streams that support riparian vegetation for at least 100 feet. The SCA width is 100 feet from the top of bank in the Inland and Coastal Recreation Corridors, 50 feet in the City Centered Corridor on smaller infill lots, and 100 feet in the City Centered Corridor where large tracts of land are proposed for development. Activities that could alter the hydraulic capacity or natural functions of stream channels are restricted in SCAs. These include construction of new roads except for crossings, construction of most new buildings, confinement of livestock, and use of motorized recreation vehicles. Livestock grazing, trails, repairs on existing structures, and habitat improvement projects are among the uses allowed in SCAs.

The following are changes that could be made to improve watersheds in Marin County, and the parties who can contribute:

Recommendations:

A. Prohibit any new development that would raise the 100-year water surface elevation or degrade riparian and aquatic habitat. Encourage flooding and restoration of wetlands. (See Objective 2, Recommendation E, pg. 26.)

B. Increase water infiltration. Groundwater supplies are recharged as more rainwater percolates into the soil instead of running off hard surfaces directly into the stream.

C. Implement an aggressive outreach campaign to let Marin County residents know that increasing infiltration depends on everyone, not just government agencies. Explain what they can do and how much difference their efforts can make.

D. Preserve the hydraulic capacity of all streams, including ephemeral channels. The hydraulic capacity is the amount of water a stream can move. Keep fill and structures out of stream channels. Make sure that instream habitat enhancement measures, such as logs or weirs, allow for flood flows.

E. Design repair or restoration projects to create stable channels with the sediment supply entering the reach approximately equal to the sediment leaving it.

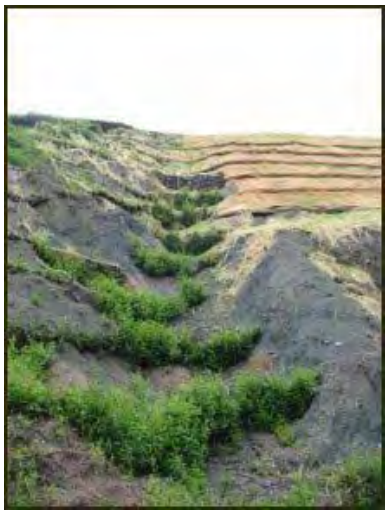
F. Increased infiltration efforts should focus on new development and opportunities in watersheds that currently have low percentage of impervious cover.

Water Infiltration Best Management Practices

- **Use pervious pavements whenever possible. Drain roof water into cisterns, dry wells, or infiltration trenches. (See Pervious Pavement in Appendix B.)**
- **Keep vegetated areas undisturbed whenever possible. Re-establish groundcovers and woody plants immediately after disturbance.**
- **Use grass-lined swales instead of hard-surfaced ditches. (See Grass-lined Swales in Appendix B.)**
- **Require stormwater management plans for new construction. (See Stormwater Management in Appendix B.)**
- **Protect groundwater sources from excessive withdrawals. (See Objective 5.)**
- **Practice water conservation and re-use.**

Before photo of biotechnical repair in Olema in Point Reyes National Seashore.

Close up of willow walls shortly after planting.



After photo of the entire project site.

Source: Prunuske Chatham photo

G. Protect and restore native riparian vegetation. (See Objective 2, Recommendation D., pg. 26.)

H. Manage streams to sustain large woody debris in the stream channel. (See Woody Debris in Appendix B).

Elements of Successful Stream Restoration

(See also Restoration in Appendix B)

- **Use reference reaches to see how a healthy part of the same stream or a similar, nearby stream looks and functions.**
- **Incorporate low flow and bankfull channels wherever possible.**
- **Anticipate change. Allow room for sinuosity. Where possible, attempt to re-create meanders.**
- **Design for self-sustainability.**
- **Use biotechnical bank stabilization techniques where possible. Incorporate materials that occur naturally nearby or in the reference reach. (See Erosion Control in Appendix B.)**
- **Involve upstream and downstream neighbors.**
- **Revegetate stream banks with native riparian plants.**

Woody debris obstructing the stream flow that should be repositioned.

Source: Reprinted with permission from "How You Can Help Improve Coho Salmon and Steelhead Habitat" by the Marin Municipal Water District, Corte Madera, CA.

Woody debris repositioned to create habitat while reducing streambank erosion and sedimentation problems.

Source: Reprinted with permission from "How You Can Help Improve Coho Salmon and Steelhead Habitat" by the Marin Municipal Water District, Corte Madera, CA.

Fallen Trees and Branches

- **Trees or large branches that have fallen into a stream channel should be left where they are unless they are causing an erosion or safety problem.**
- **Consult CDFG before removing or modifying logjams to restore fish passage. Most debris jams (dense piles of logs and branches that form across a stream channel) in Marin County do not restrict salmon and steelhead movement.**
- **Protecting and restoring indigenous riparian tree species creates a supply of large woody debris for the future as the trees age and fall. Because of their size and durability, redwood trees are especially important for coho salmon and steelhead habitat.**
- **Establish a "log bank" to store redwood root wads and logs that have been removed from public lands for use in instream habitat enhancement projects.**

I. Support watershed assessments of sources of accelerated erosion and sedimentation based on consideration of overall watershed sediment transport and hydrologic processes.

J. Implement recommendations developed through the assessments. Prioritize sediment reduction projects based on how well they address habitat restoration or conservation goals.

K. Conduct a study to reevaluate the standards used to define SCAs Consider available data on stream protection and management standards, their effectiveness at sustaining healthy stream function, and alternatives to the current standards used in Marin County. Include input from professionals such as a fluvial geomorphologist, hydrologist, and vegetation ecologist, together with resource agencies and interested public citizens.

Objective 2: Protect and where possible restore native plant and wildlife communities.

Marin County is exceptionally rich in habitat variety and special-status species. Seventy-seven plants and 52 animals are listed as rare, threatened, or endangered by the CNDDB (Appendix D). Some Marin County habitats, including many wetlands, have also been identified by CDFG as being rare or threatened (Figure 2).

Habitat Restoration Best Management Practices

- **Use revegetation and biotechnical techniques whenever possible to control and prevent erosion.**
- **Use erosion control Best Management Practices (BMPs). The Marin County Local Coastal Plan, RWQCB, NRCS, and the Marin County Stormwater Pollution Prevention Program have developed lists of BMPs appropriate to this area. (See Best Management Practices in Appendix B.)**

Wetlands are recognized as an especially important and vulnerable habitat type. In addition to supporting a vast range of aquatic and terrestrial wildlife species, including migrating waterfowl and many increasingly rare reptiles and amphibians, they store rainfall, which can reduce flooding and recharge groundwater. They also help purify water by cycling nutrients and other pollutants into plant tissues. Wetlands come in many shapes and sizes, from tiny freshwater seeps to extensive coastal salt marshes.

Coastal terrace prairie, central dune scrub, northern maritime chaparral, and serpentine bunchgrass are also identified by CNDDB as sensitive natural communities in Marin County. Oak woodlands, while not considered sensitive, deserve special consideration because of their high wildlife value and vulnerability to SOD (MCCDA, 2002a). All natural habitats contribute to the overall vigor and function of watersheds, sometimes in ways we don't fully understand. Managing landscapes to sustain healthy, diverse habitats is one of the most effective tools available for protecting wildlife.

Recommendations:

A. Conserve landscape-scale patterns of habitat mosaics. A typical west Marin County pattern, for example, consists of dense corridors of live oaks, bays, and associated trees and shrubs growing along a network of small tributaries with patches of grassland in between the corridors.

B. Work with watershed groups and state and federal agencies to identify key habitat areas in each watershed for special status species, including seasonal and daily movement corridors. Prioritize critical areas for protecting and restoring connectivity. Maintain maps of these areas through the County GIS.

Typical west Marin landscape

Source: Prunuske Chatham photo

Disturbance as Diversity

- **Disturbance is essential to maintaining diversity within the landscape. Grazing, fire management, and mowing are forms of disturbance and can be used to maintain habitat diversity. These tools are very site-specific and require careful planning, often under the guidance of a professional forester or Certified Rangeland Manager. Fire management should not be done without the support of the Marin County Fire Department or other appropriate fire protection agency.**
- **Try to re-establish native plant communities where they were located before significant disturbance degradation. For example, even though redwoods are found in a particular watershed, they may not have grown in the upper reaches of the small tributaries. Oaks and bay trees may be more appropriate to plant in such locations.**
- **Monitor mowing, grazing, and other disturbance to encourage natural regeneration.**

C. Protect these key areas from development that would reduce their habitat value. Consider using conservation easements to support willing private landowners who have extensive areas of critical habitat.

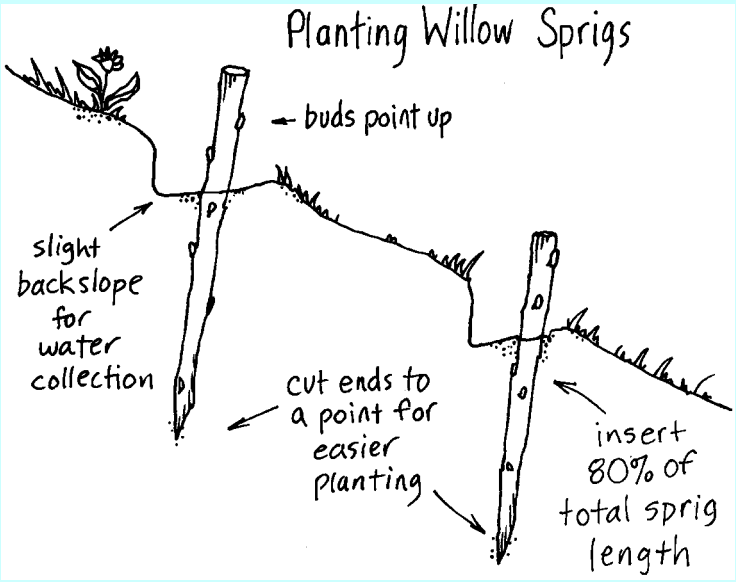
D. Identify limiting factors for target wildlife species. Design restoration efforts to address these limiting factors.

E. Protect and restore native riparian vegetation. (See Native Plants and Protecting the Riparian Corridor in Appendix B.)

Willows Planting Steps

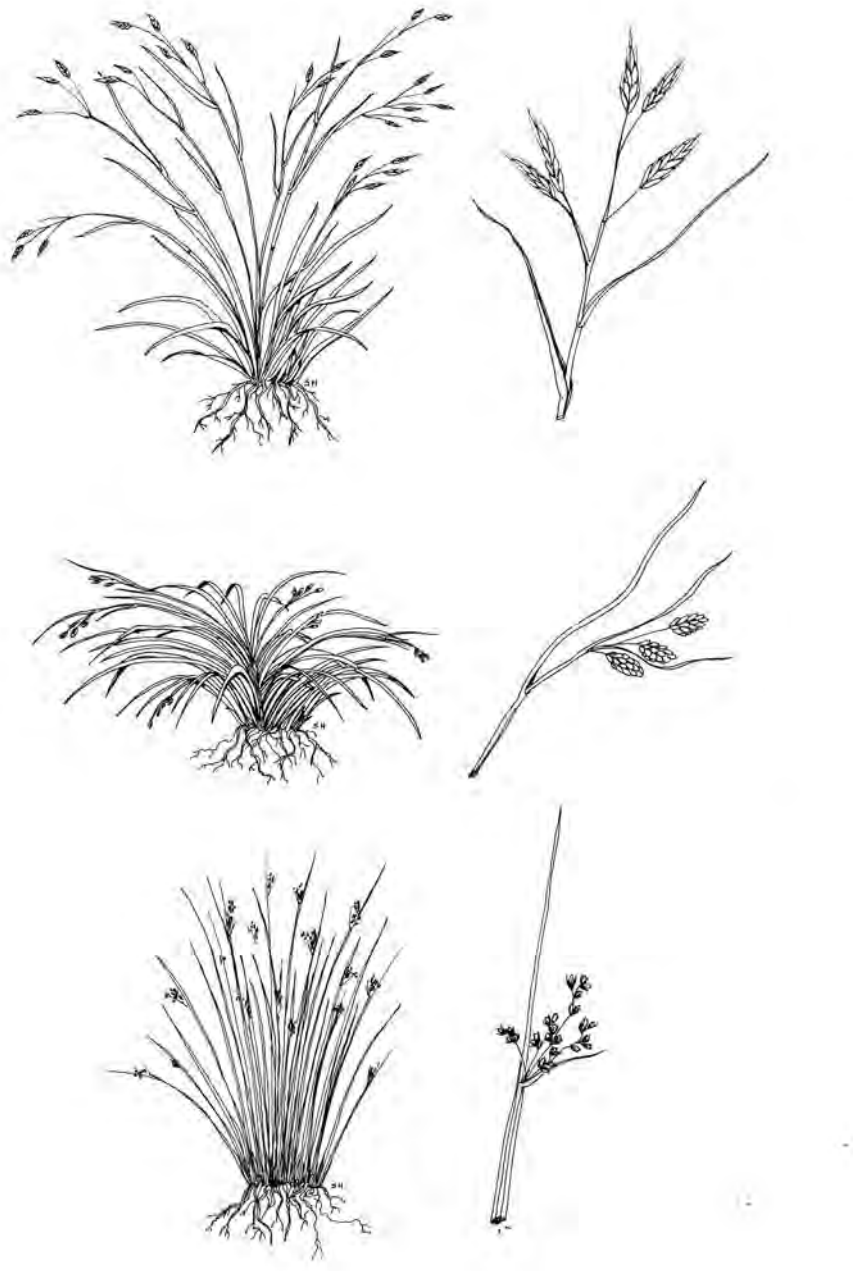
Willows can be planted from dormant cuttings or "sprigs" following these steps:

1. **Cut willows in the fall as soon as the leaves have dropped, and the ground is soft and wet. It is critical to plant willows as early as possible. This gives them a chance to develop good root systems before they sprout leaves in the spring. Planting too late is the most common cause of failure.**
2. **Willow cuttings should be at least 3/4 inch in diameter, and bigger is better. Large diameter branches can be used. Cuttings should be at least 14 inches long but can be longer.**



3. **Plant cuttings by pushing the cut end into soft soil, or make a hole with a sharp stick or pick. If you make a hole, be sure to compress soil tightly around the cuttings. They may need to be pounded in with a hammer. To give plenty of area for root growth, bury at least two-thirds of the length of the cutting. Angle sprigs slightly downstream to prevent them from being undermined by storm flows.**
4. **Plant willows low enough on the bank to ensure adequate soil moisture during the summer. Even if streams or gullies have year-round water, willows that are planted too high are likely to dry out and die. Cuttings should not need water if they are planted in an appropriate area.**

Native grasses, sedges, and rushes.



Grasses: *Poaceae.* Stem hollow, round or flattened, jointed; Leaf sheath open at the back.
Sedges: *Cyperaceae.* Stem solid, triangular or round, not jointed; Leaf sheath closed at back.
Rushes: *Juncaceae.* Stem solid, mostly round.

Source: Illustrations and text by Susan Holve, Prunuske Chatham, Inc.

F. Protect and where possible restore wetlands. (See Wetland Function in Appendix B.)

G. Seek to protect viable habitat before re-creating habitat through mitigation. Because of the complexity of building ecosystems where they are not naturally found, protection is a much more effective conservation tool.

H. Control populations of invasive exotic pest species such as starthistle, distaff thistle, gorse, and bullfrogs.

Best Management Practices

- **Identify and prioritize critical areas for controlling expansion of pest species.**
- **Develop a coordinated program between private citizens and public land managers to control and where possible reduce invasive pests.**
- **Discourage the sale of non-native, invasive plants from Marin County nurseries.**
- **Continue and strengthen outreach and education efforts to help people**

Wetlands Best Management Practices

- **Locate development to avoid wetlands.**
- **Maintain buffers around wetlands to protect water quality and adjacent upland habitats essential for many wetland wildlife species. Develop criteria for determining the effective size of the buffers.**
- **Design restored and created wetlands so that they are self-sustaining.**
- **Limit land uses to activities that provide or protect wetland habitat such as flood retention areas, carefully managed grazing, and passive recreation.**
- **Encourage the use of small wetlands to help clean agricultural runoff.**

I. Encourage the use of native plants for landscaping and erosion control.

J. Expand native habitats into urban areas.

K. Develop a comprehensive plan to control the spread of SOD. (See Sudden Oak Death in Appendix B.)

Native Plant Best Management Practices

- **Require indigenous native plants for all County-regulated soil stabilization and restoration projects except where non-invasive herbaceous seeding is needed for short-term erosion control.**
- **Use indigenous plants in all County landscaping projects.**
- **Support efforts to remove and replace invasive non-native species.**
- **Continue and strengthen education efforts.**

L. Encourage grazing methods that benefit native grasses and forbs and protect riparian vegetation. (See Grazing in Appendix B.)

Riparian pasture along Stemple Creek.

M. Develop and implement guidelines for pesticide use on both private and public lands. Consider eliminating the use of insecticides, herbicides, or toxic chemicals within sensitive habitats unless no other reasonable alternative exists to protect the habitat from significant threat.

N. Support the efforts of watershed groups, the Marin RCD, Students and Teachers Restoring a Watershed (STRAW), and others to restore natural habitat.

Objective 3: Protect and where possible restore habitat connectivity.

Connectivity is a measure of spatial continuity along a corridor or in a mosaic of habitat types. Habitat connectivity is important in the dispersal of native plant and animal species, and it is vital to providing the range size and variety that many animals need to complete their full life cycles. Because landscape-scale connectivity also allows animals to move locally in response to disturbances, it creates the foundation for maintaining stable, self-sustaining populations. Different wildlife species require different scales of connectivity. Interior forest species may need to be miles from the forest edge to find desired habitat, while an insect or amphibian may be sensitive to the edges and interiors of the microhabitat under a rotten log. Songbirds may forage for seeds in grassland and then retreat to the trees and shrubs of an adjoining riparian forest for nesting or protection from predators.

Corridors connect many small natural areas to make larger, more complex habitats with the potential for large wildlife populations and higher biodiversity. The critical failures in corridor systems can often occur at the reach scale where a single break in continuity, such as a barrier to anadromous fish passage, can have a domino effect on the entire corridor. Evaluating connectivity can provide some of the most valuable insight for designing restoration actions that mitigate disturbances and promote habitat function.

Recommendations:

A. Identify key habitat areas in each watershed for special status species, including seasonal and daily movement corridors. Prioritize critical areas for protecting and restoring connectivity (Objective 2, Recommendation B).

B. Coordinate efforts by public agencies and private landowners to protect and restore these areas. An example of such coordination would be to site new roads, trails, or other facilities on private or public land to avoid breaking connectivity with habitats on the neighboring property.

C. Identify and address localized impacts affecting the stream corridor, such as a major break in riparian cover resulting from new development, roadway construction or long-term grazing.

D. Protect and restore tributary streams to connect mainstem riparian corridors with upland habitat.

E. Implement the recommendations from the FishNet 4C Program (Harris, et al., 2001) and the Marin County stream assessment (Taylor, 2003) to remove barriers to anadromous fish passage.

Hedgerow

Source: Photo courtesy of CAFF

F. Promote restoration and conservation projects that provide contiguous habitat on adjacent parcels under different ownership.

G. Encourage private developers to maintain or restore areas that provide links to adjoining natural habitat.

H. Incorporate transition areas into habitat restoration projects where appropriate to gradually change from one vegetation type into another.

I. Plant hedgerows between agricultural fields to provide wildlife corridors and connect riparian to upland habitat. Hedgerows consist of a variety of densely planted shrubs and trees that serve

as both fences and habitat. They should be designed carefully to avoid using plants that are invasive themselves or could attract invasive wildlife species. (See Hedgerows in Appendix B.)

J. Encourage small-scale restoration projects that contribute to connectivity. Backyard clusters of native trees and shrubs, for example, can provide safe nesting habitat for songbirds that are then able to forage in larger urban ranges.

Objective 4: Maintain levels of water quality in streams and major waterbodies sufficient to provide adequate supplies of healthy drinking water and support natural resources.

Marin County's water is one of its most precious resources. Surface water provides almost all of the County's drinking supplies, as well as water for industrial and agricultural uses. The quality of this water is very closely tied to what is happening in the watershed lands that supply it.

Maintaining high water quality requires cooperation from everyone living and working in a watershed. Sources of upstream contamination can have profound effects on downstream users, including wildlife. Multiple sources can quickly lead to complex cumulative impacts. Water quality can be affected by many factors, some of which are widely recognized as pollutants, such as runoff from oily streets or mine tailings, and others that can be more subtle and harder to pinpoint. Loss of riparian vegetation, for example, can increase water temperatures beyond the range tolerable to salmon and steelhead. Common water quality concerns in Marin County include urban stormwater runoff with pesticides, PCBs, and other harmful compounds, sediment, nutrients, pathogens from animal manures and human waste (septic), and, in Walker Creek and Tomales Bay, mercury from historic mining operations.

Water quality goals can vary in different watersheds depending on the end use of the water. Such things as suspended sediment load and fecal coliform could be above human health standards but not impact the natural resources. Balancing human activities with meeting specific water quality targets requires comprehensive monitoring, as well as informed and committed watershed residents and managers.

Recommendations:

A. Work with the RWQCB to develop sensible and effective targets and attainment strategies for impaired waterbodies.

B. Restore the natural function of stream channels as described in Objective 1. Functioning streams absorb and recycle nutrients, regulate water temperature and bank erosion rates, and aerate the water with oxygen.

C. Support the Tomales Bay Watershed Council (TBAC) and other watershed groups in developing comprehensive water quality monitoring programs.

Water Quality Best Management Practices

- **Use the erosion control BMPs identified in the Marin County Local Coastal Plan for new development throughout Marin County.**
- **Use the management practices recommended by the Bay Area Council of Resource Conservation Districts and NRCS for controlling sediment and nutrient yield from horses.** (See Manure Management in Appendix B.)
- **Use the best management practices as described in FishNet 4C manual guidelines for "Protecting Aquatic Habitat and Salmon Fisheries for County Road Maintenance," January 2004.**
- **Construct new roads and driveways so as to minimize alterations to natural drainage patterns and watercourses. Avoid unstable slopes.**
- **Unsurfaced public and private roads and driveways should be maintained to minimize sediment loss and concentration of surface runoff. Culverts should be inspected regularly to ensure that they are functioning properly. Crossings that create barriers to fish passage should be removed or modified.** (See Roads in Appendix B.)
- **Implement the multi-agency MOU for road maintenance.**
- **Complete grading or any soil disturbance before the winter rainy season. Protect exposed soil with straw, erosion control netting, or other similar material.**
- **Establish adequate spoils storage sites throughout the County so that spoils from landslides and road maintenance can be stored safely away from streams.**
- **Require a Stormwater Pollution Prevention Plan (SWPPP) for County review for all new development. The plan should include measures tailored to the site to control temporary runoff and prevent erosion.** (See Stormwater Management in Appendix B.)
- **Follow the recommendations listed under Objective 1 for increasing infiltration, restoring stream channels, and protecting and restoring riparian vegetation.**

D. Reduce sediment yield from sources of accelerated erosion.

E. Reduce runoff from environmental toxins including pesticides, fertilizers, cleaning agents, swimming pool chemicals, road oil and household hazardous wastes.

Toxics Best Management Practices

- **Use non-toxic products for cleaning, weed abatement and other commercial and household activities.**
- **Do not drain swimming pools directly into streams or storm drains. Contact Marin County Stormwater Pollution Prevention Program (MCSTOPPP) at (415) 499-6528 or the website (http://www.mcstoppp.org/) for more information.**
- **Take all hazardous items (paint, solvent, pesticides, etc.) to a hazardous waste collection site.**
- **Wash vehicles and equipment in a grassy or gravel area where soapy water can filter into the soil.**

F.Maintain pathogen and nutrient levels at or below target levels set by RWQCB.

Pathogen and Nutrient Best Management Practices

- **Support the County's planning effort to improve Tomales Bay east shore septic systems.**
- **Evaluate the effectiveness of septic systems in other rural Marin County communities.**
- **Manage manure from both confined and range livestock to minimize nutrient and pathogen pollution. Provide training and support for agricultural operators to develop nutrient budgets so that plant uptake matches the nutrients supplied from spread manure or sprayed waste. Ensure that animal waste pond capacities are adequate. Separate rainwater from animal waste. (See Manure Management in Appendix B.)**
- **Protect streams and wetlands with buffer strips. Widths required vary depending on the slope, soil, and quantity of runoff. Herbaceous vegetation, such as grasses or sedges, is more effective at quickly using nutrients than trees, while trees keep the water cool. Incorporate both woody and herbaceous plants for stream buffers.**

G. Support the development of regional clearinghouses to coordinate and manage water quality monitoring data so that trend and cumulative impact analysis can be conducted.

H. Support the efforts of watershed groups, water districts, the Marin RCD, UC Cooperative Extension, and others to help private landowners improve water quality.

I. Pick a few target indicators for each major watershed and implement a campaign to keep the public informed as to how the

watershed is doing with regard to these targets. For example, water temperature at a few publicly accessible points could be used to index changes in the Walker Creek watershed. Monthly results could be published in the Point Reyes Light with comparison to average and target temperatures. Make sure that the programs are designed to show collective progress, not individual culpability. Anticipate that 5-10 years of data collection will be needed to assess the results.

Objective 5: Provide a sustainable water supply for Marin County residents.

Watersheds gather, filter, and store water as surface water in lakes, reservoirs and streams, and as groundwater in underground aquifers. Marin County's watersheds need to supply water for its human residents as well as for fish and wildlife. Two major water districts, MMWD and NMWD, provide water to most of Marin County's residents. Bolinas, Dillon Beach, Stinson Beach, Inverness ,and Muir Beach are served by small community water districts. Springs, farm ponds, and wells provide water for rural families and agricultural operations.

Most of the drinking and commercial water used in Marin County comes from surface water stored in reservoirs or diverted from streams. MMWD and NMWD also uses water from the Russian River under an agreement with the Sonoma County Water Agency. In addition, NMWD draws water from wells in the alluvial aquifer below the Lagunitas Valley for its west Marin customers.

Recommendations:

A. Work with water public utilities to match projected growth estimates with long-term water supply plans.

B. Maintain sufficient stream flow to support riparian vegetation and native aquatic wildlife including salmon and steelhead in streams with current or recent runs. Set target instream flow levels for all

Pond

Source: Prunuske Chatham photo

streams that support anadromous fish. Incorporate these target levels into the County review process and prohibit new projects that jeopardize instream flows.

C. Install stream gauging stations on major streams to measure and monitor stream flow.

D. Support agricultural water users in developing adequate water sources for livestock and irrigation that have minimal impacts on downstream flow. New impoundments should not decrease stream flows below the minimum necessary to maintain fish habitat, water quality, and riparian vegetation.

E. Increase the infiltration of stormwater. (See Objective 1, Recommendation B, pg. 20.)

F. Assess and map groundwater sources in Marin County.

G. Promote water recycling and conservation for both agricultural and domestic uses.

Objective 6: Support land uses that co-exist with natural watershed function.

Marin County is fortunate to have protected vast areas of open space through public land acquisition, supportive zoning, and agricultural conservation easements. Almost a third of Marin County's 333,000 acres are park and public

open space lands. Other lands are protected through easements with MALT and the Marin County Open Space District (MCOSD). Although this land is not pristine wilderness, it allows many watershed functions to continue with considerably less alteration than they do in urban areas. The large tracts of contiguous open space also present opportunities for landscape-scale restoration and enhancement.

Agriculture is the primary land use in the undeveloped areas of Marin County, including on many of the federal parklands. The vast majority of the County's agriculture is based on grazing, directly dependent on a steady supply of grass and forbs grown on the slopes of Marin County's watersheds. Tomales Bay's oyster growers are another sort of farmer, harvesting a crop that can accumulate watershed pollutants to such a degree that it is no longer commercially viable. Vegetable growers are tied to the vigor of the soil, the ability of the surrounding ecosystem to keep pest populations under control, and the availability of summer water.

This direct economic relationship to watershed function can breed a deep appreciation of the basic principle of interdependence. Having clean water and keeping soil from eroding become top priorities when one's livelihood depends on them. Marin County has been a pioneer in recognizing the critical role agriculture plays in maintaining open space as well as preserving a practical, working relationship to the landscape.

Tourism is another key element of the Marin County economy that is directly tied to the health and beauty of the natural environment. More than 2.5 million people visit Point Reyes National Seashore each year contributing to a $500-million-per-year tourist industry.

Recommendations:

A. Continue to support open space and agricultural land protection through the Williamson Act, MALT conservation easements and the Marin County Open Space District.

B. Maintain agricultural zoning as a primary tool for preserving the agricultural land base. Develop policies that encourage new, non-agricultural landowners to keep their land in agricultural production through leasing or agricultural diversification.

C. Support the efforts of the Marin RCD, MALT, UC Cooperative Extension, and others to protect and enhance natural resources on agricultural lands. Encourage programs that contribute to the community's capacity to sustain productivity and economic stability.

D. Implement a coordinated planning effort among Marin County's public land management agencies to assess the cumulative

impacts of visitor use on natural resources. Use this information to set and monitor appropriate levels of use.

Objective 7: Incorporate monitoring into restoration and management programs.

Monitoring is vital to understanding and continually improving the success of management and restoration actions. It helps maintain focus on overall goals and provides a structure to regularly evaluate and adapt programs. Monitoring should begin with the determination of baseline conditions and continue through the planning and implementation of the restoration plan. It should assess the performance of the restoration or management activities in achieving the initial program goals, and it should provide information that can be used to improve the existing measures and the design of future projects. Long-term monitoring can track changes in habitat conditions or specific populations of plants or animals. Chapter 4 explains different types of monitoring and presents guidelines for developing a watershed monitoring program.

Recommendations:

A. Support the TBWC in developing a comprehensive water quality program for Tomales Bay (Objective 4, Recommendation C). Support similar programs in other parts of Marin County.

B. Monitor the long-term effectiveness of restoration and enhancement projects. An example of long-term monitoring is annual monitoring for the first 5 years after implementation followed by monitoring every 5 years for the next 15 years.

C. Provide funding and/or technical support to assist watershed groups with effectiveness monitoring.

D. Support the development of regional clearinghouses to coordinate and manage water quality monitoring data (Objective 4, Recommendation G).

E. Continue the MCSTOPPP Aquatic Macroinvertebrate Sampling Program in urban Marin County streams. Expand into streams in the western part of the County. The program tests for the presence or absence of certain small animals, such as insects, that live in stream bottoms. Some species can only tolerate very clean water; others survive in varying levels of degraded water quality. Aquatic invertebrates can be a quick and accurate indicator of stream condition.

F. Develop consistent protocols for monitoring common parameters. Provide training for agencies, watershed groups, and interested individuals.

G. Monitor populations of key species, including steelhead trout, coho salmon, and California freshwater shrimp.

Objective 8. Support local watershed management efforts.

In Marin County's privately-owned lands, watershed health is dependent on the people who live and work on the land. Their participation in describing the future they want for their watershed and then taking responsibility for realizing that vision are absolutely fundamental to preserving and enhancing watershed resources. Marin County has many local watershed efforts, some well organized, others quite informal. Whatever the level of organization, building and

Keys to a Successful Watershed Group or Council

Watershed groups and councils play a key role in preserving and enhancing the watersheds of Marin County. Key aspects to the success of a watershed group or council include the following:

- **Funding - the most frequently identified key to success**
- **Hire a skilled facilitator and/or coordinator**
- **Keep the scope of activities limited or focused**
- **Foster interpersonal assets- successful partnerships are those that assess and build trust between members**
- **Cooperative and committed participants**
- **Trust**
- **Agency staff support and participation**
- **Consensus decision-making**

(Lewis, 2003)

The top lesson learned for successful watershed efforts and partnerships identified by EPA (1997) include:

1. **The best plans have clear visions, goals, and action items.**
2. **Good leaders are committed and empower others.**
3. **Having a coordinator at the watershed level is desirable.**
4. **Environmental, economic, and social values are compatible.**
5. **Plans only succeed if implemented.**
6. **Partnerships equal power.**
7. **Good tools are available.**
8. **Measure, communicate, and account for progress.**
9. **Education and involvement drive action.**
10. **Build on small successes.**

(EPA, 1997)

maintaining community participation requires a sustained effort over a long period of time.

Recommendations:

A. Encourage County departments to participate in community-based watershed management efforts. Without dominating such efforts, the County can provide much-needed support through technical advice, GIS, and other mapping services, meeting and outreach assistance, and coordinating on-the-ground County work, such as road maintenance, with other watershed activities. (See Watershed Groups in Appendix B.)

B. Expand the MCSTOPPP community stewardship funding program to provide additional support for small-scale restoration, enhancement, and monitoring projects.

C. Develop an additional County funding program to assist watershed groups with building and maintaining the organizational capacity to meet their watershed goals. This is the most difficult type of funding for watershed groups to obtain through foundation or government grants. Small amounts of funding for items such as office equipment, monitoring supplies, grant writing, professional meeting facilitation, and maintaining a skeleton staff between grant cycles can mean the difference between survival and giving up.

D. Continue semi-annual or quarterly forums to bring together watershed groups and agency personnel. Such forums allow groups to share information, as well as have easy access to regulators and agency specialists. They also give agency employees an opportunity to hear concerns and impart critical information through attending one meeting instead of many individual watershed meetings.

E. Provide opportunities for local schools, including area colleges and universities, to contribute to watershed planning, management, and monitoring.

F. Collect and preserve oral histories as a tool to document changes in stream conditions, wildlife ranges, plant communities, and other natural features.

G. Acknowledge when communities have done a good job protecting watershed resources through awards, as well as articles and features on MCSTOPPP and other websites.

Objective 9. Coordinate public agency management of watershed lands and resources.

Approximately half of Marin County is in public ownership or management. The National Park Service (NPS), California Department of Parks and Recreation (DPR), MMWD, and the MCOSD are the major public landowners. Other County agencies, such as the Community Development Agency, Public Works Department, the Agricultural Commissioner's Office, and the Marin County Fire Department, play critical roles in watershed planning and management. Still others, such as the Marin RCD and UC Cooperative Extension, work with private landowners to facilitate watershed management and restoration efforts. Coordination among these different agencies allows for planning and management to occur on a landscape scale. Sharing resources and expertise can also save money and give agencies access to a more comprehensive perspective.

Public agencies also play an important role in regulating development and other activities that alter the landscape or impact environmental quality. Acquiring the permits needed to undertake some types of watershed restoration activities can be a daunting task. Work in the stream channel can require authorization from Marin County, RWQCB, CDFG, and ACOE. If special status species are involved, NOAA Marine Fisheries and USFWS need to be consulted. The California Coastal Commission regulates construction and activities that change the type or intensity of land use within the Coastal Zone, while the San Francisco Bay Conservation and Development Commission (BCDC) has jurisdiction over projects that impact San Francisco Bay. CEQA requires that all projects be reviewed for their impacts on natural and cultural resources, including an assessment of cumulative impacts. Appendix C contains a summary of environmental regulations and compliance requirements. Programs such as the Bay Area Joint Aquatic Resources Permit Application (JARPA) that simplify the environmental compliance process are another avenue for agencies to work cooperatively to support watershed restoration.

Recommendations:

A. Develop coordinated management plans for adjoining public lands.

B. Develop forums for resource managers to meet and share information, or where they already exist, continue to support them. TBWC, the Bolinas Lagoon planning effort, and the North Bay Watershed Council are examples of such forums.

C. Acknowledge departments or individuals at all levels that are contributing to healthy watersheds. Consider an annual watershed award given by the Board of Supervisors that recognizes extraordinary effort while at the same time highlights the diversity of skills needed for effective watershed management.

D. Continue to provide staffing and technical support to FishNet 4C to help Marin County agencies better protect salmonid populations.

E. Institute Sustainable Conservation's one-step permit process in Marin County. Monitor program effectiveness annually. The program is intended to cover common practices used for watershed management and enhancement. It includes federal, state, and local agencies, and it will be administered through the NRCS office in Petaluma.

F. Support the proposed Marin County Agricultural Ombudsman program to help agricultural producers navigate through the permitting process.

Objective 10. Promote watershed education for all Marin County residents and visitors.

Education is the most basic and powerful tool for changing the way people care for their watersheds. In his chronicle of saving the salmon runs on the Mattole River in northern California, Freeman House writes, "There is no separate life." Once we understand our interdependency with the world around us, it is hard to pour that motor oil down the storm drain.

Because watersheds are so complex, learning about them is a continual process. Watershed education needs to address all levels of learning, from school children discovering the water cycle to experienced scientists learning from each other's research. A vast range of skills is needed for effective watershed management—the practical know-how to build a willow wall or manage a herd of cattle, organizational talent, up-to-date scientific understanding, political shrewdness, vision, and the ability to communicate well. Education is the key to sharing and honing these skills.

Recommendations:

A. Use schools as community watershed centers. Support the efforts of TBI's STRAW Project, MCSTOPPP, and others to provide hands-on watershed restoration opportunities for students and community members.

B. Develop a toolbox of watershed information materials from one-page handouts to posters to small booklets similar to the "Backyard Pests" and others distributed by MCSTOPPP. Distribute them in libraries, schools, County offices, and at community events.

C. Post watershed signs at major watershed divides, similar to the signs than now mark some creeks.

D. Develop a watershed stewardship certification program for contractors and agency maintenance staff.

E. Support MCSTOPPP in keeping their website up-to-date and well supplied with watershed-related information. Provide easy links from other County sites.

F. Consider starting an annual Marin Watershed Fair. Include tours, actual restoration or monitoring projects, how-to workshops, presentations from Marin watershed groups, art work, etc.

G. Support the biennial State of Tomales Bay Conference and similar events that bring together scientists and watershed residents.

H. Provide technical trainings on assessment, monitoring, and restoration techniques.

Chapter 4. Monitoring Guidelines

Introduction

The protection and restoration of environmental resources is a continuous process. One key component of this process is the ability to check progress against benchmarks to see if the restoration activities are on the right path toward achieving the established goals. Often, protection and restoration projects do not have immediate, observable results. A good monitoring program can pick up subtle changes and provide feedback to ensure programs truly are effective. The process of using feedback from monitoring to make corrective actions is often called "adaptive management." Monitoring, evaluation, and adaptive management are critical to effective restoration.

Monitoring can be used to:

- Develop a long-term data set on the status of a watershed to serve as a comparative baseline to judge changes and improvement in the system.
- Determine if a watershed is impacted by human activities.
- Provide information on the effectiveness of management decisions.
- Evaluate the progress and success of restoration projects.

A good monitoring program should include both pre- and post-restoration monitoring, as well as monitoring during the implementation of restoration projects and/or of changes in watershed management practices. Monitoring may also be used to determine the status of a watershed feature such as a stream based on physical, chemical, and biological standards. All of these monitoring components contribute to determining the success of the restoration design and/or the continued success in meeting water quality objectives. Monitoring provides needed information, documents chronological and other aspects of restoration succession, and provides lessons learned to be used in similar future efforts (Landin, 1995).

Community involvement and education should be components of all monitoring programs in order to build a foundation of understanding to generate the political and economic support needed to make changes. The realization that a problem or opportunity exist in a watershed may galvanize schools, community groups and individuals to begin volunteer monitoring as the first step in a bigger restoration effort. Federal, state, or local agencies may be mandated to undertake restoration efforts as a result of a legislative action or an internal agency directive. Groups with special cultural or economic interest (e.g., sport fishermen, native tribes) may also initiate a restoration effort. Still others might undertake stream corridor restoration as part of a broad-based, cooperative initiative that draws from various funding sources and addresses a diversity of interests and objectives. In all of these cases, the importance of a well-designed monitoring

plan to assess the baseline conditions, follow the progress, and evaluate the success of the restoration project is paramount. Without monitoring, there is no scientifically sound way to judge the success of any management protocol that has been applied to a watershed issue.

While much of the emphasis in this section is on restoration efforts, the basic monitoring principles apply to all types of monitoring. Unfortunately, monitoring of undisturbed systems is rarely done, with the result that knowledge of seasonal fluctuations in natural watershed ecosystems is very limited.

Questions to Be Addressed

Monitoring programs need to address the management questions that are being asked or will be posed in the future. The key is to develop and refine these questions and to make sure the monitoring stays on track to answer them with the most cost-effective and credible means possible. Some basic questions that a watershed monitoring program needs to address, along with the appropriate type of monitoring, include:

- Is progress being made toward achieving the goal of protecting the watershed and stream systems? (*Trend monitoring*)
- Are water quality and habitat being protected? Is progress being made to support natural systems? (*Trend monitoring, such as of anadromous fish production*)
- What are historic conditions (e.g., historic salmon numbers)?
- What factors in each watershed limit stream habitat and thus require protection of beneficial uses? (*Trend monitoring*)
- Are the projects or programs designed to improve watershed habitats and water quality being implemented as proposed? (*Implementation monitoring*)
- What are the conditions in the watershed, or related to a particular feature such as water quality *before* a program or policy is instituted? (*Implementation monitoring*)
- Are the mitigation measures, projects, or programs implemented to improve watershed habitat values and water quality effective? (*Effectiveness monitoring*)
- Are mitigation measures installed as required? (*Compliance monitoring*)
- Are specific mandated water quality criteria achieved in the watersheds of concern? (*Compliance monitoring*)

Although the emphasis in this chapter is on monitoring watershed restoration and management efforts, it is important to remember that watersheds are also influenced by factors beyond those that can be affected by such initiatives. Salmonid populations, for example, can be greatly affected by ocean temperatures or severe storms that wash away their eggs from the stream gravels.

Types of Monitoring

Trend monitoring is the monitoring of long-term changes in key indicators or conditions. It includes changes in animal or plant population sizes over time or long-term changes in key factors that directly indicate progress toward meeting management goals. It can be used to evaluate changes over time and to provide information for future policy decisions. It can also include evaluations at key points in the watershed where the effect of changes in the watershed can most feasibly and reliably be understood. It should be as quantitative as possible to give statistically supportable answers to management questions. Monitoring changes in fish populations or aquatic insects over time are examples of trend monitoring.

Trend monitoring also includes keeping track of the changes in those factors that are most likely associated with changes in key indicators. Management includes answering "why" things have changed, not only "when" they have changed (McDonald, et al., 1991). Knowing why things have changed allows the adaptive management process to work.

Baseline monitoring/assessment involves measuring progress toward meeting management goals, which is not possible without knowing, or "bench marking," where you started. The baseline assessment needs to be focused on factors that, if tracked, can show long-term trends. Watershed assessments also provide a description of habitat types in the stream system, sources of sediments and other pollutants, and a general understanding of the watershed system. The establishment of baseline or "reference" conditions can be difficult in watersheds that are already heavily impacted by humans. Depending upon the questions or goals of the monitoring program, a true reference location may have to be outside the immediate watershed under study. However, if at all possible, it is much better to have reference locations within the watershed being monitored.

Implementation monitoring is intended to determine whether and to what degree an activity or project was carried out as planned or required. Implementation monitoring is usually done only once for specific project activities; however, for longer-term projects, it is needed to check the progress over the course of several years. This type of monitoring is typically carried out as an administrative review and does not involve any field sampling or analysis. It verifies if the procedures have been completed as intended. It can be cost-effective because the results give managers direct feedback as to the status of the activities. However, the results from this type of monitoring cannot directly link management activities to changes in field conditions.

Effectiveness monitoring is intended to determine whether and to what degree any specified practice has achieved its immediate objectives. Evaluating individual practices may require detailed and specialized measurements that are best made at the site of, or immediately adjacent to, the management practice. Monitoring

individual practices is quite different from monitoring to determine whether the cumulative effect of all the practices used in a project results in adequate water quality or beneficial use protection. Sometimes called "project monitoring," effectiveness monitoring is usually done in the stream channel or on instream uses.

In the final analysis, the effectiveness of the action in protecting instream values is the true test of whether the action has been effective. To eliminate changes due to other factors, this kind of monitoring typically requires use of a reference stream reach where the hydrologic and biologic conditions are similar to the reach in which the practice is being applied. Often the reference reach will be upstream from the test area.

Validation monitoring is another aspect of effectiveness monitoring that is intended to determine if predicted effects, as specified by conceptual models or a hypothesis, correspond to what actually happened when the practice was carried out.

Compliance monitoring is used to determine if a mitigation measure is being used or to determine whether and to what degree specific water quality objectives or standards are being met. Often, the regulations associated with an individual standard or mitigation will specify the location, frequency, and method of measurement. Permits obtained from federal, state, or local agencies to undertake construction or related development activities often require compliance monitoring.

The Monitoring Plan

The monitoring plan should be developed in conjunction with an overall watershed management plan. Monitoring begins with the determination of baseline conditions and continues throughout the development and implementation of the watershed management plan. In addition to providing a basis for assessing watershed conditions, baseline monitoring enables planners to identify goals and objectives, as well as to eventually measure success of implementation projects.

In the case of restoration, the overall goals of a monitoring plan should be to:

- Determine the initial condition of the watershed elements that will be changed or improved through implementation of the watershed management plan.
- Assess the performance of the restoration initiative relative to project goals.
- Provide information that can be used to improve the performance of the restoration actions.
- Provide information about the overall effectiveness of the restoration initiative.

The National Research Council (NRC) recommended the following components to ensure a sound monitoring plan (NRC, 1992).

1. Clear, meaningful monitoring plan goals and objectives that provide the basis for scientific investigation.
2. Appropriate allocation of resources for data collection, management, synthesis, interpretation, and analysis.
3. Quality assurance procedures and peer review.
4. Supportive research beyond the primary objectives of the plan.
5. Flexibility that allows for modifications where changes in conditions or new information suggest the need.
6. Useful and accessible monitoring information available to all interested parties.

A sound monitoring plan includes three major segments—planning, implementing and managing, and responding to the monitoring results. The planning segment can be further broken into the seven following steps:

Step 1. Define the Restoration Vision, Goals, and Objectives

The goals set for the restoration drive the monitoring design. These goals should be:

- As simple and unambiguous as possible.
- Directly related to the vision for the restoration.
- Able to be measured or assessed through the monitoring program.

Step 2. Develop the Conceptual Model

A conceptual model is a useful tool for developing linkages between planned goals and the monitoring parameters that can be used to assess their performance. Monitoring parameters are measurable factors, such as levels of dissolved oxygen or number of fish. A conceptual model can be informal, and it should be a work-in-progress. It forces the team planning the restoration to identify direct and indirect connections among the physical, chemical, and biological components of the ecosystem from the beginning of the project through its completion. The modeling process helps ensure that progress toward goals can be measured, and it identifies where one type of monitoring can serve more than one purpose. Figure 6 shows an example of a conceptual model.

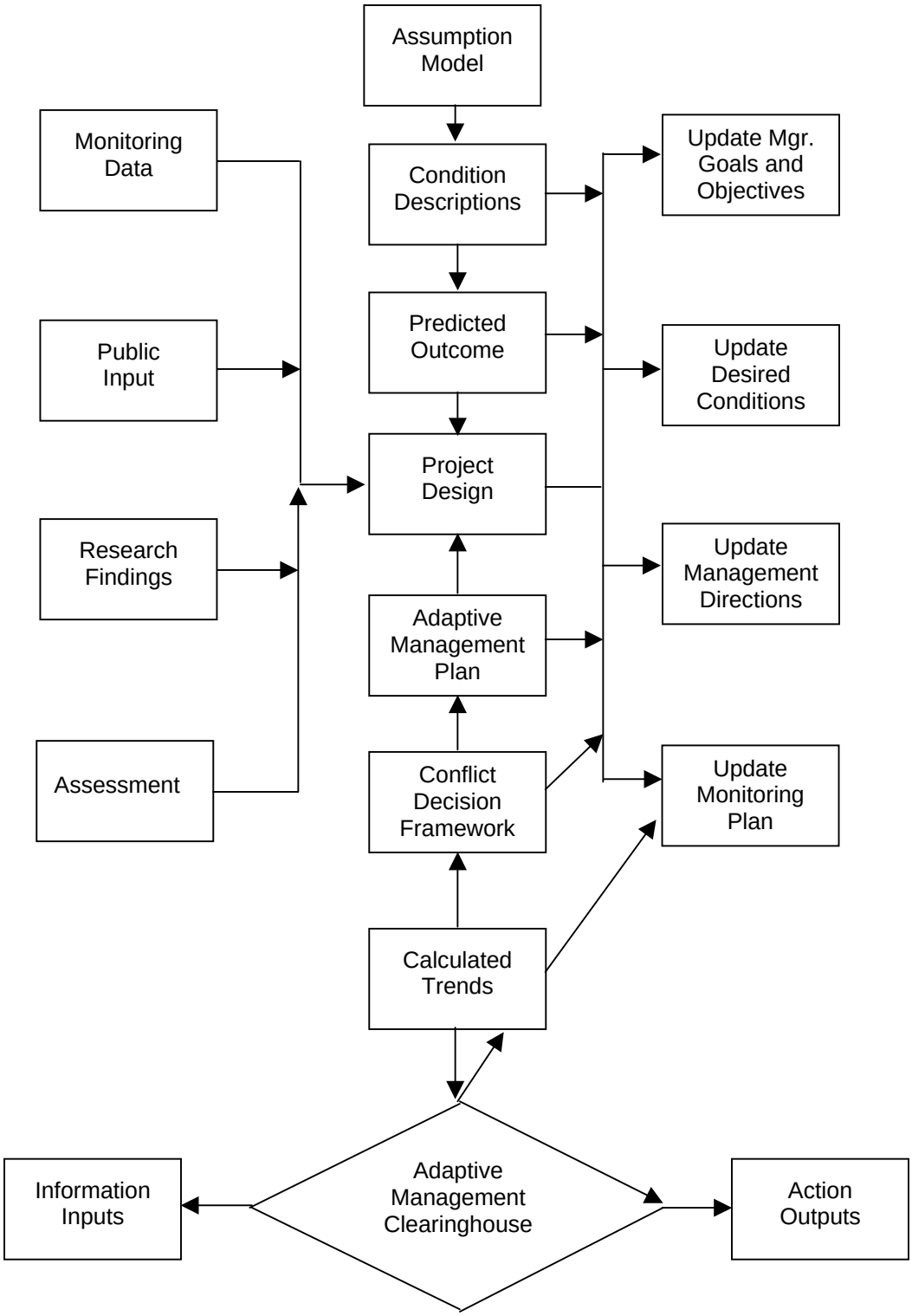


Figure 6. Example of a Conceptual Model

Step 3. Choose Performance Criteria

Performance criteria are standards by which to evaluate measurable or otherwise observable aspects of the restored system and thereby indicate the progress of the system toward meeting the planned goals. For example, the Tomales Bay Watershed Stewardship Plan has a goal to "ensure water quality in Tomales Bay and its tributaries sufficient to support natural resources and beneficial uses." (TBWC, 2003). Performance criteria for this goal might include a specified reduction in harmful bacteria and nutrients from certain tributary streams, or a reduction in the number of days that the shellfish industry needs to close due to high pathogen levels. Performance criteria also enable the stakeholders and general public to see results, especially in long-term restoration efforts.

Performance criteria should:

- Directly reflect progress toward achieving the restoration goals.
- Relate to the actual measured parameters.
- Have upper and lower limits or bounds. For example, 5 coho salmon returning to spawn in a certain tributary might be the lower limit of a successful restoration effort while 10 would mark a resounding triumph.

A reference site or sites should be monitored along with the restored areas to assess whether the changes observed are a result of the restoration activities or if external factors have also contributed to the changes.

Step 4. Choose Monitoring Parameters and Methods

First, based on the conceptual model, identify the parameters to monitor. Include physical, hydrological, and ecological measures (NRC, 1992). Numerous monitoring programs and techniques have been developed for particular types of resources, different regions, and specific management questions. The references at the end of this chapter identify sources for monitoring techniques.

Methods selected should meet the following criteria:

- Efficiently provide accurate data.
- Provide reasonable and replicable data.
- Be feasible within time and cost constraints.
- Be appropriate to the geographic region and to the system being monitored.

Because stream corridors are the final expression of many of the natural functions occurring within a watershed, most watershed monitoring programs should include assessment of the stream corridor. For example, if a watershed goal is to increase permeability or decrease pesticide use, measuring stream flow or specific pesticide levels in the water would be an efficient and accurate way to see if the implementation efforts are working.

Step 5. Estimate Costs

Environmental monitoring can be expensive. A monitoring program needs to be directed at answering specific questions to keep the program focused and the costs reasonable. Various project components must be considered when developing a cost estimate, which include:

1. Monitoring plan—the inclusion of a monitoring program is often overlooked when watershed management plans are developed.
2. Quality assurance—the inclusion of this very important aspect of any data collection activity is essential. For the monitoring program to be considered reliable and scientifically sound, a Quality Assurance and Quality Control (QA/QC) program must be in place. The Quality Assurance and Quality Control section below describes such programs in greater detail.
3. Data management— the real costs of the data management aspect of monitoring is often underestimated. Tasks to consider budgeting for include sample tracing, data entry, data storage, and report generation.
4. Field sampling plan—the cost of equipment, cameras, supplies, and personnel to carry out the monitoring plan must be realistically estimated.
5. Laboratory sample analysis—this cost factor can become expensive depending upon the monitoring plan and the issues surrounding the need to monitor.
6. Data analysis and interpretation—costs must be figured in to conduct the proper analysis of the data collected from the monitoring program.
7. Report preparation—it is very important to make the results of the monitoring available of managers, field personnel, regulatory agencies, and the general public. Thus, these costs must be factored into the project.
8. Presentation of results—attending technical and public meetings and producing presentation materials and handouts are also important to presenting the results of the monitoring program.

Step 6. Determine How Data Will Be Used

Monitoring data has different uses. It can help in the planning stages by providing baseline information. It can assess if the implementation is being carried out as planned, and it can evaluate the performance of completed projects or be used in other studies as needed. Making sure that each type of data being collected has a use and that it is collected with the correct procedures for that use can save a tremendous amount of time and money.

Step 7. Determine the Level of Effort and Duration of the Study

How much monitoring is required? The answer to this question is dependent on the goals and performance criteria for the restoration, as well as on the type of

ecological system being restored. A monitoring plan does not need to be complex and expensive to be effective. Items to consider include:

- Timing—the monitoring plan should be designed prior to conducting any baseline studies. A challenge with this approach is that the time of year is important to consider for many types of monitoring (e.g., stream flow or rare plants) and most likely will dictate when the baseline monitoring can begin.
- Frequency—this is often determined by how rapidly the systems change over time. As a system becomes more stable, it is generally less vulnerable to disturbances and can be sampled less frequently.
- Duration—the monitoring plan should extend long enough to provide reasonable assurances either that the system has met its performance criteria or that it will not meet the required level of success. Thus, the monitoring should be continued until sufficient data has been collected to evaluate the success of the restoration project. For adaptive management, monitoring needs to continue throughout the duration of the restoration program in order to make the adjustments to the implementation activities needed to achieve the program goals.
- Statistical framework—the monitoring plan needs to include consideration of statistical issues, including the location of sample collection, the number of replicate samples to collect, the sample size, and other considerations.
- Sampling level—the appropriate level of sampling or the number of replicates under any particular field or laboratory sampling effort depends on the information required and the level of accuracy needed.

Using Indicators in Monitoring Programs

Monitoring indicators can provide an efficient way to assess progress toward achieving restoration goals. Indicators in a watershed are often a species or group of plants or animals that respond quickly to changes in the environment. Physical parameters, such as water temperature or stream flow, can also be used as indicators. In western Marin County, the Point Reyes Bird Observatory has been monitoring neotropical songbird populations (birds that breed here and winter in Central and South America) as a measure of overall riparian corridor recovery. Monitoring of aquatic invertebrate communities or algae is often used to assess water quality and stream conditions.

Indicators should give a snapshot of the existing conditions at a particular time. Priority should be given to indicators that are important and understandable to the public, such as the number of salmon that spawn each winter. To accurately monitor success, indicators must respond directly to changes in watershed conditions brought about by the restoration or management activities. Social, economic, land use, and health indicators should also be considered in monitoring programs.

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) are crucial for ensuring the accuracy and reliability of monitoring results and confidence in the information, especially for quantitative monitoring or monitoring done by diverse groups. The QA component usually includes detailed objectives, reference materials, a training program, minimum personnel qualifications, and project protocols. The QC component is comprised of procedures to detect and correct errors and omissions. Most public agencies that fund monitoring programs require QA/QC programs. Many will help volunteer groups to develop a program that fits their needs and budget.

Volunteer monitoring can be a very important source of data gathering. Local watershed groups and educational programs can use volunteer help in many aspects of watershed monitoring. However, a sound QA/QC program must be in place with volunteers along with timely training programs to assure that the data collected is usable and reliable.

Documenting and Reporting

The monitoring report should include a systematic review of changes in resource management priorities and watershed conditions along with a discussion of the possible implications for restoration measures and objectives. The report should be wide-ranging, including observations and concerns that might not require immediate attention but that should be documented to ensure continuity in case of turnover in personnel. The monitoring report should alert project managers to proposed developments or regulation changes that could affect the restoration effort so that feedback can be provided and stream corridor concerns can be considered during planning for the proposed development.

Three simple concepts make up the best documented reports:

- A single file that was the repository of all restoration information.
- The events and tasks of the restoration were recorded chronologically in a systematic manner.
- Well-written documents were produced and distributed widely enough to become part of the general local or regional awareness of the restoration.

Main sections in a general format for a monitoring report should include title page, summary or abstract, introduction, site description, methods, results, discussion, conclusions, recommendations, acknowledgments, and literature cited.

Implementing and Managing the Monitoring Plan

Management of the monitoring plan is perhaps the least appreciated yet one of the most important components of the restoration effort. Because monitoring

continues well after implementation activities, there is a natural tendency for the plan to lose momentum, for the data to accumulate with little analysis, and for inadequate documentation and dissemination of the information to occur. The following steps can be taken to prevent or minimize these problems:

- Envisioning the plan—the manager must understand the entire monitoring plan, how long it will last, and how it fits into the overall objectives and goals of the restoration project.
- Determining roles—the responsibility of the manager or person selected to head up the monitoring program must be established at the start of the project.
- Ensuring quality—the manager must buy into the quality assurance and quality control (QA/QC) program and uphold the scientifically defensible data required.
- Interpreting results—results must be interpreted with objectivity, completeness, and relevance to the restoration objectives.
- Managing data—data should be stored, reviewed, and maintained in a systematic and logical manner that facilitates analysis and presentation.

For more information on monitoring, check these sources:

Measuring the Health of California Streams and Rivers by Jim Harrington and Monique Born. 2000. Sustainable Land Stewardship Institute. This manual offers background and references for using the California Stream Bioassessment Procedures. In-depth and exhaustive in its information, this manual includes keys for identifying freshwater invertebrates. The manual is available for purchase from the Sustainable Land Stewardship Institute, www.slsii.org.

Volunteer Estuary Monitoring: A Methods Manual: EPA 842-B-93-004 and *Volunteer Stream Monitoring: A Methods Manual: EPA 841-B-97-003*. These easy-to-use manuals includes the why and how of monitoring for the volunteer in streams and estuaries. Containing lots of useful information, The manual is available free from the EPA website, http://www.epa.gov/owow/.

The Volunteer Monitor's Guide to Quality Assurance Project Plans: EPA 841-B-96-003. This manual outlines the procedures used in monitoring to assure the quality of the data collected. This guide offers easy-to-follow advice for developing a plan. Available through the EPA website, http://www.epa.gov/owow/.

Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: EPA 841-B-99-02. The complete guide to the EPA's standard for periphyton, benthic macroinvertebrates, and fish bioassessment. Complete and informative for anyone interested in biological monitoring in-stream. Available through the EPA website, http://www.epa.gov/owow/.

Creating a Watershed Atlas & Monitoring Program Watershed Stewardship Workbook. In depth and clearly written, this manual is a step-by-step how-to for creating a watershed atlas and monitoring program. Available through the Sotoyome Resource Conservation District website: http://www.sonomamarinrcds.org/district-ssr/

Marin County Stormwater Pollution Prevention Program. A gold mine of locally appropriate information. (415) 485-3363. http://www.mcstoppp.org/

Chapter 5. Framework for Subsequent Plans for Individual Watersheds

Introduction

The watershed planning process defines the goals of a community or group of stakeholders and articulates a plan to achieve them. Although concern about a particular stream or watershed is often galvanized by an urgent problem or threat, watershed plans place these pressing issues in the larger context of their impact on the overall watershed condition. They draw the planmakers into grappling with choosing priorities and developing realistic implementation strategies. The process inherently involves discovery as new information is uncovered through the assessments and as participants bring their particular concerns and desires to the table. At its best, a watershed plan is the tool through which a group of neighbors, schools or resource managers forges a common purpose and achieves substantive, coordinated progress towards protecting or restoring their watershed.

A handful of Marin County watersheds have overall plans completed or underway, but many watersheds lack plans. This chapter focuses on basic elements to include in plans for the restoration and management of individual watersheds.

Each watershed is unique, and each group of planners has its own needs and constraints. Funding levels, the extent of volunteer participation, the amount of available information, the size of the watershed, and whether it is primarily in public or private ownership are among the factors that contribute to a wide variety of final documents. The following elements are basic building blocks that can be expanded or simplified to fit most watershed planning processes.

Plan Elements

The Watershed Group

Taking time to build a solid, well-functioning watershed group is vital to a plan's long-term success. Community watershed planning is rarely an easy process, but it is well worth the time and effort. Tackling divergent views early on will gain a wider acceptance for the plan and make implementation proceed more smoothly. A good group needs to represent the people who live in and use the watershed. In the case of publicly-owned lands, it needs to include all the agencies or departments that are involved in managing the area. Skills that will help build a strong group include technical expertise, political savvy, and management and organizational capacity. People with a deep local knowledge of the area, such as long-term residents, are invaluable resources. Artists, writers, teachers, students, business people, and especially good cooks can all contribute vitality and momentum to watershed groups. The EPA Office of Wetlands, Oceans, and Watersheds (OWOW) website (EPA, 2000) and the California State Coastal

Conservancy Watershed Planning Guide (CSCC, 2002) provide excellent tips for developing and managing watershed groups. Local processes used for the Tomales Bay, Redwood Creek, and Stemple Creek watersheds also provide valuable models. The following are the elements of a community watershed plan:

The Community Watershed Plan

Executive Summary

The executive summary is a short recapitulation of the purpose, major goals, findings, and recommendations contained in the plan. A standard feature in most scientific reports, it is also a very useful document for outreach and public relations purposes.

Introduction

The introduction explains the purpose of the plan, the methods used to produce it, its consistency with the Marin County Watershed Guiding Principles, including the formation of the watershed group and the meeting process.

Community Priorities

This section articulates the ultimate target for all the assessment, implementation, and monitoring work that will follow. Some plans present this as a vision statement, others as goals, guiding principles, or a list of desired watershed conditions. It may be the single most important piece of a community watershed plan. If the future the planning participants envision for their watershed is exciting enough to them, they will start making it happen almost immediately. The vision of any one watershed should be consistent with the Marin County Watershed Guiding Principles (page 2).

Watershed Description

The watershed description presents basic information about the watershed—its size, historic and current land use, major features such as reservoirs or notable habitat types, and a summary of prior planning or restoration activities. It should also include a description of the overall watershed condition based on a synthesis of information gathered through the assessment process.

Assessments

Watershed assessment is the process of gathering existing information and identifying gaps where additional studies or inventories are needed. The watershed group's concerns and priorities guide the choice of which watershed features to assess. For example, if restoring coho and steelhead populations is a priority, then assessment might include instream habitat condition, sediment sources, riparian condition, and water supply.

Mapping can be a very useful tool to see the relationship between different sets of information. Marin County maintains GIS information on many watershed features including habitat types, stream locations, topography, special status species, geology, and zoning that can be displayed on watershed maps. Computer modeling is another tool that may be available to some watershed groups to help synthesize information and develop restoration objectives.

Oregon and Washington have developed watershed assessment manuals with many procedures applicable to Northern California (Watersheds Professionals Network, 1999; Washington Forest Practices Board, 1997). A cooperative project between state agency and university staff is underway to complete a California Watershed Assessment Manual that will offer a range of assessment methods for both scientists and community volunteers. The North Coast Watershed Assessment Program, a multi-agency effort, has completed assessments for several watersheds that demonstrate a comprehensive, scientific approach (NCWAP, 2003).

Restoration and Management Objectives

Restoration objectives are derived from the synthesis of the information gathered through the assessment. They are measurable targets for achieving the vision or broad goals described in Chapter 3.

Action Plan

The action plan is the map for accomplishing the restoration and management objectives. Actions are specific steps that include who will implement the action and a timeframe for implementation. Cost estimates, if possible, and a list of permits or other regulatory compliance issues that need to be addressed are also helpful in the Action Plan.

Unless very few actions are identified, they need to be sorted by priority. The EPA OWOW Overview of Watershed Planning suggests using the following criteria for prioritization:

- Ability of the action to result in change.
- Amount of time between implementing the action and achieving the results.
- Willingness of those responsible to implement the action.
- Cost-to-benefit ratio.

Actions can include additional studies, restoration projects, educational activities, organizational needs, such as securing funding or permits, and monitoring. If baseline monitoring has not been initiated before the plan is completed, it should be a high priority action.

Monitoring Plan

Chapter 4 describes the elements of a monitoring plan and the critical role monitoring plays in adaptive management. Adaptive management is the process of using feedback from monitoring to make changes or correct the action plan to better achieve the restoration objectives. Monitoring is often left out of the initial planning, but it is essential to design the monitoring plan along with the action plan to insure that sufficient baseline data is collected before the implementation phase begins.

Implementation Strategy

After the action plan is completed, the first steps needed to implement the plan are identified in this section and include:

- Funding strategy. Include a list of tasks, a schedule, and who will be responsible for each component.
- Environmental compliance strategy. Can permit acquisition and/or CEQA compliance be combined for those high priority actions that call for immediate construction or environmental alteration?
- Milestones for reviewing and adapting the plan. Once the plan is completed, the watershed group members often need to catch their breath. However, the process is not over. An effective plan needs to be regularly reviewed and probably modified to achieve the overall goals.

References Used

Include the references used in completing the assessments and writing the plan. (See Appendix F for an example.)

Chapter 6. Summary of Next Steps for Marin County

Recommended Actions

The following is a list of recommendations from Chapter 3 for which the County of Marin has either the sole authority to implement or could play a significant role in their implementation. The recommendations are sorted into four categories:

A. Recommendations the County can implement through the permit and planning process.
B. Recommendations the County can implement through its own construction and maintenance projects. These recommendations provide an opportunity for the County to directly benefit watershed condition as well as model techniques and practices for other agencies and private landowners.
C. Recommendations the County can implement through studies or interagency planning efforts. Several of the studies identified form the basis for recommendations included in Category A.
D. Recommendations the County can implement through education and outreach campaigns.

Recommendations A, B, and C have been sorted, below by those that can be implemented in the short term (0–2 years or between 2004–2006) and those that require longer study, planning, or coordination before they can be implemented (2–10 years or between 2–10 years or 2006–2016). It is necessary to identify funding sources for implementation.

A. Recommendations the County can implement through the permit and planning process

Short-term implementation (0–2 years or between 2004–2006) listed in no particular order:

1. New development should not raise the 100-year water surface elevation or degrade riparian and aquatic habitat.
2. Encourage flooding and restoration of wetlands as part of development projects, where appropriate.
3. Require stormwater management plans that reduce runoff produced by storms through infiltration and detention for new construction. Require that stream maintenance and restoration projects preserve the hydraulic capacity of all streams, including ephemeral channels. Keep fill and structures out of stream channels. Require that instream habitat enhancement measures, such as logs or weirs, allow for flood flows.

4. Require that stream maintenance and restoration projects create stable channels with the sediment supply entering the reach approximately equal to the sediment leaving it. This can be achieved in the following ways:
    a. Use reference reaches to see how a healthy part of the same stream or a similar, nearby stream looks and functions.
    b. Incorporate low flow and bankfull channels wherever possible.
    c. Anticipate change. Allow room for sinuosity. Where possible, attempt to recreate meanders.
    d. Design for self-sustainability.
    e. Use biotechnical bank stabilization techniques where possible.
    f. Incorporate materials that occur naturally nearby or in the reference reach. Involve upstream and downstream neighbors.
    g. Revegetate stream banks with native riparian plants.
5. Require that all new development projects protect native riparian vegetation.
6. Require that restored and created wetlands be designed so that they need little or no maintenance to sustain their function and habitat value.
7. Limit land uses in wetland areas to activities that provide or protect wetland habitat such as flood retention areas, carefully managed grazing, and passive recreation.
8. Require that all reasonable attempts be made to protect viable wetland, riparian, and other sensitive habitat in new development before resorting to re-creating habitat through mitigation.
9. Require indigenous native plants for all County-regulated soil stabilization and restoration projects except where non-invasive herbaceous seeding is needed for short-term erosion control.
10. Require a Stormwater Pollution Prevention Plan (SWPPP) for all new development that disturbs an acre or more of land or on smaller project as warranted. The plan should include erosion control and stormwater management BMPs developed by MCSTOPPP, RWQCB, BASMAA, NRCS, and others for the north bay area, or comparable practices that protect water quality, healthy stream function, and natural habitats. (See BMPs in Appendix B.)
11. In addition to the SWPPP, require that new roads, driveways, and trails be constructed so as to minimize alterations to natural drainage patterns and watercourses, avoid unstable slopes, and allow for anadromous fish passage at stream crossings.
12. Require that grading or any significant soil disturbance be completed before the winter rainy season. Require that exposed soil be protected with straw, erosion control netting, or other similar material as described in A9 above.
13. Require buffers around wetlands in new construction to protect water quality and adjacent upland habitats essential for many wetland wildlife species (see C4, pg. 67).
14. Attach to the building permits the one-page BMP's.
15. Amend the Development Code regarding SCAs to reflect new CWP.
16. Adopt and implement the MMWD roads MOU for multiple agencies.

Medium to long-term implementation (2–10 years or between 2006–2016) listed in no particular order:

1. Protect groundwater sources from excessive withdrawals based on recommendations from groundwater studies (see C11, pg. 68).
2. Once critical habitat areas for special status species have been identified see C2, pg. 67), protect them from development that would reduce their habitat value. Consider using conservation easements to support willing private landowners who have extensive areas of critical habitat.
3. Require that all new development projects maintain sufficient stream flow to support riparian vegetation and native aquatic wildlife, including salmon and steelhead in streams with current or recent runs (see C3, pg. 67).
4. Support agricultural water users in developing adequate water sources for livestock and irrigation that have minimal impacts on downstream flow. New impoundments should not decrease stream flows below the minimum necessary to maintain fish habitat, water quality, and riparian vegetation.
5. Continue to support open space and agricultural land protection through the Williamson Act, MALT conservation easements, and MCOSD. Maintain agricultural zoning as a primary tool for preserving the agricultural land base. Develop policies that encourage new, non-agricultural landowners to keep their land in agricultural production through leasing or agricultural diversification.
6. Support the efforts of the Marin RCD, MALT, UC Cooperative Extension, and others to protect and enhance natural resources on agricultural lands. Encourage programs that contribute to the community's capacity to sustain productivity and economic stability.
7. Support restoration and conservation projects that provide contiguous habitat on adjacent parcels under different ownership.
8. Require a Stormwater Pollution Projection Plan (SWPPP) for all new development (see A10, above, and Appendix B).

B. Recommendations the County can implement through its own construction and maintenance projects

Short-term implementation (0–2 years or between 2004–2006) listed in no particular order:

1. Follow MCSTOPPP recommendations and those presented in Objective 1, Recommendation B in Chapter 3 to increase infiltration on County-owned land.
2. Practice water conservation and re-use.
3. Preserve the hydraulic capacity of all streams, including ephemeral channels. Keep fill and structures out of stream channels. Make sure that instream habitat enhancement measures, such as logs or weirs, allow for flood flows.

4. Design repair or restoration projects to create stable channels with the sediment supply entering the reach approximately equal to the sediment leaving it (see A4, pg. 66, for methodology).
5. Protect and restore native riparian vegetation on County-owned lands. Do not remove native riparian vegetation unless it creates a safety hazard.
6. Use erosion control and stormwater management BMPs developed by MCSTOPPP, RWQCB, BASMAA, NRCS, and others for the North Bay area or comparable practices that protect water quality, healthy stream function, and natural habitats.
7. Implement the BMP's in FishNet 4C Roads Manual for Public Works, Parks and Open Space and others.
8. Use indigenous plants in all County landscaping and restoration projects. Follow the guidelines presented in Objective 2, Recommendation E in Chapter 3.
9. Develop and implement consistent SOD policies for all public field staff to avoid spreading contaminated material.
10. Continue implementation of the recommendations from the FishNet 4C Program (Harris, et al., 2001) and the Marin County stream assessment (Taylor, 2003) including remove barriers to anadromous fish passage.
11. Construct new roads and trails so as to minimize alterations to natural drainage patterns and watercourses. Avoid unstable slopes (see MMWD Roads MOU).
12. Maintain unsurfaced roads and trails to minimize sediment loss and concentration of surface runoff. Culverts should be inspected regularly to ensure that they are functioning properly. Crossings that create barriers to fish passage should be removed or modified (see MMWD Roads MOU).
13. Complete grading or any soil disturbance before the winter rainy season. Protect exposed soil with straw, erosion control netting, or other similar material.
14. Eliminate the use of insecticides, herbicides, or toxic chemicals within sensitive habitats unless no other reasonable alternative exists to protect the habitat from significant threat.

<u>Medium to long-term implementation (2–10 years or between 2006–-2016) listed in no particular order:</u>

1. Allow flooding and restore wetlands on County-owned land where such activities will not create safety hazards, damage essential infrastructure, or otherwise conflict with the land use.
2. Manage streams to sustain large woody debris in the stream channel. (See Objective 1, Recommendation C in Chapter 3.)
3. Continue implementation of the recommendations from the FishNet 4C Program (Harris, et al., 2001) and the Marin County stream assessment (Taylor, 2003) to remove barriers to anadromous fish passage.
4. Establish a "log bank" to store redwood root wads and logs that have been removed from public lands for use in instream habitat enhancement projects.

5. Implement the recommendations developed through sound, community-based watershed management plans for controlling erosion, revegetation, removing barriers to fish passage, and other restoration activities on County lands.
6. Conserve landscape-scale patterns of habitat mosaics on County lands.
   a. Disturbance is essential to maintaining diversity within the landscape. Grazing, fire management, and mowing are forms of disturbance and can be used to maintain habitat diversity. These tools are very site-specific and require careful planning, often under the guidance of a professional forester or Certified Rangeland Manager. Fire management should not be done without the support of the Marin County Fire Department or other appropriate fire protection agency.
   b. Where appropriate, try to re-establish native plant communities where they were located before significant degradation.
   c. Monitor mowing, grazing, and other disturbance to encourage natural regeneration.
7. Monitor the long-term effectiveness of restoration and enhancement projects on County lands.
8. Establish adequate spoils storage sites throughout the County so that spoils from landslides and road maintenance can be stored safely away from streams.

C. Recommendations the County can implement through studies or interagency planning efforts

Short-term implementation (0–2 years or between 2004–2006) listed in no particular order:

The following actions are in this category because they are urgent and/or they contribute to or support ongoing efforts.

1. Develop a comprehensive plan to control the spread of SOD. (See Sudden Oak Death in Appendix B.) Coordinate SOD planning efforts with Sonoma County, Marin County's only contiguous neighbor.
2. Continue to provide staffing and technical support to FishNet 4C to help Marin County agencies better protect salmonid populations.
3. Institute Sustainable Conservation's one-step permit process in Marin County. Monitor program effectiveness annually.
4. Support the proposed Marin County Agricultural Ombudsman program to help agricultural producers navigate through the permitting process.

Medium to long-term implementation (2–10 years or between 2006–2016) listed in no particular order:

1. Conduct a study to re-evaluate the standards used to define SCAs. Consider available data on stream protection and management standards, their

effectiveness at sustaining healthy stream function, and alternatives to the current standards used in Marin County. Include input from professionals such as a fluvial geomorphologist, hydrologist, and vegetation ecologist, together with resource agencies and interested public citizens.

2. Work with watershed groups and state and federal agencies to identify key habitat areas in each watershed for special status species, including seasonal and daily movement corridors. Prioritize critical areas for protecting and restoring connectivity. Maintain maps of these areas through the County GIS. Coordinate efforts by public agencies and private landowners to protect and restore these areas.
3. Work with state and federal resource management agencies to set target instream flow levels for all streams that support anadromous fish. Incorporate these target levels into the County review process and prohibit projects that jeopardize instream flows.
4. Develop criteria for determining the effective size of the buffers needed to protect the habitat value and function of wetlands.
5. Identify and prioritize critical areas for controlling expansion of exotic invasive pest species. Maintain maps of these areas through the County GIS.
6. Develop a coordinated program between local, state, and federal land managers to control and, where possible, reduce exotic invasive pest species. Include an education and outreach component for private landowners.
7. Develop and implement guidelines for pesticide use on both private and public lands. Consider mandating the elimination of the use of insecticides, herbicides, or toxic chemicals within sensitive habitats unless no other reasonable alternative exists to protect the habitat from significant threat.
8. Promote restoration and conservation projects that provide contiguous habitat on adjacent parcels under different ownership.
9. Develop a comprehensive plan to control the spread of SOD. (See Sudden Oak Death in Appendix B.) Coordinate SOD planning efforts with Sonoma County, Marin County's only contiguous neighbor.
10. Implement the Department of Health Services (DHS) plan to improve Tomales Bay east shore septic systems. Evaluate the effectiveness of septic systems in other rural Marin County communities.
11. Support the development of regional clearinghouses to coordinate and manage water quality monitoring data so that trend and cumulative impact analysis can be conducted. The County could provide support through contributing data, providing technical assistance, and providing funding.
12. Work with water public utilities to match projected growth estimates with long-term water supply plans.
13. Work with state and federal resource management agencies to install stream gauging stations on major streams to measure and monitor stream flow.
14. Assess and map groundwater sources in Marin County. Develop a program to protect the quality and quantity of the County's groundwater.
15. Implement a coordinated planning effort among Marin County's public land management agencies to assess the cumulative impacts of visitor use on

natural resources. Use this information to set and monitor appropriate levels of use.

16. Continue the MCSTOPPP Aquatic Macroinvertebrate Sampling Program in urban Marin County streams. Expand into streams in the western part of Marin County.
17. Participate in and, where necessary, initiate coordinated management plans for adjoining public lands.
18. Develop forums for resource managers to meet and share information or, where they already exist, continue to support them. TBWC, the Bolinas Lagoon planning effort, FishNet 4C, and the North Bay Watershed Council are examples of such forums.
19. Acknowledge departments or individuals at all levels that are contributing to healthy watersheds. Consider an annual watershed award given by the Board of Supervisors that recognizes extraordinary effort while at the same time highlights the diversity of skills needed for effective watershed management.

D. Recommendations the County can implement through education and outreach campaigns

1. Implement an aggressive outreach campaign to let Marin County residents know that increasing water infiltration and decreasing runoff depends on everyone, not just government agencies. Explain what they can do and how much difference their efforts can make.
2. Implement an education campaign with Marin County residents, nurseries, and landscape contractors to discourage the sale of non-native, invasive plants. Continue and strengthen outreach and education efforts to help people identify and control pest species.
3. Continue and strengthen education efforts about the use of native plants for landscaping and erosion control.
4. Encourage ranchers and public land managers to work with NRCS, UC Cooperative Extension, or other rangeland managers to develop site-specific grazing strategies that support livestock production and native plant diversity.
5. Encourage small-scale restoration projects that contribute to connectivity. Backyard clusters of native trees and shrubs, for example, can provide safe nesting habitat for songbirds that are then able to forage in larger urban ranges.
6. Continue and strengthen outreach to Marin County residents about reducing runoff from environmental toxins including pesticides, cleaning agents, swimming pool chemicals, road oil, and household hazardous wastes.
7. Promote water recycling and conservation for both agricultural and domestic uses.
8. Promote the use of the management practices recommended by the Bay Area Council of Resource Conservation Districts and NRCS for controlling sediment and nutrient yield from horses.
9. Encourage small scale streamside restoration projects in Marin to contribute to healthier connected riparian corridor.

10. Establish watershed-based native plant nurseries to grow the plants for creek side land owners.

E. Recommendations the County can implement through support of community or watershed groups

Support includes providing technical assistance and review, assistance with obtaining any necessary County permits, and funding or assistance with obtaining funding.

1. Support watershed assessments, including but not limited to:
   - Sources of accelerated erosion and sedimentation based on consideration of overall watershed sediment transport and hydrologic processes.
   - Wildlife populations and habitat conditions.
   - Sensitive habitat mapping.
   - Water quality and supply.
   - Historic conditions.
   - Recreational use.
2. Support community efforts to remove and replace invasive non-native species.
3. Support the efforts of watershed groups, the Marin RCD, TBI's STRAW Project, and others to restore natural habitat.
4. Support TBWC and other watershed groups in developing comprehensive water quality monitoring programs.
5. Support the efforts of watershed groups, water districts, the Marin RCD, UC Cooperative Extension, and others to help private landowners improve water quality.
6. Provide funding and/or technical support to assist watershed groups with effectiveness monitoring.
7. Encourage County departments to participate in community-based watershed management efforts. Without dominating such efforts, the County can provide much-needed support through technical advice, GIS and other mapping services, meeting and outreach assistance, and coordinating on-the-ground County work such as road maintenance with other watershed activities.
8. Expand the MCSTOPPP community stewardship funding program to provide additional support and resources for small-scale restoration, enhancement, and monitoring projects.
9. Develop an additional County funding program to assist watershed groups with building and maintaining the organizational capacity to meet their watershed goals. (See Objective 8, Recommendation C in Chapter 3.)
10. Continue participating in semi-annual or quarterly forums to bring together watershed groups and agency personnel. Support such forums as needed through providing meeting facilities and assisting with notification.
11. Provide opportunities for local schools, including area colleges and universities, to contribute to watershed planning, management, and

monitoring. Support the use of local schools as community watershed centers.

12. Assist with the preservation of oral histories as a tool to document changes in stream conditions, wildlife ranges, plant communities, and other natural features.
13. Acknowledge when communities have done a good job protecting watershed resources through awards, as well as articles and features on MCSTOPPP and other websites.
14. Continue to support the efforts of TBI's STRAW Project, MCSTOPPP, and others to provide hands-on watershed restoration opportunities for students and community members. Provide County staff to supervise and maintain community restoration projects.
15. Develop a toolbox of watershed information materials from one-page handouts to posters to small booklets similar to the "Backyard Pests" and others distributed by MCSTOPPP. Distribute them in libraries, schools, County offices, and at community events.
16. Post watershed signs at major watershed divides, similar to the signs that now mark some creeks.
17. Develop a watershed stewardship certification program for contractors and agency maintenance staff.
18. Support MCSTOPPP in keeping their website up-to-date and well supplied with watershed-related information. Provide easy links from other County sites.
19. Consider initiating an annual Marin Watershed Fair. Include tours, actual restoration or monitoring projects, how-to workshops, presentations from Marin watershed groups, artwork, etc.
20. Support the biennial State of Tomales Bay Conference and similar events that bring together scientists and watershed residents.
21. Provide technical trainings on assessment, monitoring, and restoration techniques for County staff and residents.

Selection Criteria for Restoration Projects

The following list of criteria was developed to assist Marin County staff in selecting projects to support through grants in the event that monies become available for the County to disperse. An assumption was made that County funding would focus on County and private lands, not on state or federal lands.

Restoration Categories

Restoration projects can be divided into two main categories. The first category occurs on lands that are managed primarily for their natural resources, such as parks, open space, or public watershed lands. In these areas, restoration designers and practitioners often have a wide berth in which to restore natural function and structure. Whole reaches of creek with their complete floodplains can be managed or restored to achieve a particular objective. Watershed-wide programs

can be implemented to control invasive exotic plants or expand certain habitat types.

In the second category, restoration occurs on lands that are primarily managed for more intensive human use—urban areas, rural residential sites, farms, and ranches. In these areas, usually only a portion of the natural function and structure can be restored or enhanced. Property values, productive land use, and human safety are paramount concerns when designing projects to improve natural habitat at these sites. In fact, the restoration is often driven by safety or economic concerns, such as an eroding stream bank that threatens a home or a gully that eats away at productive pasture.

Both types of restoration are important. The first category, wildland restoration, delivers more immediate and more comprehensive results. Because it occurs on a habitat scale, it is a critical tool in protecting species of concern. The second category, referred to in this report as "domesticated land restoration," plays a less spectacular, but equally important, role. It creates refuges for wildlife in developed settings, and it can provide critical habitat contiguity for species such as steelhead trout moving through impacted areas. Since domesticated land restoration also requires direct involvement from the people who own or use the property, it can be a compelling source of education and community participation.

The criteria listed below apply to both wildland and domesticated land restoration. They are not ranked; each is presented as being equally important. However, certain criteria would reasonably be given greater weight under the objectives of specific programs. For example, if a goal of the funding program was to support community-based restoration, projects sponsored by or having strong involvement from community groups would receive a higher ranking.

Selection Criteria:

1. The project outcome is clearly defined, and the procedures identified to achieve the outcome are effective and realistic.
2. The natural functions and structure needed to achieve the outcome are either present or will be restored through the project. For example, placement of redwood logs to improve instream rearing habitat for juvenile coho salmon will not be successful if the reach of stream where the logs are installed dries up most summers.
   Sub-criteria include:
   - Stream restoration projects are designed to be consistent with the natural geometry of the stream channel—width, depth, sinuosity, floodplain dimensions, pools, and riffles—as well as its capacity to transport both sediment and water1.

[1] *A Primer on Stream and River Protection for the Regulator and Program Manager* (Riley, 2002) is an excellent resource for assessing stream restoration projects on the basis of whether or not they encourage natural stability.

- In wildland areas and wherever feasible in domesticated land projects, restoration methods incorporate elements already occurring naturally within the local habitat or a reference area. For example, a willow brush mattress could be an appropriate bank repair in a sunny, low-gradient stream reach, while a boulder repair might be appropriate for a rocky cascade in an upper watershed tributary.
- Restoration is designed to be self-adapting to changes in watershed or channel conditions.

3. The restoration project increases connectivity through one or more of the following:
   - It is contiguous to other protected or restored areas.
   - It forms a corridor that connects existing viable habitat or creates viable habitat out of isolated islands.
   - It increases patch size so that habitat value and function are improved.
4. The project increases biodiversity through one of the following:
   - It provides or protects habitat for indigenous species.
   - It provides or protects habitat for species of concern
5. The restoration site is protected through public ownership or a conservation easement, or the land use is stable and not expected to change within the foreseeable future.
6. The restoration project is identified in a watershed plan or similar planning document or through a stakeholder-based process.
7. The grantee has a credible, long-term management and maintenance plan to care for the project.
8. The proposed budget is sufficient to complete the project. If a phased project, a realistic plan is presented to obtain all of the necessary funding.
9. The grantee has the capacity to responsibly and effectively manage the grant.

Glossary

Bankfull flow: The stream flow level that is most effective at maintaining the average morphological characteristics (such as depth, location of sand and gravel bars, meanders, pools, etc.) of channels. The bankfull stage has a recurrence interval of 1.5 years.

Biotechnical Slope Protection: A process involving the use of live and dead woody cuttings and poles or posts collected from native plants to revegetate watershed slopes and stream banks. The cuttings, posts, and vegetative systems composed of bundles, layers, and mats of the cuttings and posts provide structure, drains, and vegetative cover to repair eroding and slumping slopes.

Ephemeral Stream: A stream that flows only for a short period in direct response to precipitation.

Floodplain: Any land area that is susceptible to being inundated by water from a river, creek, watercourse, ocean, or lake. Often times a distinction is made by hydrologists and geomorphologists between the upper floodplain or terrace and the active floodplain. The uppermost floodplain is referred to as a terrace while the active floodplain area is the areas inundated by bankfull flow or the 1.5-year recurrence flow.

Floodway: Portion of the floodplain that must be kept free of development so that flood elevations will not increase beyond a set limit – a maximum of 1 foot under the National Flood Insurance Program. The floodway usually consists of the stream channel and land along its sides.

Geomorphology: That science that deals with the form of the earth, the general configuration of its surface, and the changes that take place in the evolution of land forms. Fluvial geomorphology addresses how stream channels are shaped by sediment transport and water flow.

Groundwater: Water that flows or seeps downward and saturates soil or rock, supplying springs and wells. The upper surface of the saturate zone is called the water table.

Hedgerows: A line or group of trees, shrubs, perennial forbs, and grass that is planted along field edges, fencelines, drainage channels, property borders, and diverging land-uses.

Hydrology: The science of the properties of earth's water, especially of its movement in relationship to land.

Indigenous: Existing, growing, or produced naturally in a region.

Intermittent stream: a watercourse that flows during the wet season, continues to flow after the period of precipitation, and ceases surface flow during at least part of the dry season. During drought years, intermittent streams may not have any flow.

Large woody debris: Coarse wood material such as branches, logs, whole trees, and root wads that fall into streams.

Limiting factor: A condition whose absence or excessive concentration is incompatible with the needs or tolerance of a species or population and which may have a negative influence on their ability to thrive and/or survive. A factor such as temperature, light, water, or a chemical that limits the existence, growth, abundance, or distribution of an organism.

Perennial stream: a watercourse that flows throughout the year (except for infrequent or extended periods of drought), although surface water flow may be temporarily discontinuous in some reaches of the channel such as between pools.

Pervious paving: Paving material that allows water to penetrate to the soil below.

Pool: A location in an active stream channel, usually located on the outside bends of meanders, where the water is deepest and has reduced current velocities.

Reference reach: A stable reach of stream which represents a large section of the stream with respect to area, depth, slope, and the volume of water being transported.

Riffle: A shallow rapids, usually located at the crossover in a meander of the active channel. Salmon and trout usually spawn at the upstream end of riffles.

Riparian: The riparian corridor is the area adjacent to the stream that supports a plant and animal community adapted to flooding or wet conditions.

Sinuosity: The curviness of a stream. Sinuosity is measured as the ratio of channel length between two points on a channel to the straight-line distance between the same two points. Channels with sinuous ties of 1.5 or more are called "meandering".

Smolt: a young salmon or steelhead trout undergoing the transformation that will allow it to migrate from fresh water into the ocean.

Stream channel: see Channel.

Undercut bank: A streambank with a small cave or shelf carved by the streamflow under the top of the bank. Undercut banks provide important cover for many fish.

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APPENDIX A

WESTERN MARIN COUNTY WATERSHEDS DESCRIPTIONS

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ACRONYMS USED IN THIS APPENDIX

ACOE	U.S. Army Corps of Engineers
ARS	Agricultural Research Service
BLTAC	Bolinas Lagoon Technical Advisory Committee
BMP	Best Management Practice
CDFG	California Department of Fish and Game
DHS	California Department of Health Services
DPR	California Department of Parks and Recreation
EA	Environmental Assessment
EHS	Marin County Environmental Health Services
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESU	Evolutionarily Significant Unit
FishNet 4C	Fisheries Network of the Central California Coastal Counties
GGNRA	Golden Gate National Recreation Area
Gold Ridge RCD	Gold Ridge Resource Conservation District
LMER	Land Margin Ecosystem Research
MALT	Marin Agricultural Land Trust
MCOSD	Marin County Open Space District
MMWD	Marin Municipal Water District
MOU	Memorandum of Understanding
Marin RCD	Marin Resource Conservation District
NCRWQCB	North Coast Regional Water Quality Control Board
NOAA	National Oceanic and Atmospheric Administration
NMWD	North Marin Water District
NOAA Fisheries	National Marine Fisheries Service, a part of NOAA
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resource Conservation Service
PCI	Prunuske Chatham, Inc.

PL	Public Law
PRBO	Point Reyes Bird Observatory
PRNS	Point Reyes National Seashore
PWA	Pacific Watershed Associates
RWQCB	Regional Water Quality Control Board
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SFZC	San Francisco Zen Center
SPAWN	Salmon Protection and Watershed Network
SPAWN	Salmon Protection and Watershed Network
Southern Sonoma County RCD	Southern Sonoma County Resource Conservation District
STRAW	Students and Teachers Restoring a Watershed
SWRCB	State Water Resources Control Board
TBA	Tomales Bay Association
TBAG	Tomales Bay Agriculture Group
TBSTAC	Tomales Bay Shellfish Technical Advisory Committee
TBWC	Tomales Bay Watershed Council
TMDL	Total Maximum Daily Load
UCCE	University of California Cooperative Extension
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service

ESTERO AMERICANO WATERSHED

GENERAL DESCRIPTION

The Estero Americano watershed is a coastal estuary at the base of Americano Creek. It forms a portion of the northern boundary between Marin and Sonoma counties where it drains into Bodega Bay. In some years, a seasonal sand bar at the mouth restricts tidal exchange. Periods of hypersalinity have been recorded in the Estero. When the mouth is open, the tidal influence ranges up to 4 miles upstream. Americano Creek, the sole tributary of the Estero, is ephemeral and generally dries up for 4 to 6 months between late spring and fall.

Watershed Area: 49 square miles (31,360 acres)
Channel Length:
Americano Creek: 7 miles (11.3 kilometers)

DOMINANT OR INTERESTING HABITATS

The Estero Americano contains 301 acres of open water and 412 acres of wetland habitat, including mudflats, seasonal brackish marsh, and freshwater marsh. A mudflat in the middle reach of the Estero "strongly limits exchange between the upper and lower Estero." (Commins, et al., 1990). The California Department of Fish and Game (CDFG) has identified Estero Americano and its southern neighbor, Estero de San Antonio, as one of the most significant habitat areas in the state. Streamside habitat along Americano Creek consists of grazed pastures with few trees interspersed with dense willow thickets. Coastal oak woodland occurs in the upper watershed.

SPECIAL SPECIES

Special status species: Northwestern pond turtle, steelhead, Myrtle silverspot butterfly, tidewater goby, and tricolored blackbird have been observed in the watershed. Special status plants that are known to occur include showy Indian clover and Point Reyes checkerbloom.

Other species of interest: Seventy-one species of water and marsh-associated birds, 66 species of terrestrial birds (Madrone, 1977), and 44 marine and freshwater fish species (Commins, et al., 1990). have been identified in and surrounding the Estero. Over 70 species

of benthic invertebrates and 30 species of epibenthic invertebrates were collected in the Estero in the late 1980s (Commins, et al., 1990).

LAND USE

Historically, the Estero Americano was an important area for Coast Miwok who inhabited the beaches along the mouth. From 1865 to 1982, the area was used extensively for agriculture, including corn, beets, potatoes, onions, oats, and hay. In the late 1800s, the Estero Americano was reportedly a navigable body of water, and products such as potatoes were shipped to market. Today, land use within the watershed is primarily dairy operations, beef and sheep grazing, and residences. The small communities of Valley Ford and Bloomfield are within the Sonoma County portion of the watershed.

WATERSHED PLANNING AND MANAGEMENT

Extensive background information on the Estero Americano has been documented. In 1977, CDFG published "The Natural Resources of Esteros Americano and de San Antonio," a synthesis of information accumulated on wetland areas for the Coastal Wetland Series. As part of the Santa Rosa Subregional Water Reclamation System Long-term Studies, additional assessments were completed on the Estero Americano. These included evaluations of aquatic habitats, wetlands, fish and wildlife communities, discharge criteria, streamflows, and additional resources within the Estero Americano watershed.

The *Sonoma County Coastal Wetland Enhancement Plan*, an erosion survey of the Estero Americano and several coastal watersheds to the north, was completed in 1987 by Circuit Rider Productions for the Gold Ridge Resource Conservation District (Gold Ridge RCD) (State Coastal Conservancy and Circuit Rider Productions, 1987). With funding from the State Coastal Conservancy, Gold Ridge RCD undertook repair of many of the erosion sites identified. Gold Ridge RCD continues to be active in the watershed, sponsoring workshops to assist agricultural landowners in developing ranch plans and implementing projects to improve water quality and reduce erosion.

IMPORTANT WATERSHED ISSUES

1. **Water quality**. The Estero Americano is identified as an impaired waterbody by the North Coast Regional Water Quality Control Board (NCRWQCB) due to nutrients and sedimentation/siltation. As in its southern neighbor, the Estero de San Antonio, significant historic erosion occurred within the watershed resulting in an approximately 25 percent loss in tidal prism. Current watershed enhancement efforts have focused on reducing polluted runoff from agricultural operations and repairing remaining sites of accelerated erosion.
2. **Agricultural viability.** As in most of western Marin County, agricultural producers are struggling to stay profitable (University of California Cooperative Extension [UCCE], 2003). This is especially true for sheep and beef producers within the watershed.
3. **Invasive non-native plants.** Invasive non-native plant species are displacing native vegetation and are reducing the extent and quality of habitats for native species.

4. **Estero function**. Historic activities in the watershed have contributed excessive amounts of sediment to the Estero. The change in the shape of the Estero in turn affects tidal circulation, nutrient circulation, and salinitiy.

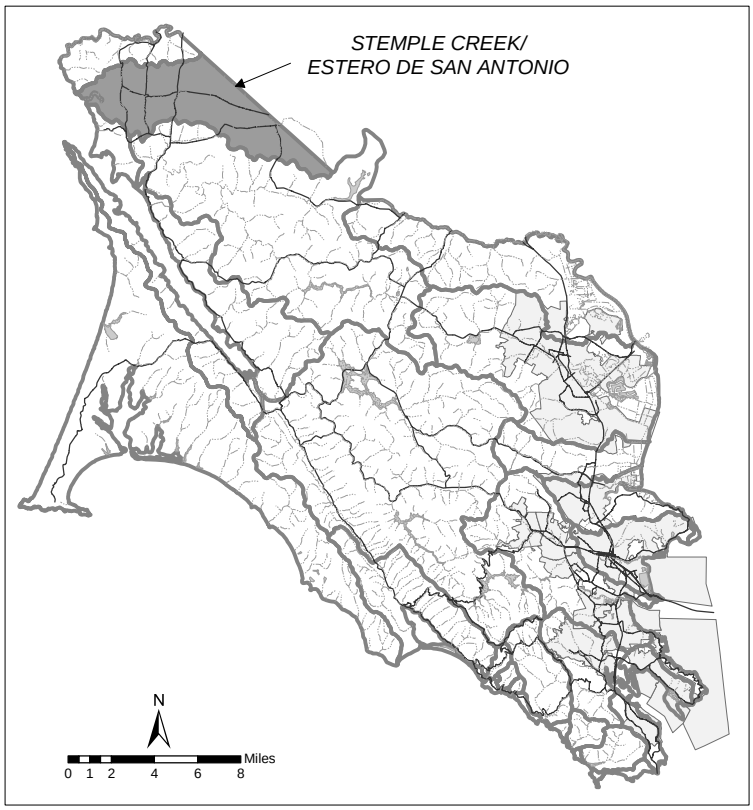
WATERSHED NEEDS

1. Ongoing funding for landowners to implement and manage habitat restoration and water quality improvement projects. Natural Resource Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP) funds and grants received by Gold Ridge RCD have provided the primary support for implementation projects.
2. Effectiveness monitoring and maintenance of completed projects.
3. Support with and simplification of permits for habitat enhancement and agricultural operations.
4. Updated assessment of Estero function.

STEMPLE CREEK/ESTERO DE SAN ANTONIO WATERSHED

GENERAL DESCRIPTION

The Stemple Creek watershed begins just west of Petaluma and empties into the Pacific Ocean through the Estero de San Antonio. It is characterized by grassy, rolling hills with grazing-based agriculture. The towns of Two Rock and Fallon once provided basic services to local ranchers, but little remains of either except a few buildings and a sense of place. The drainage is cut almost exactly in half by the Sonoma-Marin county line. The historic riparian corridor has been lost in much of the upper watershed, although restoration efforts have re-established significant reaches of riparian vegetation.



The watershed changes sharply from Highway 1 west. Slopes increase in steepness, and coastal scrub and dense stands of native perennial grasses take over the hills. The Estero de San Antonio, a small coastal lagoon, is part of the Gulf of the Farallones National Marine Sanctuary and is also included in the Central California Coast Biosphere Reserve (UNESCO Man and Biosphere Program). A sandbar often closes the mouth of the Estero in the summer or early fall. It remains closed until winter rains with heavy runoff break open the sandbar. Local residents used to blast open the mouth if hypersaline conditions developed within the Estero.

Watershed Area: 50 square miles (32,000 acres)
Channel Length:
Mainstem upstream of Highway 1: 14.6 miles (23.5 kilometers)
Mainstem below Highway 1: 9.0 miles (14.5 kilometeres)

DOMINANT OR INTERESTING HABITATS

The land draining into Stemple Creek is largely grassland. Willows have been re-established along parts of the mainstem and tributary streams; coastal oak woodland can still be found along some of the higher tributaries. Eucalyptus, planted in rows for windbreaks and fuel, is now one of the most common trees.

Stemple Creek itself was once a marginal coho salmon and steelhead trout stream. A small dam for livestock built on the Button Ranch in the early 1960s closed off the last available spawning areas. Residents tell of dense flocks of waterfowl, but, as in most areas along the Pacific flyway, their numbers have dropped precariously. Farm ponds, especially those with shallow edges, now provide some of the best remaining habitat for waterfowl, northwestern pond turtles, and other aquatic species.

CDFG has identified the Estero de San Antonio and Estero Americano as one of the most significant habitat areas in the State. It is a remarkable mosaic of intermingling habitat types—densely wooded riparian ravines, saltgrass areas, mudflats, eelgrass beds, and small freshwater ponds. The area between the two Esteros contains extensive areas of native coastal terrace prairie.

Special Species

Special status species: California freshwater shrimp, northwestern pond turtle, California tiger salamander, tidewater goby, Myrtle silverspot butterfly, and California red-legged frog have been observed in the watershed. Special status plants known to occur include Baker's larkspur, Blasdale's bent grass, showy Indian clover, and yellow larkspur.

Other species of interest: River otters have been observed in the Marin County portion of Stemple Creek east of Highway 1. Eelgrass beds in the Estero de San Antonio provide nursery habitat for Dungeness crabs. The Estero is used by over 40 species of waterfowl and is an important winter feeding area for migrating birds. Golden eagles are known to nest in the upper watershed.

Land Use

Land use in the watershed is almost exclusively agricultural. From the beginning of European settlement to the mid 1900s, the watershed had mixed farming with small livestock herds and large areas of land cultivated for barley, wheat, vegetables, and potatoes. Poultry and egg production was an important part of the local economy from the 1930s through World War II. Today 90% of the watershed is used for livestock grazing, mostly beef and sheep ranches in the Marin County portion with a half dozen dairies.

Although the Estero itself is part of the Gulf of the Farallones National Marine Sanctuary, the land surrounding it is all privately owned. Since access across land is by permission only, recreational use is limited. There are no cities or towns in the watershed.

Watershed Planning and Management

In 1994, the Marin and Southern Sonoma County Resource Conservation Districts (Marin RCD and Southern Sonoma County RCD, respectively) completed an Enhancement Plan for the Stemple Creek/Estero de San Antonio watershed. The plan was guided by a community-based advisory committee and established 10 major goals with recommendations for implementation. They included the following:

Enhancement Recommendations

1. Encourage the local community to take the lead in developing and implementing enhancement projects.
2. Assist agricultural producers with practices that promote the conservation and enhancement of natural resources.
3. Reduce pollutants entering Stemple Creek and the Estero de San Antonio.
4. Reduce soil erosion.
5. Encourage environmentally-sound management of rangeland.
6. Conserve and enhance existing natural habitats.
7. Restore the riparian corridor.
8. Develop a long-term monitoring program.
9. Support agriculture as the major land use in the watershed.
10. Request additional investigation by the Santa Rosa Subregional Water Reclamation System on the potential impacts of the proposed West County Alternative on agriculture and natural resources.

The plan's appendices include a biological assessment of the Estero de San Antonio, a report on watershed vegetation and habitat restoration, an erosion and sediment study, a geomorphic and hydrodynamic analysis of the Estero, a report on water resources, and a summary of interviews with watershed residents.

Implementation of the enhancement plan has been a decentralized effort. Although the two RCDs have led the way with grant-sponsored projects, local landowners have also implemented many measures on their own and with support from NRCS. The Shrimp Club, a nationally-recognized project of Brookside School in San Anselmo, began its stream restoration work in Stemple Creek. The Shrimp Club and its successor, STRAW (Students and Teachers Restoring a Watershed) have together replanted native riparian vegetation along 8 miles of mainstem Stemple Creek and its tributaries.

The two RCDs and NRCS are currently working to bring funding under the authority of the Watershed Protection and Flood Protection Act (Public Law [PL] 566) into the watershed to improve water quality. NRCS completed a Draft Watershed Project Plan and Environmental Assessment in 2002. A steering committee of landowners and agency representatives provided direction to NRCS staff during the planning process. If approved, the PL 566 funding would assist with upgrading waste management systems on approximately 16 dairies, restoring riparian habitat along 33 miles of mainstem and tributary streams, and providing treatment, including erosion control measures, on 13,000 acres of rangeland. Marin RCD and NRCS are working with Sustainable Conservation on the development of the Marin Coastal Watershed and Permit Program. In addition, the U.S. Department of Agriculture's (USDA) Agricultural Research Service (ARS) and NRCS conducted a Historical Sediment Study in 2001-2002.

IMPORTANT WATERSHED ISSUES

1. **Nutrients**. In 1990, Stemple Creek was listed on the federal Environmental Protection Agency's (EPA) 303(d) list as an impaired waterbody due to excessive nutrients. The NCRWQCB adopted a Total Maximum Daily Load (TMDL) and Attainment Strategy for the watershed in December of 1997. The TMDL set limits for sediment, dissolved oxygen, total and un-ionized ammonia, and temperature; it recommended a time schedule and practices to achieve these limits (NCRWQCB, 1997). A TMDL for nutrients in Stemple Creek has been adopted into the Basin Plan for the North Coast. CDFG monitoring data show that water quality in Stemple Creek has steadily improved since the early 1990s. CDFG attributes this to improved awareness on the part of dairy producers and efforts to restrict direct livestock access to creeks. However, they also note that a single spill of dairy waste can have a catastrophic effect on aquatic organisms (CDFG, 2000; CDFG, 2001).
2. **Groundwater quality**. Many of the wells serving Stemple Creek residents have been dug into the alluvium along Stemple Creek, particularly in the upper end of the watershed. The water quality from these wells is closely tied to the surface water quality. Several have tested high in nitrates.
3. **Habitat restoration**. Habitat restoration, particularly along the riparian corridor, continues to be a priority in the watershed. The 1994 Enhancement Plan stated that only 20% of the watershed's stream channels had woody riparian cover. Since that time, efforts by landowners, the RCDs, and STRAW have lead to approximately 12 miles of riparian fencing and revegetation. UCCE, with technical and financial assistance from NRCS, has developed a riparian pasture demonstration with local beef ranchers.
4. **Estero function**. In the geomorphic and hydrodynamic analysis of the Estero de San Antonio prepared for the 1994 Enhancement Plan, Williams (1993) found that 80% of the lagoon's volume has been lost through historic sedimentation. This reduction in tidal prism has led to an increase in the frequency and duration of lagoon closures from the sandbar that forms at the mouth. Evidence from the 1992/93 winter rains indicated that natural scouring of the lagoon bed could occur over time if sediment delivery to the Estero is reduced.
5. **Erosion and sedimentation.** The NCRWQCB has recommended that Stemple Creek's 303(d) listing be updated to include sediment as a cause of impairment (NCRWQCB, 2001). The Enhancement Plan states that over 80% of the accelerated erosion comes from the lower watershed with large gully systems as the primary source. Gully stabilization projects have been implemented by local landowners with support from the RCDs and NRCS, but additional work is needed.
6. **Agricultural viability.** As in most of western Marin County, agricultural producers are struggling to stay profitable (UCCE, 2003).
7. **Sediment and water quality effects from Sonoma County landfill.** The Sonoma Central Solid Waste Disposal Site, the central landfill for Sonoma County, is perched at the very top of the Stemple Creek watershed. In 1995, the NCRWQCB issued a Cleanup and Abatement Order because of excessive sediment and leachate leaving

the landfill and entering the watershed. Since that time, the landfill has completed significant erosion control and other work to contain runoff from the site.

WATERSHED NEEDS

1. Support for the PL 566 project application. A vigorous effort by local legislators, Marin County, and conservation groups could help secure funding.
2. Ongoing funding for landowners to implement and manage habitat restoration and water quality improvement projects. NRCS EQIP funds and grants received by Marin RCD, Southern Sonoma County RCD, and STRAW have provided the primary support for implementation projects.
3. Effectiveness monitoring and maintenance of completed projects.
4. A bathymetric and topographic survey of the Estero de San Antonio coupled with a monitoring program to define closure and opening events, to measure peak flood flows and low summer flows, and to determine if net scour or deposition are occurring within the lagoon.
5. Monitoring of groundwater quality.
6. Development of a Safe Harbor program. Safe Harbor programs are designed to protect landowners who restore habitat for endangered or threatened species from then incurring more stringent regulatory constraints as a direct result of their enhancement activities.
7. Support with and simplification of permits for habitat enhancement and agricultural operations.
8. Continue to educate and encourage farmers about restricting livestock access to creeks.

EAST AND WEST AREA OF THE TOMALES BAY WATERSHED

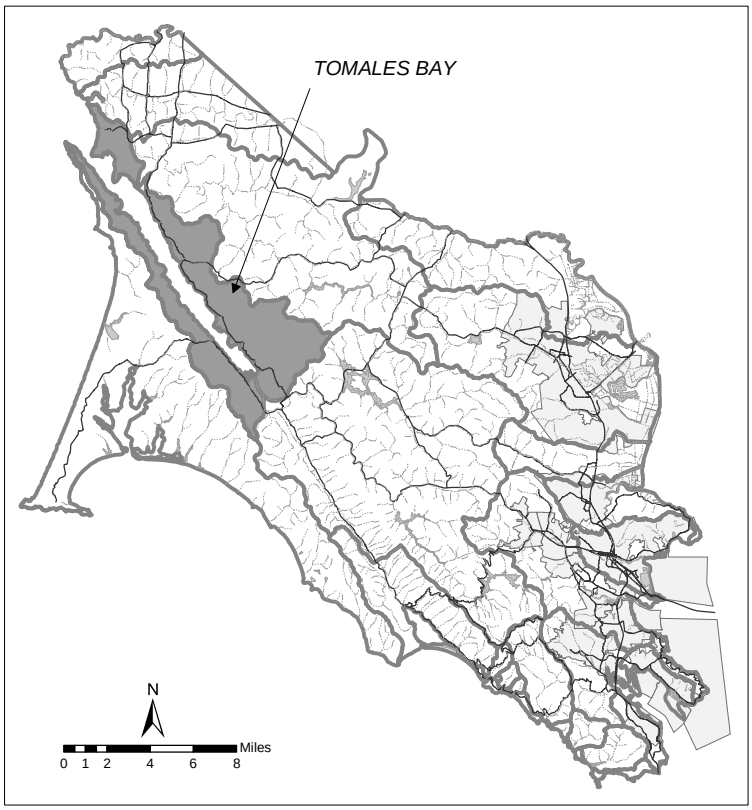
General Description

Many of the watersheds (Walker, Lagunitas, and the smaller east and west shore tributaries) addressed in this Appendix drain into Tomales Bay. This section presents an overview of bay habitat plus issues and needs that are specific to Tomales Bay itself.

Watershed Area: 215 square miles (137,600 acres)

30 miles of shoreline ringing the bay

Bay is 17.4 square miles (28 square kilometers)



Dominant or Interesting Habitats

Tomales Bay has intertidal, subtidal, and benthic habitats as well as dunes, mud flats, salt marshes, and freshwater marshes (TBWC, 2003). Large eelgrass beds grow in the northern half of the bay with smaller ones lining the eastern shore. Small islands provide roosts for birds and haul out areas for marine mammals. Tomales Bay is included in the Gulf of the Farrallones National Marine Sanctuary. It is also part of the Central California Coastal Biosphere Reserve and the Western Hemisphere Shorebird Reserve Network (TBWC, 2003). In 2002, the U.S. Fish and Wildlife Service (USFWS) designated Tomales Bay as a Wetland of International Importance (Tomales Bay Watershed Council [TBWC], 2003).

Special Species

Special status species: Tomales Bay and its watershed support over 900 species of plants and animals, including many that are listed as threatened or endangered or are identified as species of concern by state and federal agencies. Among the special status species are coho salmon, Chinook salmon, steelhead trout, tidewater goby, Tomales roach, western snowy plover, California brown pelican, Point Reyes jumping mouse, Steller sea lion, clapper rail, and California least tern.

Other species of interest: Approximately 45% of all bird species in North America have been recorded in the adjacent Point Reyes peninsula, while as many as 50,000 waterbirds may depend on Tomales Bay during winter (Kelly & Tappen, 1998). Approximately 300-600

harbor seals live in Tomales Bay. Gray whales forage at the mouth of the bay and at times enter the bay (USDA, 2001). Pacific herring runs support a small commercial fishery. Tomales Bay has the second largest mariculture industry in the state.

WATERSHED PLANNING AND MANAGEMENT

Concern about the water quality of Tomales Bay surfaced in the early 1960s when studies showed high fecal coliform counts in the winter months (Smith, et al., 1971). Subsequent studies (Sharpe, 1974; Jarvis, et al., 1978; Musselman, 1980) confirmed that fecal coliform levels rose following heavy rains and concluded that "a mixture of rural and livestock nonpoint point pollution was the most likely source of high bacterial counts in the bay." (TBWC, 2003). In 1993, the California Legislature passed the Shellfish Protection Act, which required the appropriate RWQCB to form a technical advisory committee for any commercial shellfish growing area that is determined to be threatened by water quality. The Tomales Bay Shellfish Technical Advisory Committee (TBSTAC) was formed in 1994 and undertook a two-year investigation into sources of non-point pollution (TBSTAC, 2000). During the 1990s, the National Science Foundation's Land Margin Ecosystem Research (LMER) program implemented an extensive study on water quality, bay water mixing, and nutrient dynamics. The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) is currently investigating the impacts of mercury washed from the Gambonini Mine in the Walker Creek watershed into Tomales Bay. The National Park Service (NPS), UCCE, California Department of Health Services (DHS), Audubon Canyon Ranch, and many universities and private researchers have also contributed to the understanding of the bay through studies and assessments.

The construction of Soulajule Dam on Walker Creek and the raising of Peters Dam on Kent Lake, followed by the intense winter storms of the early 1980s, galvanized community concern around increasing sedimentation of Tomales Bay and declining salmonid runs in the tributary streams. The State Coastal Conservancy implemented their Program for Restoring Tomales Bay in 1984 and funded many projects to reduce sedimentation and repair streams and wetlands damaged by the storms.

Many community groups, individual residents, and agencies have worked together to protect and restore Tomales Bay. The Environmental Action Committee, Tomales Bay Association, Inverness Foundation, Audubon Canyon Ranch, kayak companies, and oyster growers have worked on restoration and education efforts. The Marin Agricultural Land Trust (MALT) holds conservation easements on 26,000 acres in the Tomales Bay watershed (TBWC, 2003). Marin RCD and Point Reyes National Seashore (PRNS) have undertaken major restoration programs to improve water quality and restore habitat. UCCE spearheaded the Marin County Coastal Enhancement Program in 1995 and has recently initiated a pilot program to restore native oysters in the bay. UCCE has also provided ongoing support to Tomales Bay Agriculture Group (TBAG), a group of agricultural operators working to improve water quality and stream resources on their ranches. NRCS has provided financial and technical assistance to watershed landowners to implement Best Management Practices (BMPs). PRNS, Tomales Bay State Parks, and Marin County manage recreational use of the bay.

The Tomales Bay Watershed Council (TBWC) was formed in 2000 with 24 members representing residential and community groups, agricultural interests, environmental groups, maricultural interests. recreational interests, and public agencies. The Tomales Bay Draft Watershed Stewardship Plan, completed by TBWC in 2003, identifies the following goals, objectives, and tasks:

Goal A. Ensure water quality in Tomales Bay and tributary streams sufficient to support natural resources and sustain beneficial uses.

Objective 1: Improve water quality in Tomales Bay and tributary streams through reductions in sediment, pathogen, mercury, and nutrient loading – with the specific objectives of removing Tomales Bay from the 303(d) list of impaired waterbodies and reducing shellfish harvest closures by increasing the rainfall threshold and reducing the minimum duration of shellfish harvest closures.

Objective 2: Restore and maintain adequate high quality freshwater flow to Tomales Bay and tributary streams.

Objective 3: Reduce potential for other contaminants in Tomales Bay.

Goal B. Restore and preserve the integrity of natural habitats and native communities.

Objective 1: Restore and protect populations of native species in the Tomales Bay watershed.

Objective 2: Control invasive non-native species in the Tomales Bay watershed.

Objective 3: Restore and protect habitats of native species in the Tomales Bay watershed.

Objective 4: Restore and protect the hydrologic integrity of the Tomales Bay watershed.

Goal C. Develop strategies to implement the Stewardship Plan and to protect the watershed.

Task 1: Encourage comprehensive planning to address watershed issues and facilitate interagency coordination and cooperation.

Task 2: Monitor implementation of the plan. Develop recommendations for public policies and programs to achieve the goals of the plan.

Task 3: Define the role of TBWC in helping to ensure implementation and achievement of plan goals.

Task 4: Involve and educate the public to become watershed stewards.

- Encourage public awareness and participation in developing and implementing a watershed plan.
- Promote and coordinate watershed education.
- Promote volunteer efforts.
- Promote watershed stewardship.

IMPORTANT WATERSHED ISSUES

1. **Water quality.** Tomales Bay is identified by the SFBRWQCB as impaired for sedimentation, nutrients, pathogens, and mercury. Current efforts to reduce pollution are focused on human pathogen sources from failing septic systems and inadequate facilities for recreational users, animal waste from agricultural operations, mercury-contaminated sediments from the Gambonini Mine, and sediment from erosion throughout the watershed.
2. **Water quantity.** MMWD reservoirs "now capture about 40% of the freshwater that historically flowed into the bay" (TBWC, 2003). Irrigation systems, small dams, and domestic water supply systems also reduce flow. Freshwater is important in the bay for diluting pollutants, moderating salinity levels, and maintaining the bay's natural circulation patterns.
3. **Habitat protection and restoration.** Diverse and well-functioning habitat is key to maintaining the population sizes and number of species of Tomales Bay plants and wildlife. Control of invasive non-native plants and animals is an important component of habitat protection.
4. **Balancing recreation with healthy habitat.** Tomales Bay is a popular destination for camping, fishing, kayaking, clamming, and simply enjoying the area's beauty. Balancing visitor use with protecting sensitive species, keeping the water clean, and maintaining the bay's serenity is a formidable challenge.
5. **Maricultural viability.** When water quality in the bay exceeds certain standards, DHS prohibits the harvesting of shellfish, which results in a direct economic impact on the oyster industry.
6. **Education and outreach.** The Tomales Bay Stewardship Plan states that "an aggressive public outreach and education program directed at residents and visitors to the watershed will be essential for the reduction of the impacts of ever-intensifying patterns of usage."
7. **Coordination of watershed efforts.** With so many agencies, interest groups, residents, and visitors involved in Tomales Bay, coordination of monitoring, planning, implementation, and education efforts is vital.

WATERSHED NEEDS

The Tomales Bay Watershed Stewardship Plan contains the following 4 actions:

Action 1.0 Develop a coordinated and comprehensive water quality monitoring plan for Tomales Bay and tributary streams.

Action 2.0 Support implementation of practices and projects that will reduce nonpoint sources of water pollution and enhance habitats in Tomales Bay and its watershed.

Action 3.0 Assess, protect and restore key habitats for species of local interest.

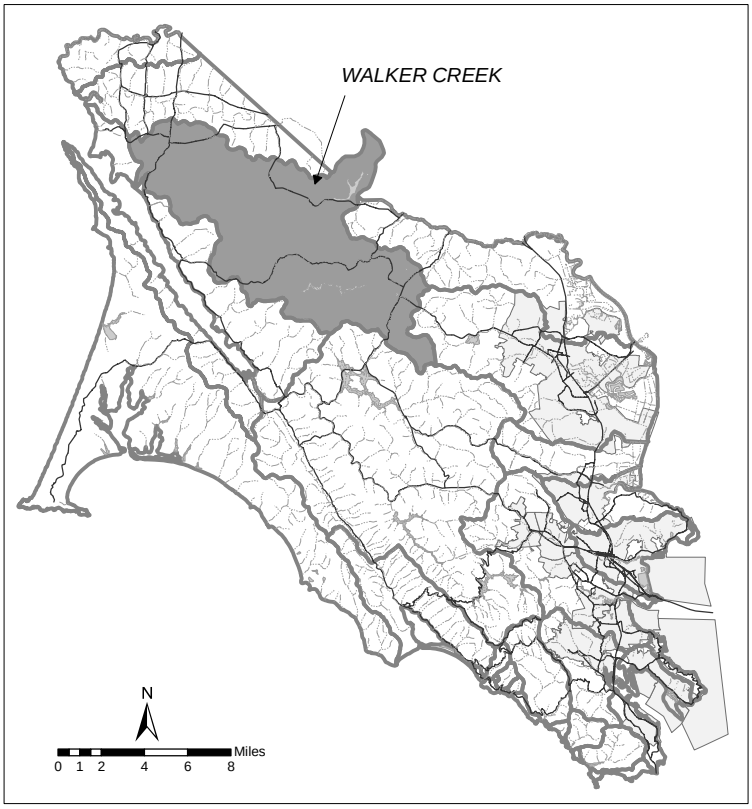
Action 4.0 Promote and support public outreach and education about Tomales Bay and its watershed.

Each action is then followed by specific recommendations organized by priority and urgency. The full "Framework for Watershed Stewardship" section of the Stewardship Plan is included as Appendix E herein.

TOMALES BAY – WALKER CREEK SUBWATERSHED

GENERAL DESCRIPTION

Topography in the 76-square mile Walker Creek watershed ranges from 1,500 feet to sea level where the creek empties into Tomales Bay just south of its mouth. The northern tributaries, Keyes Creek and Chileno Creek, flow through wide valleys with gentle, grassy hills. The upper watershed is much more rugged with extensive areas of coast live oak forest.



The watershed contains a 220-acre natural lake, Laguna Lake, at the top of Chileno Valley. Soulajule Reservoir, constructed in 1968 in Arroyo Sausal and enlarged in 1980, is managed by the Marin Municipal Water District (MMWD).

Since European settlement, the land use has been almost exclusively agricultural. Cattle ranching is the predominant industry, along with a few sheep ranches and dairies. Vineyard development has spread into the eastern edge of the watershed. The only concentrated development in the watershed occurs in the small town of Tomales.

Watershed Area: 76 square miles (48,640 acres)
Subwatershed area of major tributaries:

- **Chileno Creek:** 19.8 square miles (12,672 acres)
- **Salmon Creek:** 5.1 square miles (3,264 acres)
- **Keyes Creek:** 4.7 square miles (3,008 acres)
- **Arroyo Sausal:** 7.6 square miles (4,864 acres)

DOMINANT OR INTERESTING HABITATS

The Walker Creek watershed is a mosaic of grassland, mostly annual but grading towards perennial towards the coast, valley foothill riparian forest, coastal scrub, and oak bay woodland. A small stand of redwood trees is growing in the upper reaches of the Arroyo Sausal drainage. Laguna Lake in Chileno Valley is a shallow natural lake. Officially classified as a vernal pool, it retains water year round although it diminishes significantly in area during

the summer. The lake is used extensively for migrating and breeding waterfowl. Wetlands at the mouth of Walker Creek are also important habitat for waterfowl.

Mainstem Walker Creek contains areas of thick riparian forest, some of which are contiguous to upland forest. Other areas, particularly in the Chileno and Keyes Creek subwatersheds, have little mature riparian forest remaining, although efforts are underway to re-establish native riparian vegetation.

SPECIAL SPECIES

Special status species: Steelhead trout, coho salmon, California freshwater shrimp, California red-legged frog, yellow-legged frog, Tomales roach, tidewater goby, and northwestern pond turtle have been observed in the watershed. Special status plants known to occur include Baker's larkspur and checker bloom.

Other species of interest: The Walker Creek grasslands are excellent places to find raptors including Swainson's hawks, ferruginous hawks, and golden eagles. Restored riparian corridors in Chileno Valley attract a variety of neotropical songbirds species, including warblers, vireos, flycatchers, and thrushes.

LAND USE

Ninety-five percent of the Walker Creek watershed is in private ownership. MMWD owns land around Soulajule Reservoir, and the Marin County Office of Education operates the Walker Creek Ranch as an outdoor education facility.

Since European settlement, the watershed has been used for food production. Marin County was a primary source of beef and butter for early San Francisco. Potatoes, barley, and other grains were also grown in the watershed. From the 1850s into the early 1870s, potatoes were loaded onto shallow barges in Keyes Creek immediately downstream of the present Highway 1 bridge (UCCE, 1995). The current small size of the channel at this location, more suitable for a canoe than a barge, is dramatic evidence of significant watershed change over the past 150 years. Historic sedimentation has been linked to the disturbance of the native grassland through cultivation, change in species composition as introduced annual grasses gained dominance, and concentrated livestock use (Zumwalt, 1972).

Mercury was mined at three sites in the Walker Creek watershed after World War II. The largest mine, at the Gambonini Ranch near the confluence of Salmon Creek and mainstem Walker Creek, closed in 1970. The severe storm of January 1982 destabilized the mine site and sent massive amounts of mercury-laden sediment into Walker Creek. The federal EPA, working with the SFBRWQCB, completed remediation of the site in 2000.

Current land use in the watershed is almost exclusively agricultural with the exception of residential use in Tomales. Beef is the primary agricultural product. Few dairies are left in the watershed. One vineyard has been established in the Salmon Creek subdrainage, a small organic apple orchard has been planted in Chileno Valley, and one farm is producing organic strawberries.

WATERSHED PLANNING AND MANAGEMENT

MMWD commissioned several studies to assess the impact of raising Soulajule Dam on the Walker Creek fishery. In addition to recommending summer releases to sustain year round flow, Kelley (1976) found that streambed sedimentation contributed to the decline of salmonid populations. However, he identified "the accelerated runoff and intensification of the flash characteristics of floods" caused by overgrazing as the major culprit. After the big storms of the early 1980s, Bratovich (1984) and Rich (1989) identified embedded gravels and cobbles as a major factor in limiting salmonid populations. Rich also strongly recommended incorporating habitat and fishery monitoring into restoration activities.

The Marin RCD commissioned an early hydrology study on the Lagunitas and Walker Creek watersheds (Nolte, 1965). The study estimated peak flood flows at 20 stations along Walker Creek and estimated annual average sediment yields to be 250 to 300 tons per square mile. In 1986, Marin RCD received $1 million in finding as part of the State Coastal Conservancy's Tomales Bay Enhancement Program to repair 14 large-scale erosion sites. At that time, over $6 million of erosion control projects were identified, not including landowner outreach, contract management, design, or permitting costs (Prunuske Chatham, Inc., 1986).

The Walker Creek Watershed Enhancement Plan (Prunuske Chatham, Inc. [PCI], 2001), a project of Marin RCD, is focused around five landowner goals developed through an intensive community outreach effort:

A. Support a strong agricultural economy.
B. Provide clear, factual information on the issues facing Walker Creek.
C. Help landowners implement land management practices that support a healthy environment.
D. Provide education for the public.
E. Work with regulatory agencies to reduce the burden on the watershed's private landowners.

The plan included an erosion site inventory and a riparian habitat assessment (Prunuske Chatham, Inc., 2001). Lands above Soulajule Reservoir and Laguna Lake were excluded because the survey focused on salmonid habitat. Of the 196 erosion sites inventoried, 30% rated a high priority based on impacts to fisheries resources, erosion potential, activity, and access. Marin RCD is currently working with landowners, NRCS, and grant funders to implement and manage the erosion control and riparian habitat enhancement recommendations.

Additional erosion control work has been performed by private landowners, as well as the Marin Motorcycle Club on the Gambonini Ranch and the Marin County Office of Education on the Walker Creek Ranch. NRCS continues to provide technical assistance and cost-share programs, particularly EQIP funds that encourage landowners to implement best management practices. UCCE offers ongoing range management education and advice to Walker Creek watershed ranchers. UCCE staff members are also working closely with

TBAG, which includes several Walker Creek watershed agricultural landowners, to monitor water quality on participating dairies and to implement measures to reduce targeted pollutants.

The SFBRWQCB is continuing to monitor mercury movement through sediments and bioaccumulation in Walker Creek and Tomales Bay. In addition, Marin RCD, NRCS, and the Point Reyes Bird Observatory (PRBO) employed a Riparian Habitat Conservationist for almost 2 years to encourage restoration and to monitor changes in songbird populations after restoration.

IMPORTANT WATERSHED ISSUES

1. **Water quality**. Walker Creek is listed as an impaired waterbody for nutrients, sediment/siltation, and heavy metals (mercury). Pathogens, primarily E. coli, are also a concern because of their impact on the Tomales Bay shellfish industry. CDFG has also expressed concern over the impacts of high water temperatures on salmonids. TBAG, UCCE, NRCS, and Marin RCD have made significant progress in working with dairies to reduce nutrient and pathogen levels. Marin RCD and NRCS have implemented an aggressive program of riparian restoration to improve water quality through creating buffers for rangeland runoff, reducing soil erosion, and cooling water temperature.
2. **Riparian habitat restoration.** In addition to providing water quality benefits, riparian restoration improves habitat for salmonids and many other aquatic and terrestrial wildlife species.
3. **Range management**. Productive, healthy grasslands are vital to the agricultural economy, good water quality, and biodiversity. UCCE and NRCS provide technical assistance to Walker Creek landowners in planning and implementing range management practices. Emphasis is placed on improving distribution of livestock to reduce prolonged concentrated utilization of grassland and riparian areas and to provide periods of rest for improved grassland.
4. **Agricultural viability.** The dairy industry has been steadily declining in the Walker Creek watershed. As in most of western Marin County, agricultural producers, particularly livestock growers, are struggling to stay profitable. Diversification, marketing, and relief from regulatory costs are important watershed issues.
5. **Mercury.** Elevated levels of mercury have been found in sediment in the Walker Creek delta (Whyte, 2000). Although the largest mercury source, the Gambonini mine, has been stabilized, the mercury remains in sediment moving through the stream system and into Tomales Bay. High mercury levels were also found in fish collected from Tomales Bay (Whyte and Kirchner, 2000). More investigation is needed to directly relate the mercury concentrations in Tomales Bay sediments with the mercury in the fish tissue. Nonetheless, managing the mercury-contaminated sediment within the Walker Creek system for the least possible impact on downstream resources and human health is a critical issue for the Walker Creek watershed.

6. **Landowner participation.** Because there is so little publicly managed land within the watershed, enhancement efforts and ongoing good stewardship are dependent on the willing participation of private landowners.
7. **Invasive non-native plants.** Invasive non-native plant species (i.e., distaff, star and other thistles, scotch broom, and gorse) are displacing native vegetation and are reducing the extent and quality of habitats for native species.

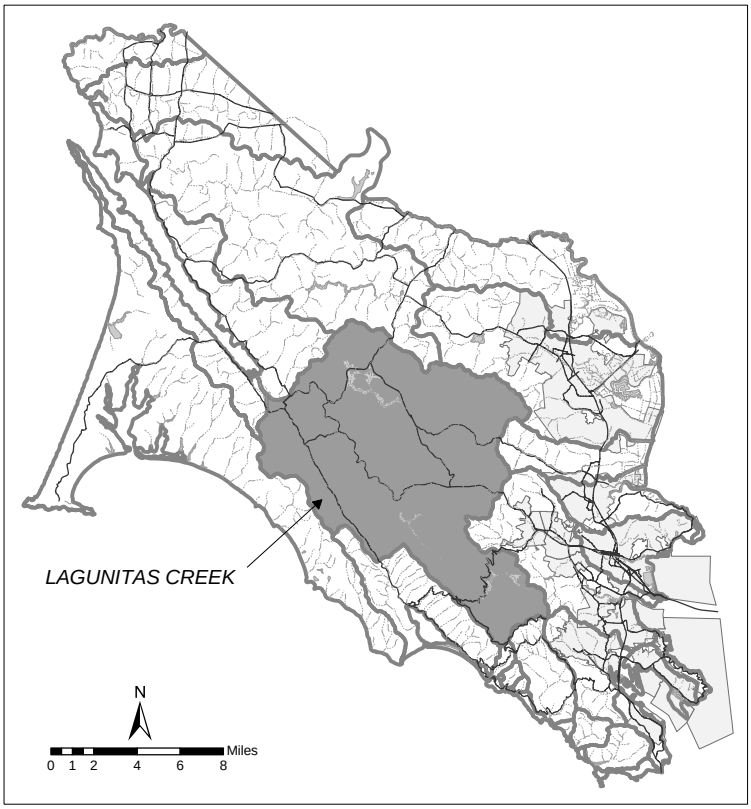
WATERSHED NEEDS

1. Continued funding of efforts to improve water quality, control erosion, and enhance habitat. Current target areas include the Chileno Creek subwatershed, Laguna Lake, the Keyes Creek subwatershed, and large-scale streambank erosion on mainstem Walker Creek upstream of the Highway 1 bridge.
2. Effectiveness monitoring and maintenance of completed projects.
3. Support with and simplification of permits for habitat enhancement and agricultural operations.
4. Limiting factors analysis for steelhead and coho. Monitoring of salmonid habitat and populations.
5. Fluvial geomorphic analysis to provide a scientific basis for selection, design, implementation, and monitoring of future fisheries habitat enhancement and sediment reduction projects. Marin RCD has received a grant from the State Water Resources Control Board (SWRCB) to conduct this analysis.
6. A monitoring program for sediment, water temperature, and other water quality parameters, as well as of neotropical songbird use of riparian corridors. Primary partners in developing and implementing the program should be UCCE, TBAG, PRBO, and other watershed landowners. The program should include instruction in self-monitoring for landowners.
7. Continued support of outreach and stewardship education efforts, including landowner workshops, tours, watershed-specific informational materials, and Marin RCD's watershed newsletter. Specific landowner education needs include managing grazing in riparian pastures, weed management, and permitting.
8. Ongoing riparian habitat mapping to measure restoration accomplishments and identify gaps.
9. Development of practical and effective TMDLs and attainment strategies.
10. Control of invasive, exotic plants.

TOMALES BAY – LAGUNITAS CREEK SUBWATERSHED

GENERAL DESCRIPTION

The Lagunitas Creek watershed is the largest drainage into Tomales Bay. Its major tributaries include San Geronimo Creek, Devils Gulch, Cheda Creek, Nicasio Creek, and Olema Creek. At the southwestern edge of the watershed, Olema Creek flows in nearly a straight line through a rift valley along the San Andreas Fault zone.



Over half of the watershed is in public ownership. The upper part is owned and managed by MMWD for water supply. Samuel P. Taylor State Park is completely within the watershed boundaries. PRNS and Golden Gate National Recreation Area (GGNRA) manage extensive holdings north and west of Samuel P. Taylor State Park and in the Olema Creek and Bear Creek subdrainages.

The Lagunitas Creek watershed holds many small rural communities — Woodacre, San Geronimo, Forest Knolls, and Lagunitas in San Geronimo Valley, as well as Nicasio, Olema, and Point Reyes Station. It has been the focus of salmonid restoration efforts for over twenty years. Coho salmon populations have rebounded from tens of fish spawning in the early 1980s to an average of 500 adults in the past few years. The creek system also supports a robust population of steelhead trout. Chinook, and chum salmon have been observed in small numbers in recent years.

Watershed Area: 103 square miles (65,920 acres)
Subwatershed area of major tributaries:
- **Olema Creek:** 14.5 square miles (9,280 acres)
- **Nicasio:** 37 square miles (23,680 acres)
- **San Geronimo:** 9.3 square miles (5,952 acres)

Reservoirs: Kent, Alpine, Bon Tempe, Lagunitas, and Nicasio

DOMINANT OR INTERESTING HABITATS

The upper Lagunitas Creek watershed is steep and fairly heavily forested. Parts of San Geronimo Creek, Olema Creek, and mainstem Lagunitas Creek through Samuel P. Taylor State Park have areas of dense redwood growth and cool water year-round. These reaches provide spawning and rearing habitat for salmonids. Except for a few open areas, most of Lagunitas Creek downstream of the state park is thickly forested with willows and alders. The valley opens below Tocaloma Bridge to broader, more gently sloping hills that are primarily used for livestock grazing.

Plant communities include coast redwood forest, mixed evergreen forest, oak woodland, non-native grassland, northern coastal scrub, coastal riparian forest, chaparral, freshwater marsh, and coastal salt marsh. Roy's Redwoods, a Marin County Open Space District (MCOSD) property in San Geronimo Valley, retains a beautiful grove of old growth redwood trees, as do parts of Samuel P. Taylor State Park. An area of serpentine soils on Carson Ridge above Woodacre and San Geronimo supports a stand of Sargent cypress trees as well as other uncommon plants, including serpentine reed grass. Several tributaries, such as Devils Gulch, have excellent examples of mature riparian forest with a rich diversity of plants, including redwoods, California nutmeg and many shrub species. Olema Marsh at the confluence of Olema Creek, Bear Creek, and Lagunitas Creek is one of the largest freshwater marshes in Marin County.

SPECIAL SPECIES

Special status species: The Lagunitas Creek watershed supports a significant population of wild coho salmon, with some estimates ranging as high as 10% of the population for the Central California Coast Evolutionarily Significant Unit (ESU). It also has steelhead trout, California freshwater shrimp, northern spotted owl, and California-red legged frog. Tiburon paintbrush and Marin dwarf-flax are two listed plant species with recorded occurrences in the watershed.

Other species of interest: Chinook and chum salmon were observed in Lagunitas Creek during the 2001/02 and 2002/03 winters. Pacific lampreys spawn in Lagunitas Creek. Until the early 1980s, green sturgeon used the lower reaches. Mountain lions are frequently seen in the watershed. Foothill yellow-legged frogs occur in some of the smaller tributary streams, and river otters have frequently been sighted in the mainstem of Lagunitas Creek**.** Serpentine endemic plants are also found within the watershed.

LAND USE

The Lagunitas Creek watershed has a mix of recreational, agricultural, water supply, and residential use. Commercial logging began in the upper Lagunitas Creek watershed in the 1860s and moved downstream until nearly all of the old growth Douglas fir and redwood trees were harvested (UCCE, 1995). Logging continued in the Olema Creek watershed until 1962. Major fires have burned portions of the watershed several times.

Samuel P. Taylor built the west's first paper mill on mainstem Lagunitas Creek near Devils Gulch in 1856. Lagunitas Creek is still referred to as "Papermill Creek" by many local residents. Dairy farming, beef and sheep production, and potato growing dominated the

more open landscapes of the lower watershed and San Geronimo, Nicasio and Olema Valleys. Gravel. Sand was mined from the streambed at the confluence of Lagunitas and Nicasio Creeks until a short time after Nicasio Dam was constructed in 1960. Ranchers regularly harvested small amounts of streambed gravel to maintain ranch roads through the 1980s.

The first reservoir, Lake Lagunitas, was built in 1872, followed by Alpine Lake in 1918, and then by Bon Tempe in 1948. Peters Dam, built in 1953 to form Kent Lake, was raised 45 feet in 1982, nearly doubling reservoir capacity from 16,600 acre feet to 33,000 acre feet. The last reservoir to be built in the watershed was Nicasio Reservoir, formed by Seeger Dam in 1960, on Nicasio Creek. In addition to blocking anadromous fish passage to miles of spawning and rearing habitat, the impoundments have altered streamflows and reduced bedload transport from the upper reaches of the watershed.

In the early 1920s, Olema Creek between the town of Olema and its confluence with Lagunitas Creek was straightened into the 3-kilometer long "Olema Canal" that drained the surrounding land for agricultural production. Olema Creek is currently reclaiming its historic configuration in an interesting example of restoration through a change in management, which in this case consists of no longer maintaining the straightened channel.

Ranching on land leased from NPS continues on the east side of Olema Valley and in Lagunitas Valley. Private ranching also occurs within Nicasio Valley, and one cattle ranch remains in San Geronimo Valley. Horse boarding facilities are located in Nicasio, Olema, and San Geronimo Valleys. Residential development is concentrated in the upper and lower ends of the watershed in San Geronimo Valley and Point Reyes Station.

Recreational use of the extensive public lands in the watershed includes hiking, bicycling, horseback riding, and camping in the state park. The railroad right-of-way from Tocaloma Bridge south through the state park has been converted into a trail.

WATERSHED PLANNING AND MANAGEMENT

The raising of Peters Dam initiated a period of intensive analysis of the geomorphology and aquatic habitat of Lagunitas Creek. Local residents and public agencies were concerned that the expansion could severely threaten the fragile salmonid runs. In the late 1970s, CDFG and MMWD initiated a series of investigations into salmonid habitat and sediment transport in order to evaluate proposed flow releases from Kent Lake.

In 1994, MMWD began a sediment management and monitoring program to reduce the annual fine sediment load from San Geronimo Creek through a combination of source control and small sediment traps. State Water Resources Control Board Order WR 95-17 set instream flow and temperature requirements and mandated that MMWD implement a comprehensive sediment and riparian management plan. The order also requires MMWD to monitor for coho salmon, steelhead trout, and freshwater shrimp populations in Lagunitas Creek (SWRCB, 1995). MMWD is continuing to prioritize and undertake projects to improve bed conditions and instream habitat in Lagunitas Creek. Their work in the

watershed is being assisted by a Technical Advisory Committee, which includes representatives from public resource agencies, environmental organizations, and academia.

Marin RCD completed an earlier round of erosion control projects in the Lagunitas Creek watershed between 1983 and 1987. An important part of the Marin RCD program was to coordinate the maintenance of unsurfaced ranch and fire roads by the Marin County Fire Department, MMWD, Samuel P. Taylor State Park, and local ranchers. Marin RCD, working with TBWC, received a grant from the SWRCB for a salmonid limiting factor analysis, prioritization and implementation of restoration and sediment control projects, and public outreach. As the largest system entering the bay, the Lagunitas Creek watershed is a major element in the draft Tomales Bay Watershed Stewardship Plan (TBWC, 2003).

PRNS commissioned a study to identify sediment sources in Olema Creek, to compare current and historic rates of erosion and sedimentation, and to develop watershed management recommendations (Questa, 1990). In 1999, they instituted a water quality monitoring program on NPS watershed lands with testing for many parameters including total suspended sediments (PRNS, 2001). PRNS has focused on enhancing aquatic habitat on their lands through riparian protection, removal or modification of barriers to fish passage, range management, and erosion control. PRNS is currently in the planning phase of a major restoration of the Giacomini Ranch at the downstream end of Lagunitas Creek. Diked for agricultural use in the 1960s, 563 acres will be restored to a complex of salt and freshwater wetlands.

Local residents have been a driving force in protecting and restoring the Lagunitas Creek watershed. Trout Unlimited volunteers maintained hatch boxes in the mid 1980s on small tributary streams where eggs stripped from wild Lagunitas Creek coho salmon were protected from predators and unstable bed conditions. Trout Unlimited also organized numerous volunteer projects in the watershed, several of which drew hundreds of people to help on erosion control and instream habitat projects. The Salmon Protection and Watershed Network (SPAWN) has undertaken water quality monitoring, spawning salmonids surveys, assessment, community outreach, and restoration projects. The Tomales Bay Association initiated the first riparian fencing projects in Olema Creek and began coho monitoring in the mid 1980s.

As an element of the SWRCB Order WR 95-17, MMWD initiated the development of a memorandum of understanding (MOU) for the maintenance and management of unpaved roads in the Lagunitas Creek watershed. Signatories to the MOU include MMWD, County of Marin, MCOSD, DPR, NPS, and Marin RCD. The intent of the MOU is to foster a consistent working relationship for sediment control and sediment reduction from unpaved roads in the watershed in order to benefit the creek habitat for coho salmon and steelhead trout.

Between May 2002 and June 2003, Ross Taylor and Associates evaluated county-maintained stream crossings within Marin County to assess juvenile and adult salmonid passage (Draft, June, 2003). The survey focused primarily on stream crossing that historically or currently support populations of coho salmon and/or steelhead. The report also includes site-specific

treatments and scheduling. The highest priority sites occur within the Lagunitas Creek and Bolinas Lagoon watersheds.

IMPORTANT WATERSHED ISSUES

1. **Water quality and quantity**. Lagunitas Creek is listed as an impaired waterbody for sediment/siltation, nutrients, and pathogens. Much of the focus to date has been on sediment and its impact to aquatic habitat. Streambank erosion in the upper watershed; the network of old logging, fire control, private access, and ranch roads; and livestock-related erosion have been identified as sediment sources. Maintaining adequate flows will be an issue into the future.
2. **Aquatic habitat**. Lagunitas Creek is extremely important to the survival of coho salmon in the Central Coast ESU. It also supports the largest remaining population of California freshwater shrimp. Managing sediment delivery and transport, maintaining stream flows through water releases from Kent Lake, and protecting riparian habitat and water quality are ongoing concerns.
3. **Fish passage.** Salmonid access to small tributary streams with good spawning and rearing habitat is a critical issue in Olema Creek and the tributaries to San Geronimo Creek.
4. **Agency and community coordination.** Because of the intertwining public and private ownership throughout this watershed, overlapping jurisdictions between agencies, and the scarcity of financial resources, close coordination is essential for effective use of funding and management resources.
5. **Community participation**. Lagunitas Creek inspires passionate commitment from its community. Opportunities for participation in planning and monitoring, volunteer enhancement projects, and education efforts are important to local residents.
6. **Water supply.** The Lagunitas Creek watershed supplies most of the water for MMWD. Management of the lands draining into the MMWD reservoirs for reliable, high quality water is vital to Marin County.

WATERSHED NEEDS

1. Limiting factors analysis for salmonids and California freshwater shrimp. Restoration priorities based on limiting factors.
2. Ongoing funding to implement erosion control and habitat restoration projects.
3. Maintenance and effectiveness monitoring of completed projects.
4. Analysis of sediment monitoring data collected by MMWD and a review and possible update of the sediment monitoring program.
5. Coordinated water quality and quantity monitoring program involving state, federal, county, and private landowners.
6. Outreach to rural residential landowners on good stewardship practices, including maintaining driveways and private roads, increasing permeability, using native plants,

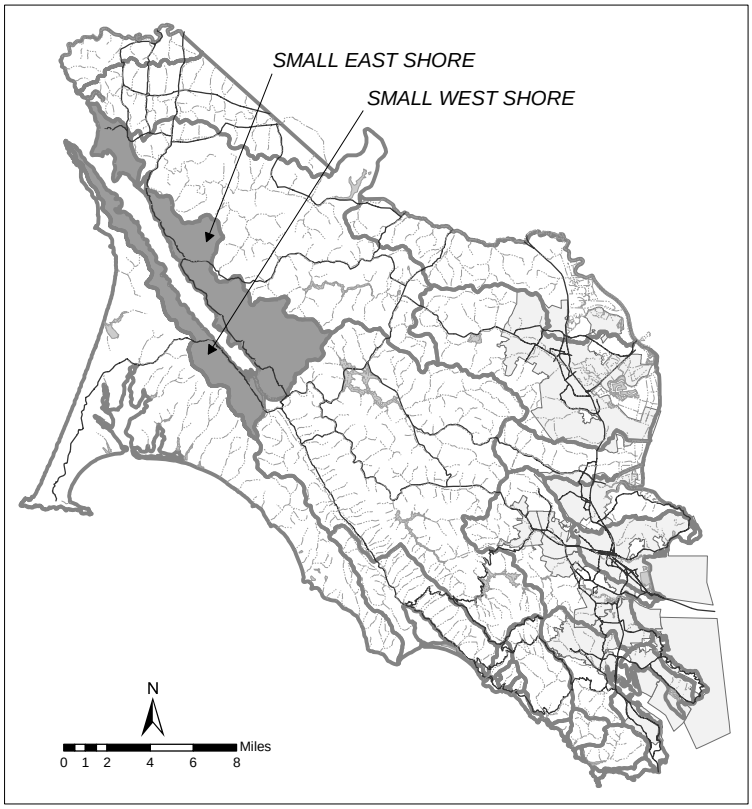
keeping horses and other animals, and reducing the use of toxic chemicals in their yards and homes.

7. Development and implementation of a comprehensive habitat management plan for the Olema Creek watershed that considers salmonid habitat, agricultural land use, and wetland restoration.
8. Evaluation of septic systems in San Geronimo Valley and other areas of rural residential development. Implementation of measures to improve septic system function.
9. A watershed forum, perhaps a subcommittee of the TBWC, to facilitate coordinated planning, monitoring, and project implementation by federal, state, and county agencies that manage land within the watershed. The current group formed to advise Marin RCD on the Proposition 13 grant funding could form the starting point for such a forum.
10. Development of practical and effective TMDLs and attainment strategies.
11. Coordinated implementation of the multi-agency MOU for maintenance and management of unpaved roads in the Lagunitas Creek watershed.
12. Restoration of the natural hydrologic processes on the Giacomini Ranch at the mouth of Lagunitas Creek.
13. Implement restoration planning based on fish passage evaluation recommendations within Lagunitas Creek.

TOMALES BAY – SMALL EAST AND WEST SHORE TRIBUTARIES

General Description

The small tributaries draining the east and west sides of Tomales Bay encompass approximately 30 square miles. The east shore drainages include Millerton Gulch, Grand Canyon, Tomasini Canyon, and other unnamed tributaries. Haggerty Gulch, Fish Hatchery Creek, Redwood Creek, and First, Second, and Third Valley Creeks drain into Tomales Bay along the western shore. These small watersheds occur on both public and private lands.



Dominant or Interesting Habitats

Along the western shore the primary vegetation communities consist of coastal scrub, oak bay woodland, and grassland habitats. The eastern shore is largely grassland with isolated patches of oak bay woodland, coastal scrub, and eucalyptus. Fresh and saltwater marshes line Tomales Bay (see description of Tomales Bay for more information). Scattered stands of coastal terrace prairie are found within the tributaries along the east shore.

Special Species

Special status species:

East shore drainages: Steelhead trout have been recorded in Millerton Gulch and Tomasini Canyon. California red-legged frog are also abundant in drainages along the east shore. Myrtle's silverspot butterfly has also been observed within the watershed. Special status plants such as fragrant fritillary and Point Reyes bird's-beak have been identified along the east shore.

West shore drainages: Many of the streams that drain Inverness Ridge are perennial, with the exception of the drainages at the northern tip, and many support steelhead populations. Northern spotted owls have been observed in isolated patches along the west shore. Special status plants including Point Reyes bird's-beak, San Francisco owl's-clover, and swamp harebell occur along the west shore.

Other species of interest: The shores of Tomales Bay are prime habitat for many species including birds, marine mammals, invertebrates, and fishes. Seals and seal lions use the shores for foraging and as haul-out sites. Huge numbers of birds, including 20,000 wintering shorebirds and up to 25,000 waterbirds, utilize the shores both year-round and during migration .

LAND USE

With the exception of the communities of Inverness and Inverness Park, most of the land along the western shore of Tomales Bay is in public ownership and is managed for recreational use. PRNS and Tomales Bay State Park are the primary landowners. In contrast, the eastern drainages are mostly on private lands with agricultural and residential uses. Miller County Park offers boat launching facilities on the east shore, and Tomales Bay State Park has facilities at Tomasini and Millerton Points and a small parcel adjacent to Cypress Grove. The California Department of Parks and Recreation (DPR) also operates the Marconi Conference Center. Cypress Grove is a 139-acre reserve owned and managed by the Audubon Canyon Ranch on the east shore of the bay. PRNS owns the former site of the historic town of Hamlet

WATERSHED PLANNING AND MANAGEMENT

After the devastating 1982 storm, the State Coastal Conservancy undertook a broad analysis of the Tomales Bay drainage. Their 1984 *Program for Restoring the Environment of Tomales Bay* recommended 7 restoration and acquisition projects at sites along Tomales Bay. Under this Coastal Conservancy program, the Inverness Foundation, a private non-profit organization, undertook work on First, Second, and Third Creeks to remove debris accumulated from the storm, repair damaged banks, and replant riparian trees. Audubon Canyon Ranch completed initial work to restore the hydrology of Olema and Livermore Marshes, and Marin County and the Marin Conservation Corps repaired storm damage on Fish Hatchery and Haggerty Gulch Creeks.

The *Marin Coastal Enhancement Plan* (1995) presented general recommendations to reduce nonpoint source pollution from lands draining into the bay. The plan identified the need for more assessment of aquatic habitat needs, support to help private landowners develop management strategies, and funding to implement conservation projects. All of the tributaries draining into the bay are addressed in the *Tomales Bay Watershed Stewardship Plan* (TBWC, 2003). The Stewardship Plan is discussed above under Tomales Bay.

TBAG is an organization of agricultural producers, many from the eastern drainages, that is working with UCCE , Marin RCD, and NRCS to implement water quality improvement practices and monitor their effectiveness. Marin RCD and UCCE have received a grant from the SWRCB from Proposition 13 bond funds for projects to address polluted dairy runoff and restore riparian corridors. Although some of these funds may be spent in the Walker Creek and Lagunitas Creek drainages, a primary focus of the grant is to bring assistance to the small tributaries on the eastern side of the bay. Marin County Environmental Health Services (EHS) has also received Proposition 13 funding to design and begin construction of

small treatment facilities for residential wastewater from homes and businesses along the eastern shore.

The Tomales Bay Association (TBA) has been actively involved in the Tomales Bay watershed and has conducted salmonid monitoring, restoration and riparian habitat improvements, and livestock fencing projects. In addition, they have published several educational documents and played a key role in obtaining appropriative water rights for instream habitat purposes (TBWC, 2003). Other community groups have also played an active role in the watershed including Inverness Foundation, East Shore Planning Group, MALT, Audubon Canyon Ranch, Village Association, and many other important groups.

IMPORTANT WATERSHED ISSUES

1. **Water quality**. Pathogen contamination in Tomales Bay continues to be a major concern, especially for shellfish growers. Septic systems and agricultural operations both contribute pathogens. Sediment from these small east and west shore tributaries has a significant impact on bay wetlands.
2. **Habitat restoration.** Because of their small size, these drainages offer important opportunities to restore connectivity from upper watershed areas through riparian corridors to bay wetlands. Audubon Canyon Ranch staff has undertaken a significant native grassland restoration effort at Cypress Grove.
3. **Community coordination of septic systems.** The Draft Tomales Bay Watershed Stewardship Plan (2003) states that there are 212 septic parcels within 100 feet of the bay or a creek on the west shore and 186 on the east shore. EHS is currently developing a program to inventory septic systems and evaluate their environmental risks.
4. **Outreach and education.** Tomales Bay is a major tourist destination. The many parks and public access points are excellent places to educate people about how a healthy watershed is fundamental to a healthy bay.
5. **Agricultural viability.** East shore dairy operators have been pioneers in adding to the diversity and economic stability of their operations through value-added products.

WATERSHED NEEDS

1. Habitat mapping and assessment. Little information is available on wildlife use, water quality or restoration opportunities for many of these small drainages or the leveed marshes at their mouths.
2. Ongoing technical and financial support of efforts by TBAG and other residents to improve water quality and habitat values.
3. Assessment of septic systems and a coordinated outreach program to private landowners on septic maintenance and repair.
4. Support of EHS effort to improve function of septic systems.

5. Control of invasive exotic plants.
6. Continue to support the work of the TBWC to provide comprehensive, community-based planning and coordination.
7. Support with and simplification of permits for habitat enhancement and agricultural operations.
8. Outreach to rural residential landowners on good stewardship practices including maintaining driveways and private roads, increasing permeability, using native plants, keeping horses and other animals, and reducing the use of toxic chemicals in their yards and homes.
9. Development of practical and effective TMDLs and attainment strategies.

STAFFORD LAKE WATERSHED

GENERAL DESCRIPTION

Stafford Lake is located in the upper reach of the Novato Creek watershed and is fed by several small tributaries. North Marin Water District (NMWD) manages the lake as part of a community water supply for the City of Novato.

Watershed Area: 8.5 square miles (5,440 acres)

DOMINANT OR INTERESTING HABITATS

The primary vegetation communities within the watershed are grassland with oak bay woodland along the upper tributaries. Novato Creek has areas of dense riparian forest.

SPECIAL SPECIES

Special status species: Great blue herons are known to occur within the watershed, and steelhead occur downstream in Novato Creek.

Other species of interest: The lake has a healthy population of bass. Canadian geese utilize the lake year-round.

LAND USE

Historical land use in the Stafford Lake watershed included dairy operations and beef and dairy cattle grazing. Today there is one remaining dairy farm in the upper reaches of the watershed and a handful of beef ranches. There is also a horse ranch on the southern side of the lake. Stafford Lake County Park is an important recreational area for local residents. The small island in the center of the lake is under the control of NMWD. Indian Valley golf course surrounds the southern and eastern edges of Stafford Lake on property owned by NMWD and leased to the Indian Valley golf course operation.

WATERSHED PLANNING AND MANAGEMENT

In the late 1980s, NMWD conducted an erosion inventory and implemented projects to reduce sediment flow into Stafford Lake. Much of mainstem Novato Creek above Stafford Lake was fenced as part of this effort. Sedimentation basins were also established on two of the main tributaries into Novato Creek, which are cleaned on a regular basis. Current NMWD activities focus on reducing the possibility of microbial contamination of Stafford Lake from organisms such as *Cryptosporidium*. To address these concerns, NMWD has secured a loan from the SWRCB.

As part of its watershed management plan, NMWD is developing a watershed users group to address the impacts of activities at the lake on water quality.

IMPORTANT WATERSHED ISSUES

1. **Domestic water supply.** Stafford Lake is susceptible to microbial contamination from surrounding land use practices. Erosion from watershed lands can reduce the capacity of Stafford Lake. NMWD will be looking at alternative means to copper

sulfate for controlling algae growth in the lake. This is part of a state-wide effort brought about by the RWQCB to limit the use of copper sulfate in drinking water reservoirs for algae control.

2. **Habitat restoration.** The livestock control fencing along mainstem Novato Creek has helped connect areas of vigorous riparian growth. Continuing to conserve and enhance natural habitats within the context of maintaining viable agricultural operations is an ongoing issue.
3. **Treatment Plant.** As a result of new enhanced surface water treatment regulations and disinfection byproduct rules promulgated by the federal EPA and adopted by DHS, the present Stafford Water Treatment Plant is unable to produce drinking water that is fully compliant with both of these regulations. As a result, NMWD will be building a new $12.4 million treatment plant that will employ an enhanced coagulation process coupled with granular activated carbon adsorption. The plant will also use chlorine dioxide as an influent oxidant and disinfectant to treat some of the potential microbial contamination issues that develop in the lake water toward the middle and end of the summer water production season.

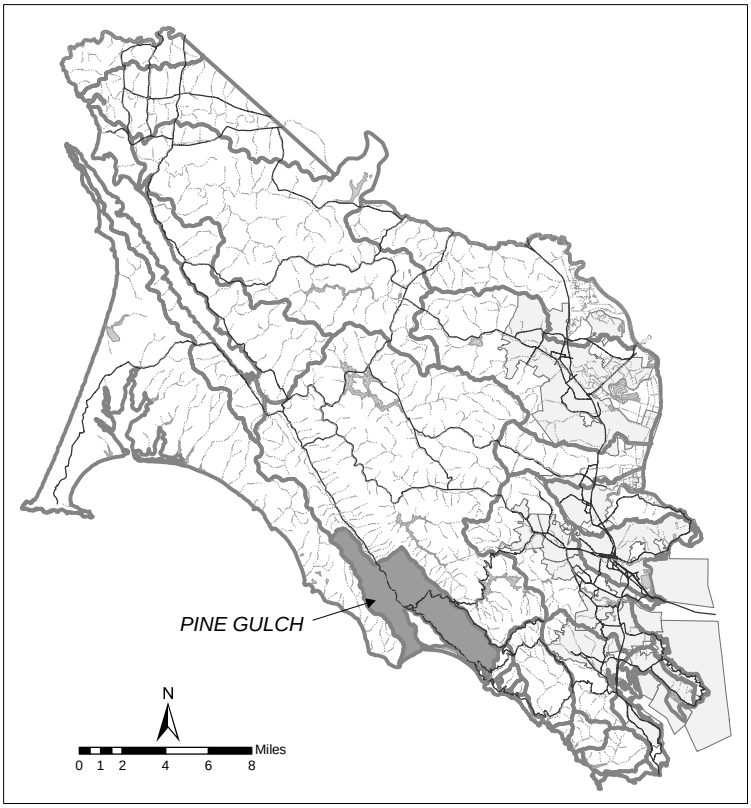
WATERSHED NEEDS

1. Develop a landowner-supported watershed plan to protect Stafford Lake.
2. Find alternative means of controlling algae growth in the lake in order to discontinue copper sulfate applications.
3. Work cooperatively with active dairy ranches within the watershed to control and manage manure and cattle feed runoff from these area. Work with grazing operations to minimize impacts to surrounding grasslands. Create set back areas along mainstem Novato Creek for both grazing and dairy operations.
4. Protect existing oaks within the watershed.
5. Work with the Indian Valley golf course in managing and regulating the type and amount of pesticides used in the watershed.
6. Work with the park operations in managing and inspecting some of the larger fair activities at the lake.
7. Work to find a means of controlling the impact of geese on the park and lake.
8. Encourage continued interested in tree plantings with the TBI's STRAW Project to control sediment runoff.

BOLINAS LAGOON/PINE GULCH CREEK WATERSHEDS

GENERAL DESCRIPTION

The Bolinas Lagoon/Pine Gulch Creek watershed extends west from Bolinas Ridge to Inverness Ridge on the Point Reyes Peninsula. The entire watershed encompasses 16.7 square miles. Sixty-six percent of the land is in public ownership; the remaining private lands include the Audubon Canyon Ranch and the communities of Bolinas, Seadrift, and Stinson Beach. Public landholders include Mt. Tamalpais State Park, GGNRA, PRNS, MMWD, and MCOSD. Seventy-five percent of the land within the watershed has been set aside for conservation purposes. The Bolinas Lagoon is designated as "A Wetland of International Significance" by the Convention on Wetlands of International Importance. The community of Stinson Beach is one of the largest known wintering sites for the monarch butterfly.



The Bolinas Lagoon watershed is often referred to as the Pine Gulch Creek watershed,, but many other streams flow into the lagoon. The Bolinas Lagoon watershed can be broken down into Bolinas Lagoon, Pine Gulch and Easkoot Creeks, and Wilkins, Morse's, McKinnon, and Stinson Gulches. Pine Gulch Creek drains into the west side of the lagoon and comprises the largest area within the watershed (50%). The largest tributaries within Pine Gulch Creek are McCurdy Gulch and McCormick Creek. Easkoot Creek is the second largest drainage, comprising 10% of the watershed. The main tributaries within Easkoot Creek are Laurel and Black Rock Creeks. Lewis Gulch flows into the north end of the lagoon and is similar in size to the tributaries along the east side of the lagoon.

Watershed Area: 16.7 square miles (10,688 acres)
Subwatershed Area:

- **Bolinas Lagoon (surface area):** 1.72 square miles (1,100 acres)
- **Pine Gulch Creek:** 8.8 square miles (5,120 acres)
- **Easkoot Creek:** 1.66 square miles (1,062 acres)
- **Wilkins Gulch:** 0.70 square miles (447 acres)

Morses Gulch: 0.68 square miles (433 acres)
McKinnon Gulch: 0.69 square miles (442 acres)
Stinson Gulch: 0.99 square miles (633 acres**)**
Lewis Gulch: approx. 1.0 square miles (640 acres)

Main Channel Length:
Bolinas Lagoon: N/A
Pine Gulch Creek: approx. 7.44 miles (12 kilometers)
Easkoot Creek: 2.06 miles (3.33 kilometers)
Wilkins Gulch: 1.86 miles (3.00 kilometers)
Morses Gulch: 1.66 miles (2.67 kilometers)
McKinnon Gulch: 1.66 miles (2.67 kilometers)
Stinson Gulch: 1.45 miles (2.33 kilometers)
Lewis Gulch: approx. 2.0 miles (3.23 kilometers)

DOMINANT OR INTERESTING HABITATS

Bolinas Lagoon represents a unique habitat within the watershed and consists of mudflats, marshes, tidal channels, and a flood shoal island. The primary vegetation communities within the watershed are coastal scrub, Douglas fir and redwood forest, and grasslands. There are small patches of eucalyptus, oak and oak bay woodlands, riparian scrub woodland, and pine cypress forest.

SPECIAL SPECIES

Special status species:
Bolinas Lagoon: Clapper and black rails, saltmarsh common yellowthroat, and California red-legged frog are known to occur adjacent to the lagoon in freshwater ponds. Plants such as Point Reyes bird's-beak also occur near the lagoon.
Pine Gulch Creek: Coho salmon, steelhead, northern spotted owl, black swift, California red-legged frog, and Marin manzanita are known to occur.
Easkoot Creek: Coho salmon and steelhead trout are known to occur. Plants within the subwatershed include Mt. Tamalpais jewel-flower, Lyngbye's sedge, showy Indian clover, Marin checker lily, Marin checkerbloom, and Point Reyes bird's-beak
Wilkins Gulch: California red-legged frog and steelhead trout are known to occur.
Morse's Gulch: Steelhead trout are known to occur.
McKinnon Gulch: Steelhead trout are known to occur.
Stinson Gulch: Steelhead trout are known to occur.

Appendix D of the Bolinas Lagoon Management Plan Update 1996 identifies additional special status species found in the Bolinas Lagoon watershed. For example, California brown pelican, American peregrine falcon, California clapper and black rails, Point Reyes mountain beaver, and Point Reyes jumping mouse have been identified within the watershed. Additional special status plants, such as dwarf peppergrass, are also known to occur.

Other species of interest: Additional species of interest are identified in Appendix D of the Bolinas Lagoon Management Plan Update 1996.

LAND USE

Lands within the watershed are largely held by public entities. Private communities occur within the Pine Gulch Creek and Easkoot Creek subwatersheds, and some private parcels within Pine Gulch Creek are used for cultivated farming. Large landholdings within the watershed can be broken down into the following:

- **Audubon Canyon Ranch:** 1,014 acres
- **Bolinas, Stinson Beach, and Seadrift communities:** 2,636 acres
- **Golden Gate National Recreation Area:** 4,121 acres
- **Marin County Open Space District:** 1,120 acres
- **Mt. Tamalpais State Park:** 1,572 acres
- **Point Reyes National Seashore:** 2,647 acres

WATERSHED PLANNING AND MANAGEMENT

Several local community efforts have been initiated to address local watershed concerns. The Committee to Save Bolinas Lagoon was established as part of the Bolinas Lagoon Foundation as a result of concern for preserving the lagoon and slowing sediment deposition. Working with local experts, the committee secured funds from Congress to begin initial studies for restoring the lagoon. Marin County and the U.S. Army Corps of Engineer (ACOE) continue to develop a plan to slow sedimentation and restore lost tidal prism in the lagoon.

In the early 1990s, the Easkoot Creek Advisory Committee, an effort of the local community government, conducted the first fisheries assessment along Easkoot Creek. This group also funded a restoration plan focused on flood control issues. In 1993, a non-profit organization was formed out of this effort, and a steelhead fish passage project was implemented within the creek. In addition, GGNRA has initiated stream channel and habitat restoration for lower Easkoot Creek.

Pine Gulch Creek organic farmers in the town of Bolinas are working with PRNS, CDFG, NOAA Fisheries, and the SWRCB on a water operations program for sustainable use of the creek's water for farm irrigation. The planning and permitting phases of the project are nearly complete.

The Bolinas Lagoon Technical Advisory Committee (BLTAC) was appointed by the Marin County Board of Supervisors in 1974. The primary purpose of the BLTAC is to advise the county on addressing management issues pertaining to the Bolinas Lagoon. The committee has been involved in many projects throughout the years, including the Bolinas Lagoon Ecosystem Restoration Feasibility Study, development of the 1996 update for the management plan, reduction of sediment input into the lagoon, and many others. In addition, the BLTAC often serves as a forum for land use issues in the watershed.

Streamatrix, a community-based organization, has been working to restore Laurel Creek. Streamatrix initiated a flow monitoring program and worked with NPS to design and implement fish passage and habitat enhancement projects. Currently, there is no overall community-based watershed group for the Bolinas Lagoon watershed.

Bolinas Lagoon Management Plan Update 1996
In 1981, the MCOSD identified the long-term management issues surrounding the loss of tidal and subtidal habitat and sedimentation in Bolinas Lagoon. The plan was revised in 1996 to reflect changing environmental, political, and legal issues. The primary management issues addressed in the plan are the loss of estuarine habitat and sedimentation accumulation in Bolinas Lagoon.

The Bolinas Lagoon Ecosystem Restoration Project
The Bolinas Lagoon Ecosystem Restoration Project is a cost shared project by the ACOE and MCOSD. The goals of this study were to identify sources and causes of sedimentation and the feasibility of restoring the lagoon to its natural, functional, and self-regulated state.

As part of the feasibility study, several documents have been drafted to assist in the efforts. For example, historical land use activities that could and may still be contributing to the sedimentation problem in the lagoon are addressed in the Historical Perspective of Bolinas Lagoon Watershed (March, 2001). The Bolinas Lagoon Watershed Study: Input Sediment Budget (November, 2001) evaluates "the sources and magnitude of sediment delivered to the lagoon via erosional processes within the watershed." This study concluded that current erosion rates are near background (pre-1850) levels within the watershed.

Fisheries Assessment for Bolinas Lagoon Tributaries within the Golden Gate National Recreation Area, 1995-2000
Due to the lack of comprehensive data on fish distribution within the watershed draining the east side of Bolinas Lagoon, GGNRA inventoried the habitat conditions and invertebrate communities and estimated abundance of fish by species within these waterways. The ultimate goal of the assessment was to better understand the habitat conditions for juvenile fish rearing.

Coho Salmon (*Oncorhynchus kisutch*) in Pine Gulch Creek, Marin County, CA, 2002 Monitoring Report
Since 1997, the National Park Service Coho Salmon and Steelhead Trout Restoration Program staff has been actively monitoring fish populations along 12 kilometers of mainstem Pine Gulch Creek. The last documented observation of coho salmon within the watershed occurred in 1968 and is on file with CDFG. Monitoring by NPS staff failed to document a single coho salmon from the fall of 1997 to the summer of 2000. Since that time, three consecutive cohort years of coho salmon have been document by NPS staff in Pine Gulch Creek. In September 2001, the juvenile population estimate of 589 ± 329 was followed by outmigration of at least 251 coho smolts in the spring 2002. The September 2002 juvenile population estimate of 1205 ± 337 was followed by smolt outmigration of at least 576 coho in the spring of 2003. Documentation overwinter survival of coho salmon from juvenile to smolt is estimated at 40% for coho year classes 2001 and 2002.

Marin County Stream Crossing Inventory and Fish Passage Evaluation (Draft, June, 2003)
Between May of 2002 and June of 2003, Ross Taylor and Associates evaluated county-maintained stream crossings within Marin County to assess juvenile and adult salmonid

passage. The survey focused primarily on stream crossings that historically or currently support populations of coho salmon and/or steelhead. The report also includes site-specific treatments and scheduling. The highest priority sites occur within the Lagunitas Creek and Bolinas Lagoon watersheds.

IMPORTANT WATERSHED ISSUES

Several issues have been identified within the watershed:

1. **Habitat restoration**. Habitat conditions of most streams within the watershed have experienced some disturbance. These include introduction of exotic riparian vegetation, large debris flows as a result of the 1982 floods, channel cleaning, shifts in channel alignment, and excavated material cast in berms lining the creeks.
2. **Easkoot Creek salmonid habitat**. Fishery habitat and the absence of habitat complexity in lower Easkoot Creek are threatening an already declining steelhead population.
3. **Flood control**. Much of the community of Stinson Beach is located within the 100-year floodplain, and flood control measures along Easkoot Creek have been implemented to reduce these occurrences. Maintaining a balance between flooding events and restoration activities is a concern.
4. **Water use**. Supplying water for agricultural and residential uses in a manner that does not degrade aquatic resources is an ongoing issue.

WATERSHED NEEDS

1. Development and implementation of a stream resource monitoring plan that includes water quality, flow (or surrogate measurements), fish community components, and related "triggers" for water management actions. Cooperators should include NPS, the local community, resource agencies, and the Stinson Beach County Water District.
2. Development and implementation of a natural resource "friendly" water management plan to ensure continuity of instream flows to protect aquatic life. Cooperators should include NPS, the local community, resource agencies, and the Stinson Beach County Water District (see item 7 below).
3. Investigation of the cause of low dissolved oxygen conditions within lower Easkoot Creek.
4. Assessment of feasibility for long-term riparian and channel improvements along lower Stinson and McKinnon Gulches. In the near-term, topographic data needs to be gathered at both locations.
5. Aquatic habitat restoration and enhancement.
6. Removal of invasive exotic plants and replacement with indigenous species.
7. Support of the efforts of farmers in the Pine Gulch Creek drainage to implement the plan developed with NPS to supply agricultural water without damaging salmonid habitat.

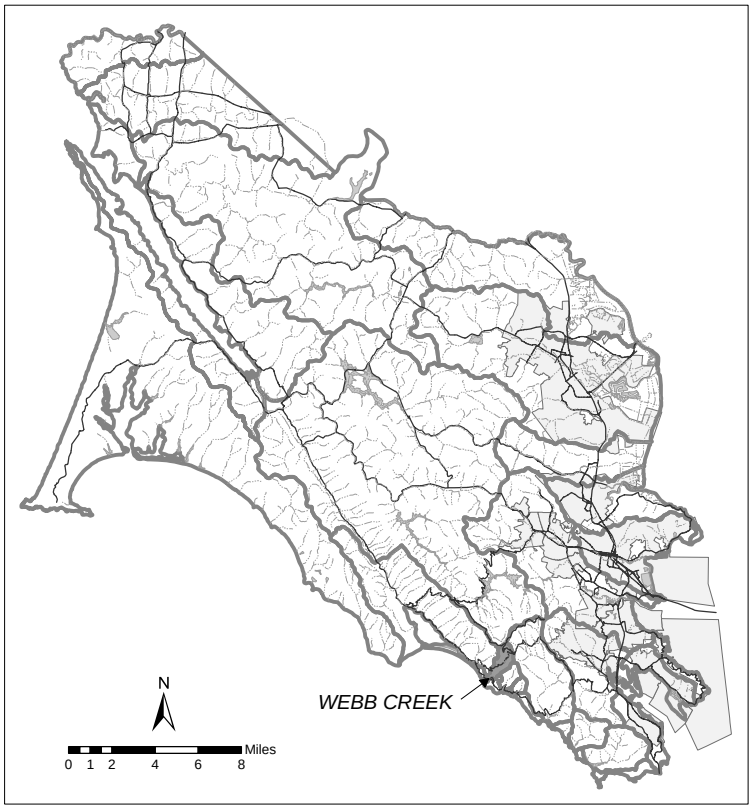
8. Education for private landowners along Easkoot Creek about the importance of protecting instream and riparian habitat.
9. Implementation of restoration planning based on fish passage evaluation recommendations within Pine Gulch Creek.

WEBB CREEK WATERSHED (STEEP RAVINE)

General Description

Webb Creek originates at the peaks of Mt. Tamalpais and flows towards the Pacific Ocean through Steep Ravine Canyon and Mt. Tamalpais State Park. The creek drains into the Pacific between Stinson Beach and Rocky Point.

Watershed Area: 1.08 square miles (691 acres)
Main Channel Length: 2.31 miles (3.72 kilometers)



Dominant or Interesting Habitats

The lower watershed contains patches of coastal scrub, and the upper watershed contains Douglas fir and redwood forest. Oak bay woodland and redwood forest occur along the drainage. Patches of grassland habitat also occur within the watershed.

Special Species

Special status species: There are no historical or current records of special status fish species within the watershed. Northern spotted owl and Tamalpais oak (at the top of the watershed) have been recorded.

Other species of interest: None identified**.**

Land Use

The Webb Creek watershed occurs within state and federal lands, including Mt. Tamalpais State Park and GGNRA. There is a small military complex within the watershed and a campground perched on the rocky bluffs along the ocean.

Watershed Planning and Management

There are no known community-based watershed groups within the Webb Creek watershed.

IMPORTANT WATERSHED ISSUES

No data available.

WATERSHED NEEDS

1. General assessment information is needed for the entire watershed.

LONE TREE CREEK AND COLD STREAM WATERSHEDS

General Description

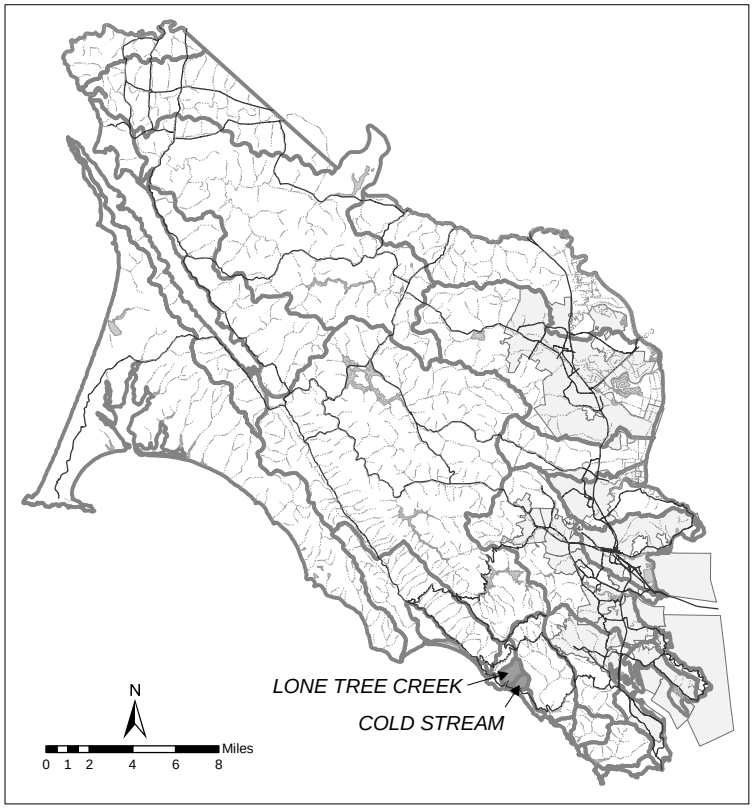
North of the community of Muir Beach, Lone Tree Creek and Cold Stream are two small streams that drain the area west of the ridge line that forms the Dipsea and Coastal Fire Roads. They flow through the lands of the GGNRA and into the Pacific Ocean after crossing the Shoreline Highway.

Watershed Area:

Lone Tree Creek: 0.78 square miles (499 acres)
Cold Stream: 0.42 square miles (269 acres)

Main Channel Length:

Lone Tree Creek: 1.55 miles (2.5 kilometers)
Cold Stream: 1.10 miles (1.8 kilometers)



Dominant or Interesting Habitats

Lone Tree Creek contains coastal scrub in the lower watershed along with oak bay woodland and grassland habitats along the drainage. The upper watershed contains stands of Douglas fir forest. The majority of the Cold Stream watershed consists of coastal scrub. The upper watershed contains patches of oak bay woodland and grassland habitats.

Special Species

Special status species:

Lone Tree Creek: There are no historical or current records of special status fish species within the watershed. Tamalpais oak has been recorded at the top of the watershed.
Cold Stream: There are no historical or current records of special status fish species within the watershed.

Other species of interest: None identified.

Land Use

Lone Tree Creek and Cold Stream watersheds occur within the public lands of GGNRA.

WATERSHED PLANNING AND MANAGEMENT

There are no known community-based watershed groups within the Lone Tree Creek and Cold Stream watersheds.

IMPORTANT WATERSHED ISSUES

No data available.

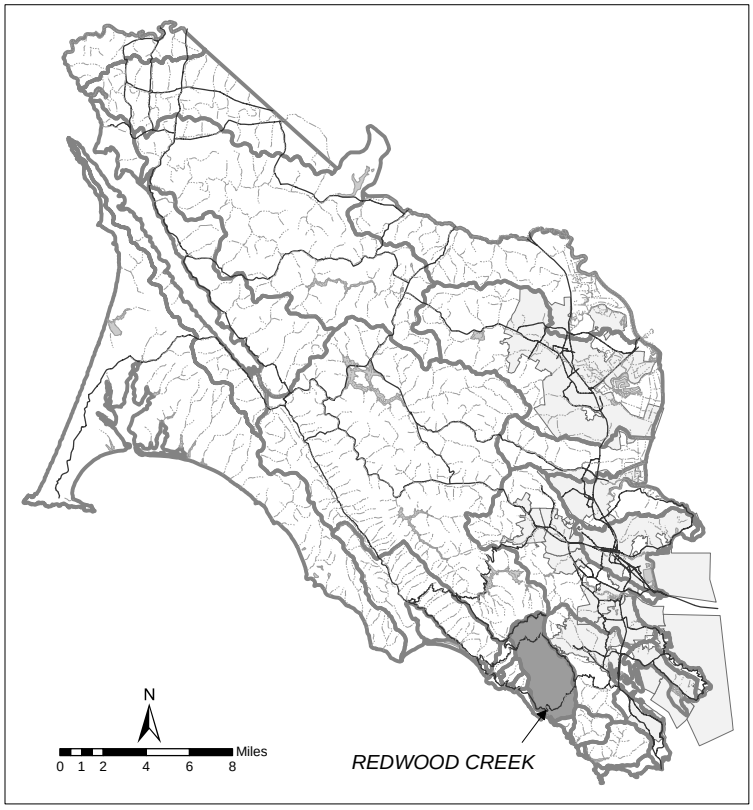
WATERSHED NEEDS

1. General assessment information is needed for both watersheds.

REDWOOD CREEK WATERSHED

GENERAL DESCRIPTION

The Redwood Creek watershed begins at the peak of Mt. Tamalpais and extends southwest to Muir Beach where it drains into the Pacific Ocean. The watershed encompasses an area of less than 9 square miles. At the mouth of the watershed is Big Lagoon, an intermittent tidal lagoon. The watershed provides habitat for several sensitive species, including northern spotted owl, California red-legged frog, coho salmon, and steelhead. The watershed is located in a recognized global biodiversity "hot spot" (one of only 5 in the continental United States) and is also within Golden Gate Biosphere Reserve. The main tributaries to Redwood Creek include Bootjack, Fern, Kent Canyon, Rattlesnake, and Spike Buck Creeks.



DOMINANT OR INTERESTING HABITATS

The Redwood Creek watershed contains a variety of habitat types including coastal chaparral, grassland, old growth redwood forest, mixed hardwood forest, seasonal wetlands, and riparian woodlands. Prior to the land use changes that followed European colonization of the watershed, a large intermittently tidal lagoon occurred at the mouth of Redwood Creek. This lagoon once covered an area of approximately 25 acres; only a remnant of the lagoon remains today. NPS is currently working with local property owners to develop restoration designs for the Big Lagoon area.

SPECIAL SPECIES

Special status species: Coho salmon, steelhead, California red-legged frog, monarch butterflies, northwestern pond turtle, and northern spotted owl have been observed in the watershed. Special status plants include Mt. Tamalpais and Marin manzanita, San Francisco Bay spineflower, Napa false indigo, Tamalpais oak, and Mt. Tamalpais thistle.

Other species of interest: None identified.

LAND USE

The majority of land within the watershed (95%) is in public ownership. Within its boundaries lie Mt. Tamalpais State Park, NPS lands including Muir Woods National Monument and portions of GGNRA, and MMWD lands. Three private communities occupy a small portion of the watershed. They include Green Gulch Farm, Muir Woods Park, and the Muir Beach community.

WATERSHED PLANNING AND MANAGEMENT

Redwood Creek Watershed Vision for the Future

The Redwood Creek Watershed Vision for the Future (January 14, 2003) was developed through a collaborative effort between public and private landowners and resource managers to successfully manage the Redwood Creek watershed. The public agencies involved in the vision include CDFG, DPR, MMWD, County of Marin, Muir Beach Community Services District, and NPS.

> "The vision, simply stated, is that the Redwood Creek watershed exists as an intact natural ecosystem that offers opportunities for people to learn about, experience, and protect a rich blend of nature, rural character, and cultural history in an urbanized area."

The Redwood Creek Watershed Vision for the Future outlines guiding principles and desired future conditions. Desired future conditions refer to natural and cultural resources, resident community, visitor experience, infrastructure, facilities, and services. Desired future conditions do not describe how to attain these conditions. The complete Redwood Creek Watershed Vision for the Future can be found at website www.redwoodcreek.org.

Guiding Principles

1. Land management agencies, local communities, and the public work together to build support for and implement the watershed vision.
2. The watershed is managed as a model of the interdependency of all resources and beings with respect for the presence and activities of people historically and currently.
3. The natural beauty and rustic character of the landscape are maintained.
4. Sustainable land management and resource use practices are used to ensure natural and cultural resources protection, resident quality of life, and quality of visitor experience.
5. An adaptive, scientifically-based approach provides the foundation for informed resource decision making and management of the watershed's resources, and scientific research in the watershed is encouraged and supported.
6. Education is provided as a foundation for future watershed protection and stewardship.
7. Opportunities for human and cultural experiences and interaction with the natural environment are fostered.

8. People are active stewards of the watershed, and land management agencies provide an example for and promote stewardship of the watershed's resources by watershed residents and visitors.

Roads and Trails Assessment Project
Pacific Watershed Associates (PWA) completed a sediment source assessment and erosion prevention plan for 67 miles of roads and trails within the watershed in 2002 (PWA, 2002). Funding was provided by the CDFG Senate Bill (SB) 271 Watershed Restoration grants and was supplemented by NPS and MMWD. The project was "specifically aimed at identifying future erosion sources that are impacting fish-bearing streams and to develop prescriptions aimed at reducing sediment input to the watershed. The field inventory identified future sediment sources from approximately 27 total miles of highway, secondary and fire roads, as well as 40 miles of trail system in the watershed."

Based on the sediment source assessment, specific treatments were recommended for both road and trail sediments sources. The future sediment sources were assigned treatment priorities based on erosion potential and erosion priority. Cost effectiveness was also a determinant for treatment priority.
Redwood Creek Watershed Sediment Budget
As part of the planning for the Big Lagoon Wetland and Creek Restoration Project, NPS is completing a comprehensive sediment budget for the Redwood Creek watershed. This sediment budget, which will be completed in early 2004, will identify sediment sources, storage areas, and transfer rates in the watershed for a range of time periods including pre-colonial, current, and future. This sediment budget will contribute to the design analysis for Big Lagoon and will be used to identify and prioritize watershed restoration actions to reduce sediment delivery to Redwood Creek.

Big Lagoon Wetland and Creek Restoration Project
NPS is currently working with local property owners to develop restoration plans for the Big Lagoon area. The Big Lagoon Wetland and Creek Restoration Project site encompasses 40.9 acres at the mouth of Redwood Creek. Although the entire site is within the GGNRA boundary, only half of the site is owned by NPS. The remainder is owned by the San Francisco Zen Center (SFZC) and is part of Green Gulch Farm.

Preliminary design alternatives for the project site were developed in the early 1990s by the California Department of Transportation, working with NPS and other agencies, as mitigation for repair of the Lone Tree Slide on Highway 1 near Stinson Beach. These alternatives, which are described in a Preliminary Environmental Assessment (EA) completed for the project, proposed excavation of 50,000 to 120,000 cubic yards of sediment and fill material to restore a freshwater lagoon ranging in size from 7.9 to 16.2 acres. Six locations were identified in the Redwood Creek watershed as potential disposal sites for sediment and fill material excavated from the lagoon and parking lot. Although the preliminary EA was completed for the project, the project was never implemented.

GGNRA has reinitiated planning at the site and is developing a new range of restoration alternatives. The current restoration effort will build on work completed for the 1994 EA but

will revisit several key design assumptions to achieve project goals. The project goals are as follows:

1. Restore a functional, self-sustaining ecosystem, including wetland, aquatic, and riparian components.
2. Develop a restoration design that: (a) functions in the context of the watershed and other pertinent regional boundaries, and (b) identifies and, to the extent possible, mitigates factors that reduce the site's full restoration potential.
3. Be consistent with restoring a functional ecosystem, recreate habitat adequate to support sustainable populations of special status species.
4. Reduce flooding on Pacific Way and in the Muir Beach community and work with Marin County to ensure that vehicle access is provided to the Muir Beach community.
5. Provide a visitor experience, public access, links to key locations, and resource interpretation that are compatible with the ecosystem restoration and historic preservation.
6. Work with the Federated Indians of Graton Rancheria to incorporate cultural values and indigenous archeological resources into the restoration design, visitor experience, and site stewardship.
7. Provide opportunities for public education and community-based restoration, including engaging local and broader communities in restoration planning and site stewardship.
8. Coordinate with the Comprehensive Transportation Management Plan (see below) to identify transportation alternatives that are consistent with ecosystem restoration.

Comprehensive Transportation Management Plan (CTMP)
"Heavy visitor traffic to Muir Woods, Mt. Tamalpais State Park, Stinson Beach, Muir Beach, Tennessee Valley and other Golden Gate National Recreation Area (GGNRA) sites has called into question the validity of single auto access, both from enhancing the park visitor experience and maintaining the parklands themselves. The CTMP project brings together Marin County, GGNRA, State Parks, Caltrans, the public, and all other relevant agencies in southern Marin to identify and investigate the development of recreational travel model options to reduce the traffic impacts of visitors to these recreational destinations. The CTMP effort will quantify current and future demand for park visitation and identify broader strategies for reducing the number of vehicles accessing recreation areas and national and state parklands along Route 1. It will look at transportation alternatives including improved trail and bicycle access, shuttle service, trams, intercept parking facilities and additional parking facilities." http://www.ctmpmarin.com/overview.html.

IMPORTANT WATERSHED ISSUES

As a part of the Redwood Creek Vision for the Future Project, issues surrounding the natural and human resources of the Redwood Creek watershed have been identified by agency partners and public input. These issues, which are in the preliminary stages of

development, fall into several categories, including aquatic habitat, exotic plants, fire, traffic and parking, visitor use intensity/visitor experience, trails/sedimentation, cultural resources, land use, and flooding. The following are just a few key issues that have been identified:

1. Reduction in available functional habitat has reduced several important aquatic species to remnant, threatened populations.
2. Invasive non-native plant species are displacing native vegetation and are reducing the extent and quality of habitats for native animal species.
3. Changes in fire regime have caused large-scale changes in vegetation and increased risk of fire.
4. Traffic and large numbers of visitors to the watershed frequently overwhelm road and parking lot capacities, detract from visitor enjoyment, and impact resources in the park and neighboring communities year-round.
5. Intensive use of roads, trails, and facilities throughout the watershed and surrounding area impacts vegetation, intrudes into sensitive resources, causes erosion and sedimentation, disturbs wildlife, and impairs peace and quiet.
6. Multiple uses (such as bicycling, hiking, wildlife watching, and horseback riding) on park trails and in park areas reduce the quality of visitor experience for each group.
7. Roads and trails are a source of sediment to stream systems, cause habitat loss and fragmentation, degrade visual quality, and impair visitor experience.
8. Sedimentation in Big Lagoon and Redwood Creek and other factors are causing frequent/persistent flooding on Pacific Way.

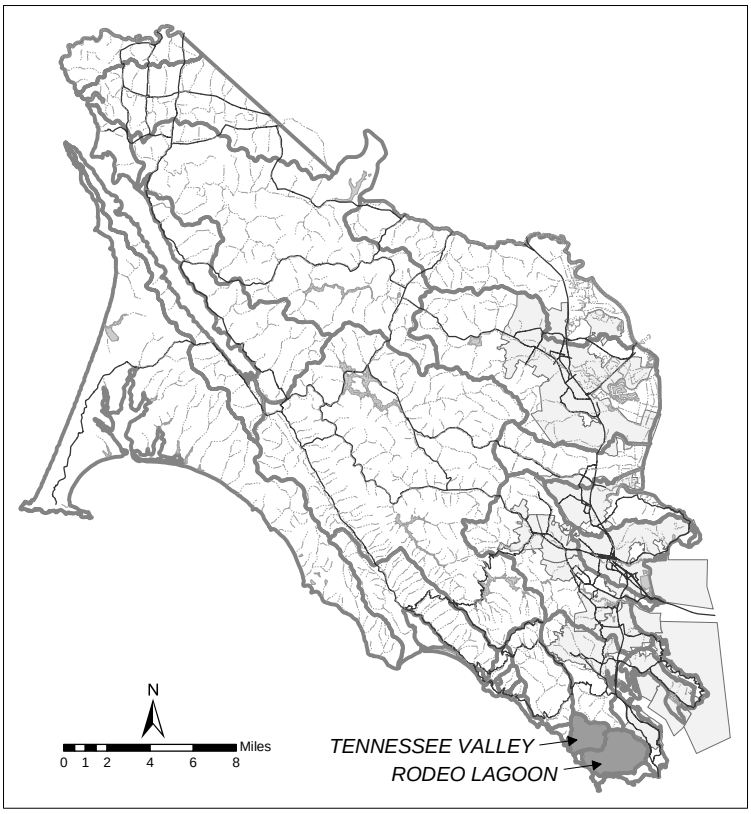
WATERSHED NEEDS

1. Evaluation, prioritization, and implementation of the measures identified in the PWA 2002 Assessment to reduce erosion and sedimentation.
2. Continuing support for and implementation of the Vision for the Future Project by the watershed stakeholders. The next step identified for this process is the completion of a comprehensive watershed assessment. Agencies in the watershed are working together to initiate this assessment.
3. Development and implementation of a scientifically-based watershed adaptive management program.
4. Restoration of functional salmonid habitat along critical portions of Redwood Creek; potential actions include addition of large woody debris in the Banducci Reach.
5. Restoration of the creek and adjacent wetlands at Big Lagoon.
6. Removal of invasive exotic plants and replacement with indigenous species.
7. Continued support for and expansion of public education and stewardship activities in the watershed.
8. Implementation of measures to reduce the effects of transportation infrastructure and traffic congestion of watershed resources.

TENNESSEE VALLEY / RODEO LAGOON WATERSHEDS

General Description

The most southerly coastal drainages flowing into the Pacific Ocean in Marin County are the Rodeo Lagoon and Tennessee Valley drainages. They are located north of Point Bonita and south of the Muir Beach community and Coyote Ridge. These systems flow through the lands of GGNRA and along the western slopes of the Marin Peninsula. Approximately five intermittent streams flow through the Tennessee Valley. Two main drainages flow from the north and south into Rodeo Lagoon near Fort Cronkhite.



Watershed Area:
Tennessee Valley Drainage: 2.36 square miles (1,510 acres)
Rodeo Lagoon Drainage: 4.39 square miles (2,810 acres)

Main Channel Length:
Tennessee Valley Channels: 2.53 miles
Rodeo Lagoon Channels: unknown

Dominant or Interesting Habitats

The Tennessee Valley watershed is largely composed of grassland and coastal scrub habitats with a small freshwater marsh near the lower watershed. Similar habitat types occur within the Rodeo Lagoon watershed. Rodeo Lagoon is an important aquatic resource for a variety of native fish and wildlife species.

Special Species

Special status species:

Tennessee Valley Drainage: Saltmarsh common yellowthroat and monarch butterfly have been recorded in the watershed.

Rodeo Lagoon Drainage: California brown pelican, saltmarsh common yellowthroat, monarch butterfly, and tidewater goby (in the lagoon) have been recorded in the watershed.

Other species of interest: None identified**.**

LAND USE

The Tennessee Valley and Rodeo Lagoon watersheds are located within the Marin Headlands, part of GGNRA. Fort Cronkhite, an old Army mobilization post, is adjacent to Rodeo Lagoon and is also part of GGNRA.

WATERSHED PLANNING AND MANAGEMENT

In the early 1990s, a draft watershed management plan for Tennessee Valley was completed by GGNRA.

There are no known community-based watershed groups within the Tennessee Valley/Rodeo Lagoon watersheds.

IMPORTANT WATERSHED ISSUES

1. **Invasive non-native plants.** Invasive non-native plant species are displacing native vegetation and are reducing the extent and quality of habitats for native animal species.
2. **Water quality and sedimentation.** The Tennessee Valley and Rodeo Lagoon watersheds are impacted by poor water quality and sedimentation.

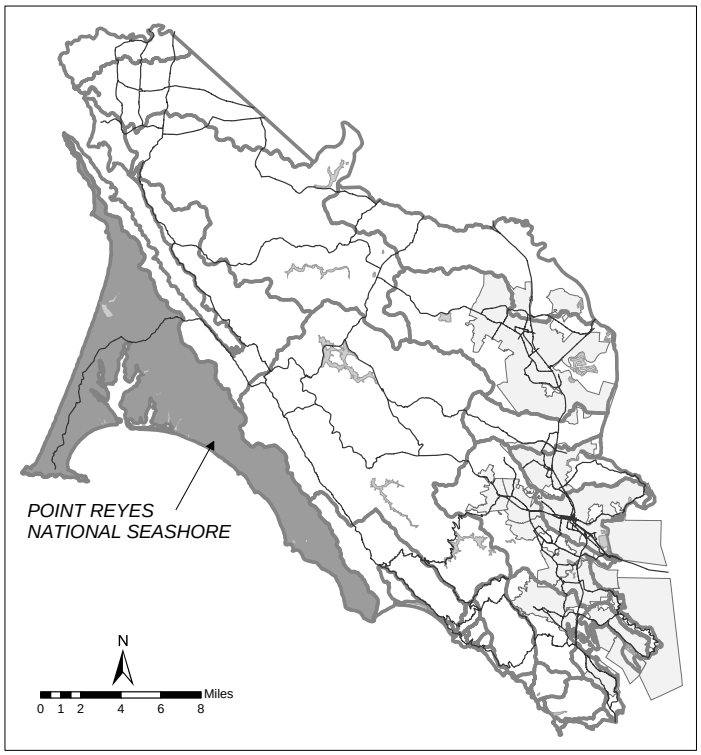
WATERSHED NEEDS

1. General assessment information for the entire watershed.
2. Identification of the cause of several fish kills that have occurred in Rodeo Lagoon since the late 1980s.

POINT REYES NATIONAL SEASHORE WATERSHED

GENERAL DESCRIPTION

The Point Reyes National Seashore (PRNS) includes those watersheds that drain into Drakes Estreo, Abbotts Lagoon, Estero de Limantour, the Pacific Ocean, and portions of the watersheds described in this plan (i.e., Bolinas Lagoon, Tomales Bay east and west shore drainages). The seashore extends from Tomales Point at the mouth of Tomales Bay toward the town of Bolinas at Pablo Point. It comprises nearly 100 square miles (64,000 acres) of open grasslands, coastal scrub, forested habitats, and coastal beaches and headlands and nearly 80 miles of undeveloped coastline. It is renowned for its unique biological and historical elements. Over 45% of North American bird species, 20% of the State's flowering plants, 37 native land mammals, and a dozen marine mammals have been identified on the peninsula.



The seashore was established by President John F. Kennedy in 1962 and attracts 2.5 million visitors annually. There are 147 miles of hiking trails, campgrounds, beaches, and a variety of recreational opportunities.

WATERSHED AREA

Drakes Estero Watershed: 13.5 square miles
Schooner Creek: approx 1.5 square miles
East Schooner Creek: 2 square miles
Home Ranch Creek: 1.9 square miles
Clenbrook Creek: 2.3 square miles
Muddy Hollow Creek: 3.25 square miles
Laguna Creek: 2.3 square miles

DOMINANT OR INTERESTING HABITATS

PRNS contains numerous habitat types including estuaries, mud flats, sandy shores, intertidal communities, and variety of upland habitats. The primary vegetation communities within the watersheds are coastal scrub, riparian woodland, Douglas fir forest, bishop pine forest, and grasslands.

The watersheds draining the west side of Inverness Ridge to Drakes Estero, Drakes Bay, and the Pacific Ocean support steelhead trout, California red-legged frog and provide freshewater inflow to four state recognized Areas of Biological Significance.

SPECIAL SPECIES

Special status species: The Point Reyes Peninsula is home to twenty-three threatened and endangered species and numerous other special status plants and animals, including Steelhead trout, California red-legged frog, harbor seal, elephant seal, eel grass beds, brown pelican, and seven threatened and endangered dune plant species. Mammals include the Point Reyes mountain beaver, which are endemic to the area and found nowhere else, Point Reyes jumping mouse, various bats, and whales. Invertebrates include San Francisco lacewing, Myrtle's silverspot butterfly, Point Reyes blue butterfly, San Francisco forktail damselfly, and several other species. Special status plants found on the peninsula are Point Reyes horkelia, Point Reyes bird's-beak, San Francisco owl's-clover, Mt. Vision ceanothus, and Point Reyes meadowfoam. Numerous fish, birds, reptiles, and amphibians are also known to occur within the seashore. Steelhead trout have also been documented in Alamere Creek near the southern portion of the peninsula.

Other species of interest: Tule elk, a subspecies of the North American elk that is found only in California, occur within the seashore. Historically, large herds of elk thrived throughout the grasslands of central and coastal California, but they were hunted to near extinction in the 1800s. Tule elk disappeared from the peninsula by the 1860s. In 1978, a small herd (10 animals) was reintroduced to PRNS. Today, there are nearly 500 in two separate herds. The largest herd occurs on Tomales Point in a 2,600-acre fenced reserved. Roughly 30 animals have been transplanted from Tomales Point to the Limantour wilderness area. The Point Reyes population of tule elk is one of the largest populations in California.

In addition to the native tule elk and black-tailed deer, the seashore is also home to fallow deer and axis deer, two non-native species introduced by a local landowner in the 1940s. These ungulates were bought from the San Francisco Zoo and released prior to the park being established.

LAND USE

The area west of Inverness ridge is nearly 50% Philip Burton Wilderness, with nearly the same amount of land managed for agriculture, 5 dairy operations, and 28,900 acres of land used for agriculture (mainly dairy and beef production). Roads within this area are managed by the County, providing access to the Lighthouse and Tomales Point.

All of the land within PRNS is held by NPS. Historical ranches, leased by former owners, continue to operate. Johnson's Oyster Company also farms oysters in Drakes Estero.

For more information on PRNS, call visitor information at (415) 464-5100 or visit http://www.nps.gov/pore/.

WATERSHED PLANNING AND MANAGEMENT

The Seashore is in the process of compliance for the Coastal Watershed Restoration Project, to replace six culverts and remove three additional facilities that impede fish passage and natural hydrologic process within the Drakes Estero Watershed.

IMPORTANT WATERSHED ISSUES

Road Alignment: The road section of Sir Francis Drake near the head of Schooner Bay and Johnson Oyster Company is identified as a dangerous road section, and regular maintenance issue due to regular flooding during winter flow events. Road improvement options may include raising the road tread elevation or realignment.

WATERSHED NEEDS

1. Assess Sir Francis Drake road condition and impacts within watersheds draining to Drakes Bay.
2. Identify potential solutions to management and maintenance problems with this road.

APPENDIX B

PRACTICES AND REFERENCES

BMPs and Management Measures

Best Management Practices (BMPs) are defined by the EPA as "a practice or combination of practices that are determined to be the most effective and practicable (including technological, economic and institutional considerations) means of controlling point and nonpoint pollutants at levels compatible with environmental quality goals. EPA and the Regional Water Quality also use the term "**management measures**" which are defined as "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, siting criteria, operating methods, or other alternatives. " Management Measures tend to provide broad guidance as well as specific prescriptions. BMPs and Management Measures have been developed for erosion control, stormwater management, pesticide use, irrigation water management, grazing, forestry, marinas and recreational boating, wetlands and riparian areas, confined animal facilities and nutrient management (e.g. applying manure and other fertilizers to range and cropland).

BMPs and Management Measures are used in different ways. Some, such as those developed for agriculture, are often used to provide guidance and examples of methods that can be adapted to specific conditions and management strategies. Others are incorporated into policies and regulations.

New technologies and methods for controlling water pollution continue to be developed. In many restoration efforts, for example, the focus has shifted from repairing erosion at specific sites to restoring overall watershed function through activities such as increasing permeability, managing grazing, and restoring effective sediment transport. Unless the choice of BMPs is restricted through a permit or other regulatory process, it is important to consider the desired short- and long-term outcomes before selecting appropriate practices.

For more information on BMPs for erosion control, sedimentation, stormwater runoff and agricultural runoff, check these sources

Start at the Source
Bay Area Stormwater Management Agencies Association (BASMAA). 1997. An excellent and accessible handbook, lavishly illustrated, with specific recommendations for reducing stormwater runoff and increasing permeability. Available through their website at www.basmaa.org.

FishNet 4C
FishNet 4C—Guidelines for protecting aquatic habitat and salmon fisheries for County Road Maintenance. Jan 2004.

Erosion and Sediment Control Field Manual
California Regional Water Quality Control Board, San Francisco Bay Region, Friends of the San Francisco Estuary. 1999. Small, field-sized binder with concise background information and clear, well-illustrated guidelines for applying many practices. Also includes a short section on monitoring completed work along with sample inspection reports. Available from Friends of the San Francisco Estuary, P.O. Box 791 Oakland, CA 94604-0791. (510) 622-2419.

Procedural Guidance Manual: Addressing Polluted Runoff in the California Coastal Zone
California Coastal Commission. 1996. This document is part of the Coastal Commission's overall strategy to reduce polluted runoff from coastal waters. It includes background technical and policy information as well as many examples of Management Measures and BMPs.

Storm Water Quality Handbooks: Construction Site Best Management Practices Manual
California Department of Transportation. 2000. Provides information on appropriate applications, standards and specifications for hydroseeding, temporary sediment control, vehicle and equipment cleaning and many other construction practices. Well-organized and easy to use.

Storm Water Quality Handbooks: Construction Contractor's Guide and Specifications
California Department of Transportation. 1997. Provides background and step-by-step process for preparing a Water Pollution Control Plan (WPCP) and a Storm Water Pollution Prevention Plan (SWPPP).

Marin County Stormwater Pollution Prevention Program (MCSTOPPP). A short (18 page) document which includes 6 matrices for selecting practices to reduce storm water pollution from pavement, streets, driveways, parking lots, buildings and landscape. Available from the MCSTOPPP website: http://www.mcstoppp.org

Plan for California's Nonpoint Source Pollution Control Program, Volume 2: California Management Measures for Polluted Runoff

State Water Resources Control Board and the California Coastal Commission. 2000. Describes Management Measures to reduce nonpoint source pollution and identifies state and local agencies with authorities and programs to implement and/or enforce each MM.

Stormwater Best Management Practices Handbooks

Storm Water Quality Task Force. 2002. Recently revised. Excellent and thorough description of practices, applicability, and specifications. Handbooks are available on New Development and Redevelopment, Construction, Industrial and Commercial, and Municipal. They can be downloaded or ordered through the MCSTOPPP website: http://www.mcstoppp.org

Action Plan 2005: Protecting and Enhancing Marin County's Watersheds

Prepared for MCSTOPPP by Eisenberg, Olivieri & Associates. This plan includes a section of performance standards, pollution prevention practices that MCSTOPP member agencies have committed to implement. Available from the MCSTOPPP website: http://www.mcstoppp.org

Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters: 840-B-92-002

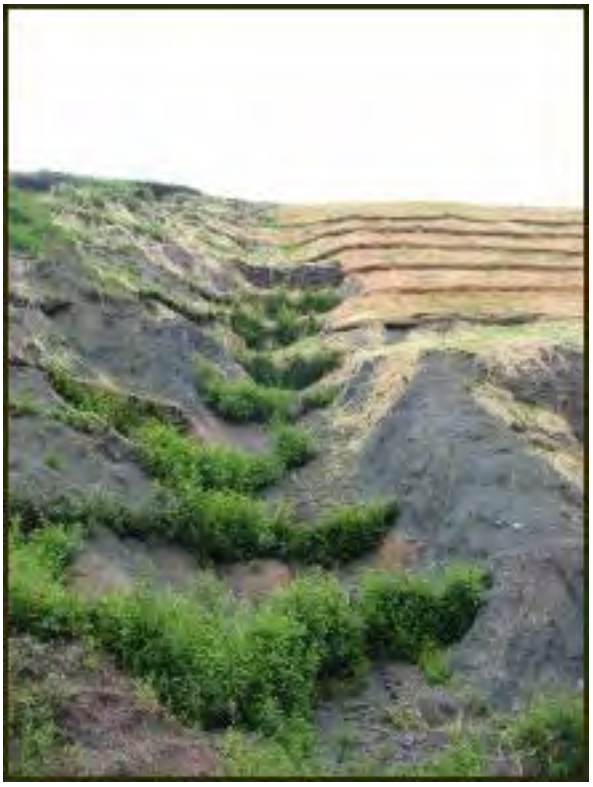
United States Environmental Protection Agency (EPA). 1993. Washington, DC, Office of Water. Massive document with a comprehensive description of management measures for reducing nonpoint pollution in coastal waters.

Natural Resource Conservation Service (NRCS).

NRCS has vast experience and many resources to help select, design and implement practices to reduce erosion and improve water quality. Staff at the NRCS office in Petaluma can provide site-specific technical assistance on a wide range of issues from grazing management to streambank repair. The NRCS Electronic Field Office Technical Guide provides Internet access to detailed standards and specifications for NRCS practices. It can be accessed through the NRCS website at http://www.nrcs.usda.gov/technical/efotg/ . The Petaluma Field Office is at 1301 Redwood Highway, Suite 170, Petaluma CA 94954, (707) 794-1242.

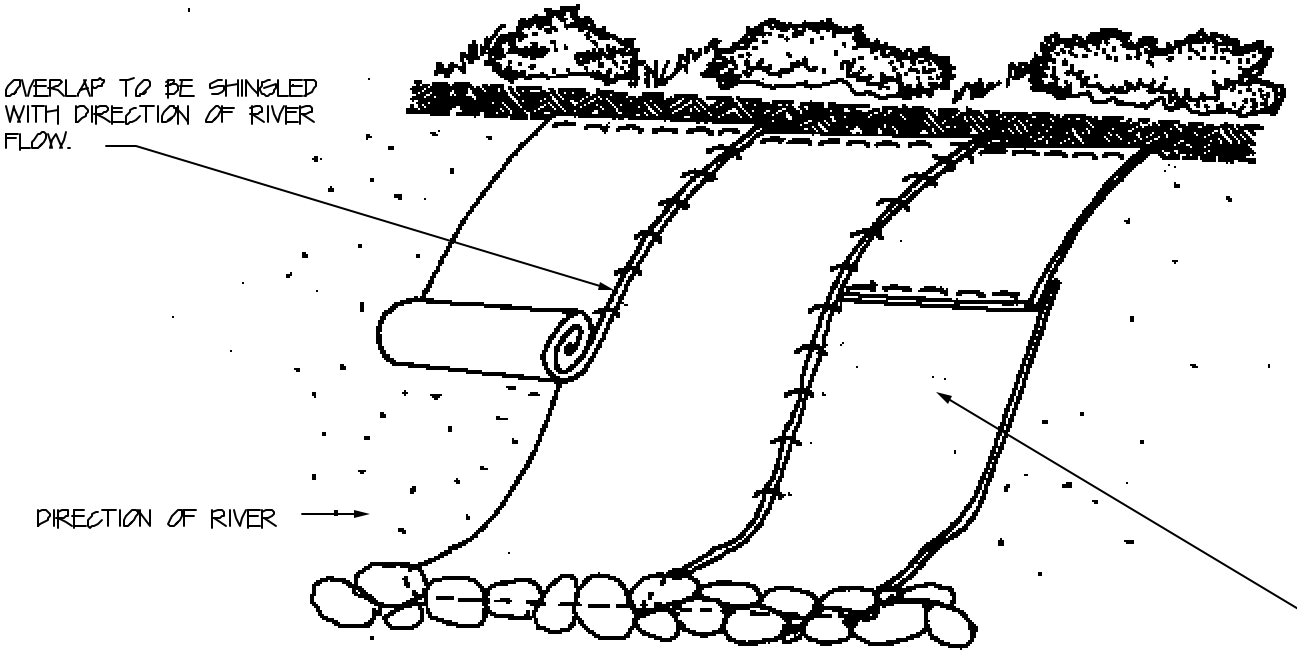
Erosion Control

Soil bioengineering or biotechnical erosion control uses traditional engineering principals in combination with live plant materials to provide surface and subsurface soil reinforcement to eroded or unstable lands. Soil bioengineering can use native plant material alone to provide deep rooting matrix's for soil stabilization or can be integrated with organic and/or inorganic building materials such as natural fiber blankets, boulders, logs and rootwads for more extensive repairs. Soil bioengineering is preferred over traditional hard engineered structures when working in streams, rivers, wetlands or other sensitive environments because it can be designed to provide forage and cover habitat for aquatic and terrestrial wildlife while using plants and materials endemic to the site. The following examples are given to provide an understanding of bioengineered projects. However due to the complexity of stream systems, any planned work should be done by a well rounded team of stream restoration specialists that may include landscape architects, civil engineers, hydrologists, geomorphologist, biologist, botanists and revegetation specialists.



Photos by Mike Jensen

Before, during, and after photos of a slide repair at Olema Creek using willow walls, straw wattles, fabric, and seed.



EROSION CONTROL BLANKET

NOTES:

1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING APPLICATION OF FERTILIZER AND SEED.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" DEEP BY 6" WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER PINNING.
3. ROLL THE BLANKETS DOWN THE SLOPE IN THE DIRECTION OF THE WATER FLOW.
4. THE EDGES OF PARALLEL BLANKETS MUST BE PINNED WITH APPROXIMATELY 2" OVERLAP.
5. WHEN BLANKETS MUST BE SPLICED DOWN THE SLOPE, PLACE BLANKETS END OVER END (SHINGLE STYLE) WITH APPROXIMATELY 6" OVERLAP. STAPLE THROUGH OVERLAPPED AREA. APPROXIMATELY 12" APART.
6. BLANKETS SHALL BE PINNED IN ROWS NOT MORE THAN 2 FT O.C., WITH A MAXIMUM OF 20" BETWEEN PINS, 3.5 PINS PER SQ YD.
7. LOWER END OF BLANKET TO BE TUCKED 6" MIN. BELOW EDGE OF STONE PROTECTION.

PRUNUSKE CHATHAM, INC.

P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

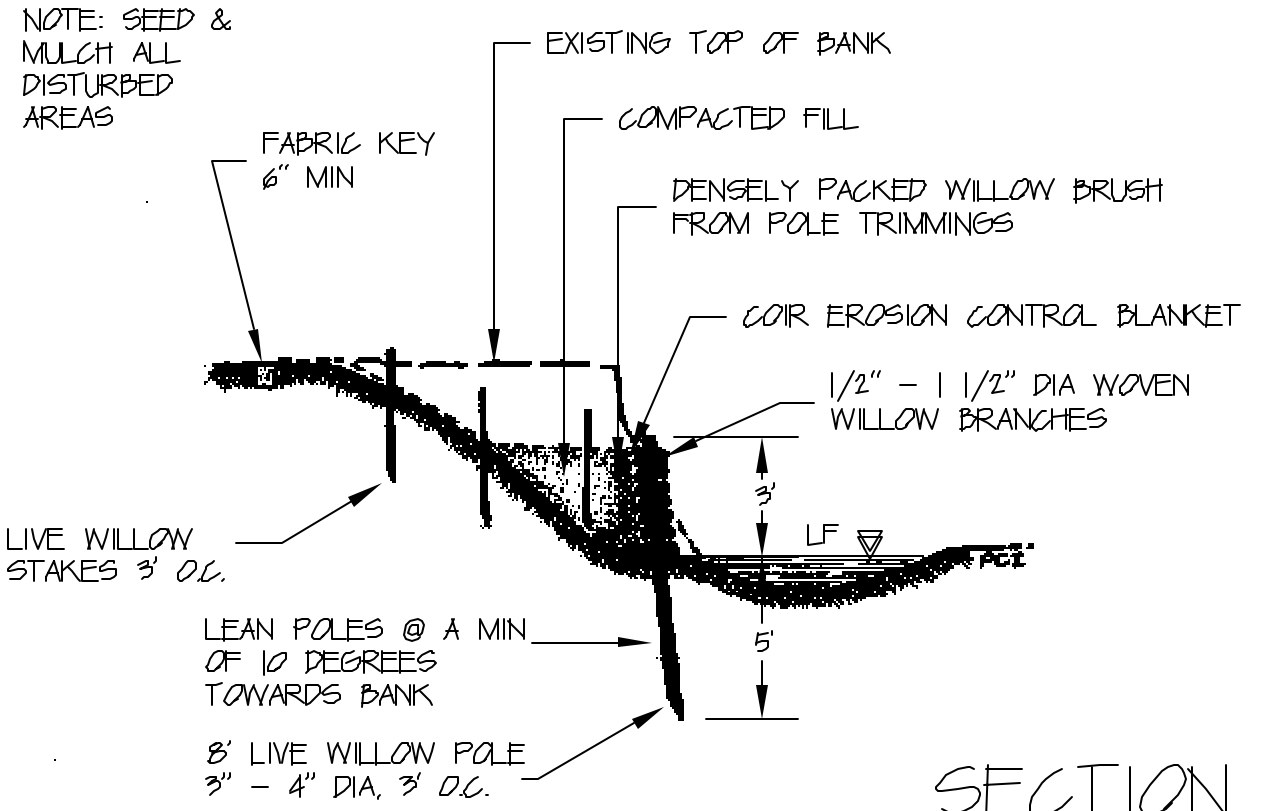
DATE: June 2002
SCALE: NTS
CHECKED BY: SC
DRAFTED BY: MJ
DESIGNED BY:

EROSION CONTROL BLANKET INSTALLATION

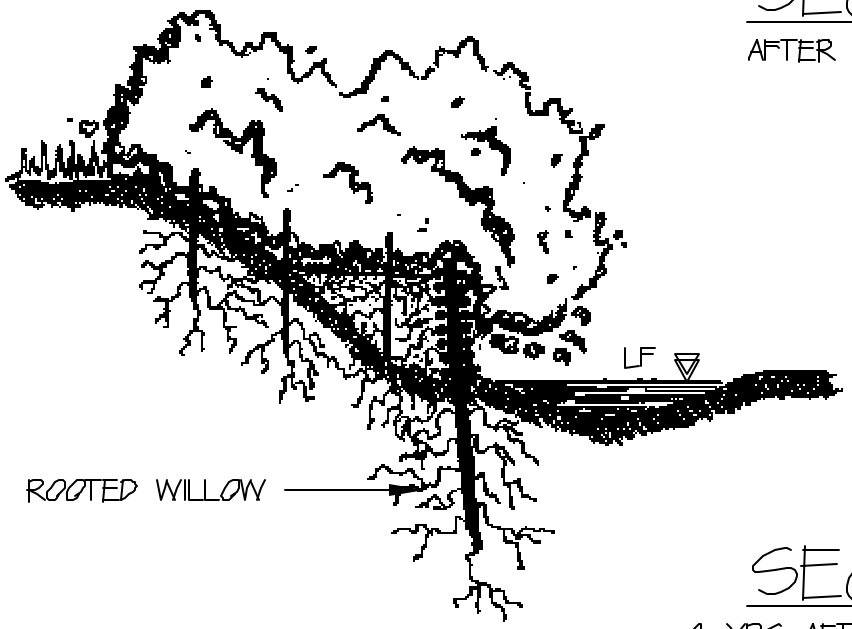
sheet

Photos by Mike Jensen

Before and after picture of a willow wall.



SECTION
AFTER INSTALLATION



SECTION
2 YRS AFTER INSTALLATION

CONCEPTUAL DRAWING
NOT FOR CONSTRUCTION

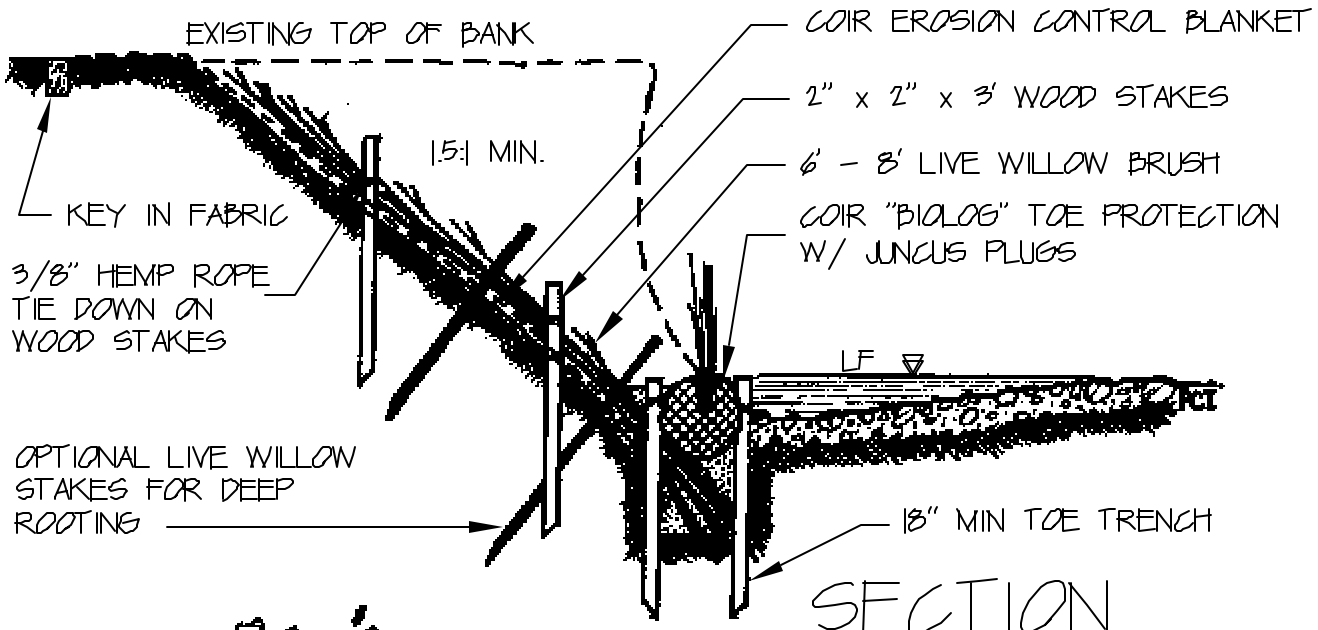
PRUNUSKE CHATHAM, INC. P.O. BOX 828 OCCIDENTAL, CA 95465 (707) 874-0100	DATE: JUNE 1, 1999 SCALE: CHECKED BY: DRAFTED BY: DESIGNED BY:	BIOTECHNICAL TREATMENTS WILLOW WALL REVETMENT	Sheet 6

Photos by Mike Jensen

Brush mattress and rock repair in Stemple Creek.

Photos by Mike Jensen

Brush mattress and rock repair in Stemple Creek.



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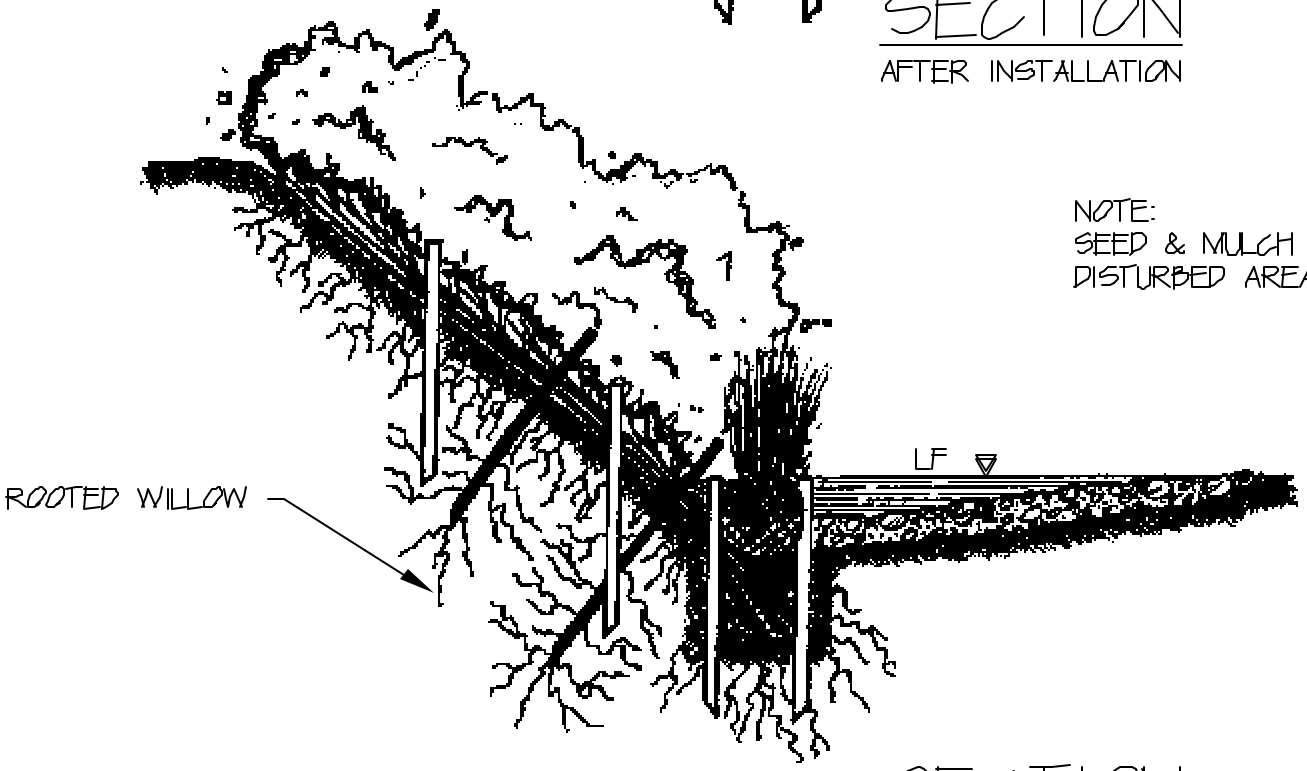

SECTION

2 YRS AFTER INSTALLATION

CONCEPTUAL DRAWING

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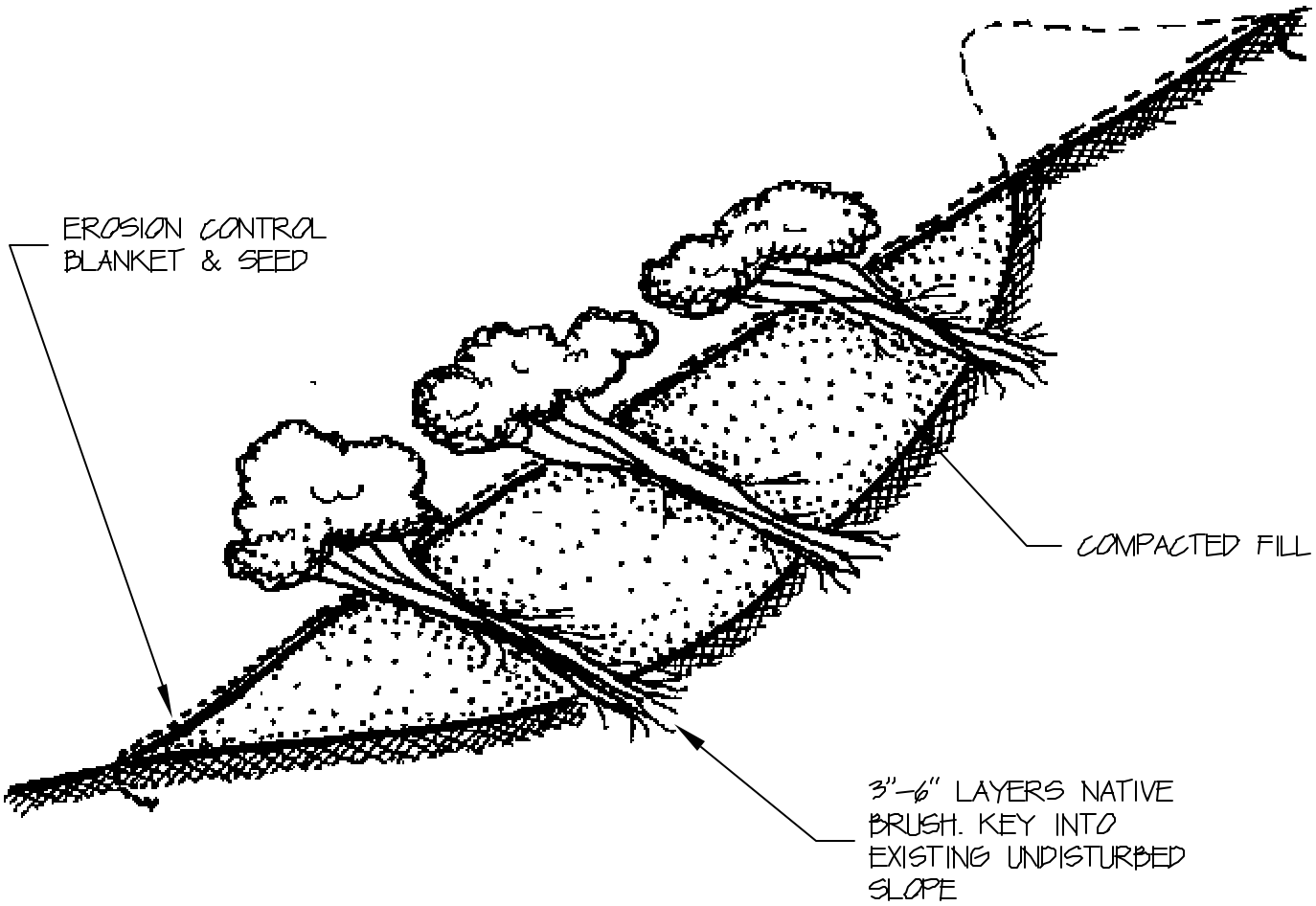
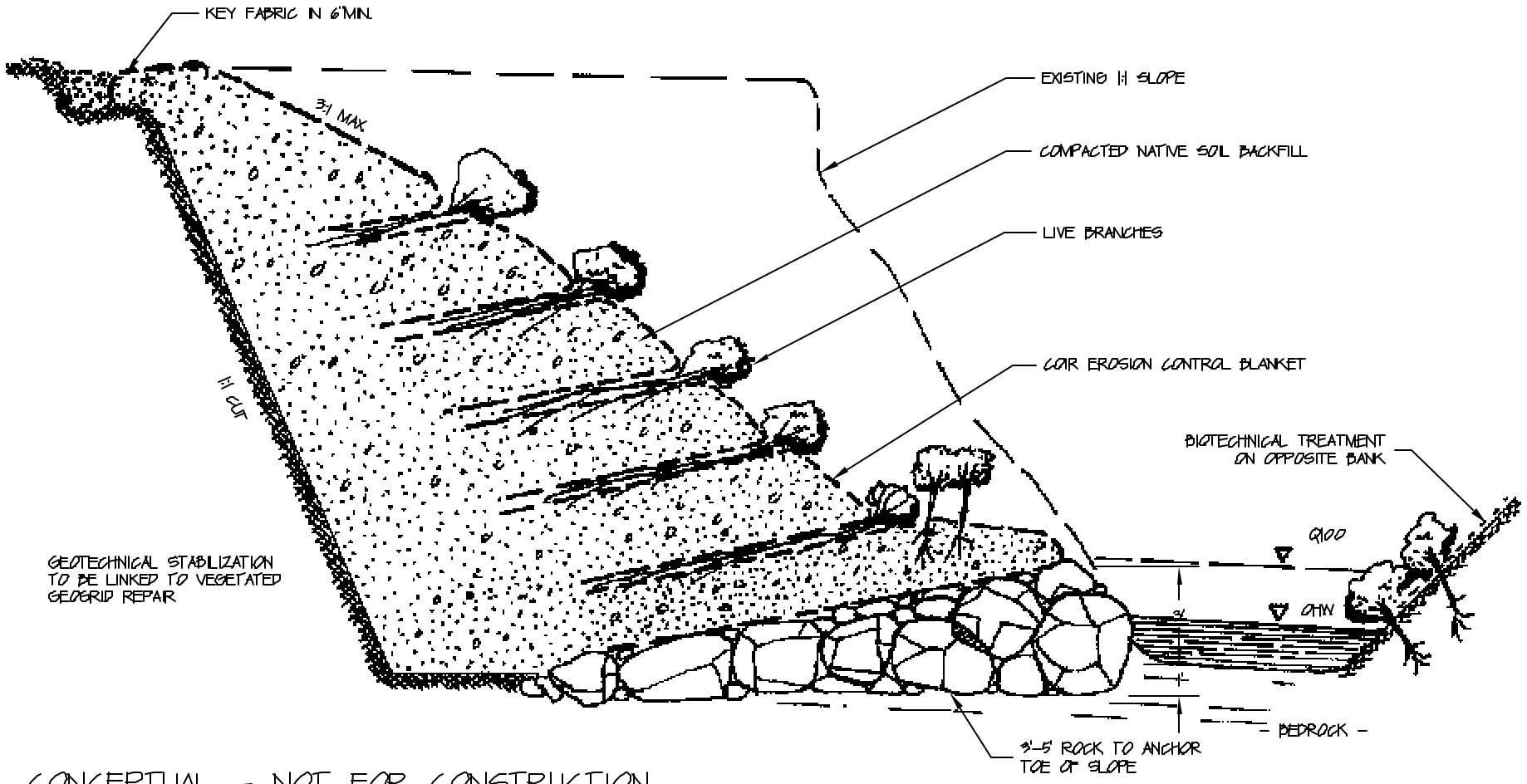
CONCEPTUAL - NOT FOR CONSTRUCTION



AREAS TO BE GRADED SHOULD BE CLEARED OF BRUSH, RUBBLE, DEBRIS AND OLD FILLS. SCARIFY EXISTING SURFACE BEFORE PLACEMENT OF FILLS.

PRUNUSKE CHATHAM, INC. P.O. BOX 828 OCCIDENTAL, CA 95465 (707) 874-0100	DATE: August, 2003 SCALE: NTS CHECKED BY: DRAFTED BY: DESIGNED BY:	BIOTECHNICAL TREATMENTS BRUSH LAYERING	Sheet



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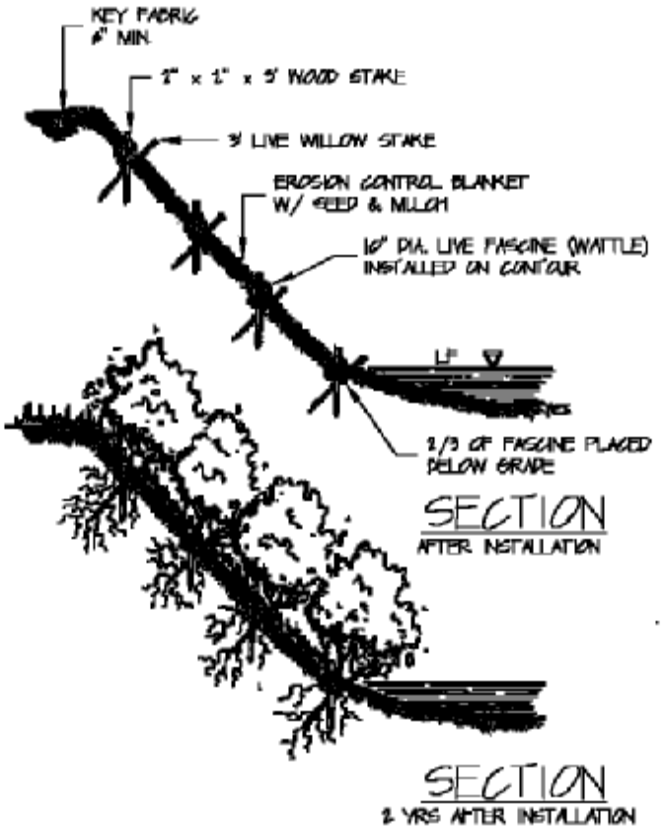
PRUNUSKE CHATHAM, INC. P.O. BOX 828 OCCIDENTAL, CA 95465 (707) 874-0100	DATE: MAY 28, 1999 SCALE: NTS CHECKED BY: DRAFTED BY:	REVISIONS	DATE	BY	PREPARED FOR:	BIOTECHNICAL TREATMENTS VEGETATED WRAPAROUND GEOGRID	SHEET

Prunuske Chatham, Inc photo

Biotechnical repair in Chileno Valley using a willow fascine.



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PRUNUSKE CHATHAM, INC. P.O. BOX 828 OCCIDENTAL, CA 95465 (707) 874-0100	DATE: MAY 1999 SCALE: NTS DRAWN BY: DESIGNED BY:	BIOTECHNICAL TREATMENTS WILLOW WATTLE STREAMBANK REPAIR	Sheet

For more information on erosion control, check these sources

Erosion and Sediment Control Field Manual
This manual from the California Regional Water Quality Control Board provides background and best management practices for controlling erosion in the field. Easy to use and illustrated with information about various erosion control practices. Manual is distributed by Friends of the San Francisco Estuary 510-622-2419.

Bioengineering for Land Reclamation and Conservation
Schiechtl, Hugo. 1980. University of Alberta Press, Edmonton, Alberta. A creative and historic look at using biotechnical methods, full of intriguing methods. Much of the source material is European.

Conquest of the Land through 7,000 Years
Lowdermilk, W.C. 1953. Revised 1975. USDA Soil Conservation Service, Ag. Info. Bull. No. 99. A delightfully written and fascinating (though sobering) account of how soil erosion has eradicated many ancient cities, and even entire civilizations.

Restoring Streams in Cities
Riley, Ann. 1998. Island Press. This book offers history, background and lessons from real projects to teach stream restoration.

Groundwork
Prunuske, Liza. 1987. Marin County Resource Conservation District.

Handbook for Forest and Ranch Roads A Guide for planning, designing, constructing, reconstructing, maintaining, and closing wildland roads
Available from the Mendocino County Resource Conservation District 707-468-9223.

Stream Corridor Restoration Principles, Processes, and Practices
Federal Interagency Stream Restoration Working Group. 1988. This is written by a collaboration of government agencies and provides a detailed and easy to use reference for restoration.
http://www.ntis.gov/products/bestsellers/stream-corridor.asp?loc=4-2-0

California Salmonid Stream Habitat Restoration Manual
California Department of Fish and Game. 2003. This manual describes the technical methods for inventory, evaluation and restoration of salmonid habitat.

Start at the Source
Bay Area Stormwater Management Agencies Association (BASMAA). 1997. An excellent and accessible handbook, lavishly illustrated, with specific recommendations for reducing stormwater runoff and increasing permeability. Available through their website at www.basmaa.org.

Journal for Erosion and Sediment Control Professionals
http://www.forester.net/ec.html

Wildlife Friendly Fencing

The first “rule” of wildlife friendly fencing is: If you really don’t need to fence, don’t.

Wildlife friendly fencing is defined as fencing which completely excludes wildlife without harm, or fencing which allows harm-free passage.

If you have to fence, the selection of fencing can be critical for wildlife, and one must consider the purpose for the fence to determine what is appropriate in any given situation.

Containment Fencing (inclusion) is designed to keep domestic animals in, and is used for cows, horses, goats, sheep and other livestock, and for containment of pets or small children. Some of the most common fencing types for these purposes are:

Simple wire strands on posts using from 1 to 6 wires, either barbed or smooth, generally from 4 to 6 feet high.

Simple wire fences can be very effective in keeping most livestock contained, and allow animal passage either over or through the wires. Small animals such as skunks, raccoons, deer fawns, and coyotes can pass under, and adult deer can easily walk through or jump over. A smooth bottom wire should be used to prevent scratching or puncture, and wire spacing should exceed 10 inches and be kept tight to prevent deer from catching their feet and hanging on the fence. Electric wire fences can generally use fewer wires since animals quickly learn to respect them.

Graduated field fence (woven or welded wire) with barbed wire on top, generally from 4 to 6 feet high.

The graduated field fence is generally used for livestock operations with young animals present, such as cow-calf operations. The graduated wire generally comes down to the ground, but can have a single barbed wire underneath to keep adult noses out, and closely spaced. These fences both keep the young animals from rolling or crawling out (while lying down), and keep predators such as coyotes and dogs out. They also generally have barbed wire strands on top to keep the adults from leaning over the fence to get the “greener grass” on the other side and breaking down the fence. The top wires of this fence type must follow the “10-inch" spacing rule and kept tight, since they have killed

more deer by leg snare than any other type. These fences should also be used in interior areas where possible, and not as perimeter fences if there is wildlife habitat present where you should allow wild animal passage or to get off the road. They also keep dogs in, but the fence should be buried in the ground some 18" to keep them from digging out, or to keep predators from digging in.

Non-Climbing wire (welded).

This fencing is generally used for horses, and uses solid frames and non-climbing wire (welded), and should be about 6 feet high, or higher for jumping horses. This height keeps most horses from jumping, or leaning on the top, which breaks them down. Most adult deer can jump 6 feet flat-footed on a vertical and flat fence. They should not be used for perimeter fencing or block wildlife habitat assess. Where adult horses are used, but not kept, the bottom of the fence can be lifted 12 to 18 inches to allow for wild animal passage when the area is not in use.

Illusionary Fencing

Deer have visual limitations . They can detect movement quickly, but have poor depth perception and cannot determine what to do with fencing which is not vertical, flat, and regular. A staggered 5-foot picket fence (on average) has been effective at keeping deer out of roses and gardens. Outriggers and leaning fences add depth, and most 5 foot high fences are not entered when leaned out or with an outreaching top section. Raccoons and opossums also have difficulty walking on uneven surfaces, but little keeps them out.

A single monofilament fishing line has been successfully used as a gate at 3-4 feet in height and put up at night across driveways and entryways. Flowerbeds have survived in the wild with a small fence built with monofilament line. Deer are startled when they touch something they cannot see, and will leave it alone. Single electric wires with an electrical "pop" will be avoided.

Exclusion fencing is designed to keep wildlife out. Each species may require different fencing designs and types, and many can be used for multiple species with similar habits and ability.

The principle that should be followed for exclusion fencing on a property, is to allow wild animals to use as much of your property as possible, and restrict them only from your designated "living space" or "garden space." This includes vineyards and other agricultural operations, where the fencing should be close to the activity. You can fence off your lawn, garden & flowerbeds with your house and other close structures, and let wildlife have the run of the rest of the property. This then provides for broad wildlife corridors and large areas of

connected habitat. For corridors, you want as large an area as you can supply, and many paths and smaller corridor units can add passage choice and reduce predation by clever species like the coyote, who learn quickly where game trails, fencing, and other features are that will aid their feeding strategy. Cattle guards work well to keep deer out of such areas if you don't want to use a gate, but use round bars and avoid flat ones that deer learn to cross.

Perimeter exclusion fencing should not include wildlife habitat, and stated opposite, wildlife habitat should not be needlessly excluded from wildlife use, or habitat is fragmented and entire local ecosystems are disrupted. This is now a serious problem in many areas for a wide range of animals, and many fences are unnecessary. You can partially correct this problem in existing fencing by making openings at strategic locations to allow animal passage.

The standard vineyard and personnel fence is 8 feet high on T-posts at 8 feet intervals, set down to ground level. The standard exclusion fence for housing areas is a wooden fence 7 to 8 feet tall that animals can't see through. This type of fence should be used only around the agricultural or living area, within the property boundaries if possible to allow for animal corridors. Corner gates are important in these fences for letting animals out. No matter what you do, someday you will find an animal in your yard and not know how it got in. If it's a deer, they are almost impossible to drive through a side gate, but will easily walk out a corner gate. Make vineyard units small, exclusion fence just the vineyard block, and allow corridors.

Corridors are critical for wildlife, and streams and other drainages are the most important areas for corridor planning. Fencing across creeks should be avoided, as well as allowing grazing animals to access perennial creek habitats. Create distinct grazing ranges or area separations with fencing that parallels the creek, and allow as much open space along the creek as you can. Grass filter strips along creeks and drainages, as well as secondary grassed drainages have proven to be critical for pollution filtering and can be more important for this function than flowing creeks. One hundred feet setback on each side is a good guide, but do what you can. A larger setback will allow for more tree, shrub, and grass habitat along upper banks and provide a higher quality corridor as well as reduce erosion losses. Where there are few corridors, the corridor should be much larger (300 feet +) to allow mixed habitat travel lanes and reduce predation. The guide here is "the bigger the better."

From: Allan Buckmann
California Department of Fish and Game

Livestock Fence Suitability Matrix

Prunuske Chatham Inc.

	Livestock				Game		# of Head			Terrain			Riparian Corridor						Vegetation					Land Use						Soil		Climate			Misc			Comments
	cattle	sheep/goats	horse	swine	deer	predator	high intensity	medium intensity	low intensity	steep slopes	variable slopes	flat	high sinuosity	medium sinuosity	low sinuosity	flood plain	daily tidal influence	gullies/depressions	forested	brush/scrub	grassland	crops	rangeland	pasture	corral	rotational	recreational	rocky	non-rocky	arid	wet	coastal (fog,salt)	low maintenance	volunteers	limited access	
Fence Styles																																				
Barbed wire (high tensile)																																				Wire spacing begins at ground
6-strand	■	▒	■	▒			■	▒		■	▒	■	■	■	■		▒	▒	■	■	■		▒	■				■	▒	▒	▒	▒				cattle & bulls, wire spacing 8-8-8-8-8-8 = 48" *
5-strand	■		▒				■	■	▒	■	▒	■	■	■	■		▒	■	■	■	■		▒	■				■	▒	▒	▒	▒				standard cattle, 12-9-9-9-9 = 48"
4-strand	■		▒				▒	■	■	■	■	■	■	■	■		▒	▒	■	■	■		■	▒	▒	▒		■	▒	▒	▒	▒		▒		cattle, 12-12-12-12 = 48"
3-strand	■							▒	■	■	■	■	■	■	■	▒	▒	▒	■	■	■		■	▒		▒		■	■	▒	▒	▒	▒	▒		range cattle, 18-12-12 = 42"
Barbed wire (standard, ie. Red Brand)																																				
5-strand	■	▒	■				■	■	▒	▒	▒	■	■	■				▒	■	■	■		▒	■						▒	▒		■			very common, subject to rust in wet areas.
High tensile (non-electric)																																				
12-strand	▒	▒	■	▒	▒	▒	■	▒		▒		■		▒	■		■	▒	▒	■	■		▒	■	■		▒	■	■	■	■	■	■	■		6-4-4-4-5-5-5-5-5-5-5-5 = 58"
8-strand	■	■	■	▒	▒	▒	■	■		▒		■		▒	■		■	▒	▒	■	■		■	■			■	■	■	■	■	■	■	■		low maintenance
High tensile (electric)																																				Note: All electric fences require weed management
10-strand	▒	■	■	▒	■	■	■	■		▒		■		▒	■			▒	▒	■	■		▒	■	■		▒	■	■	▒	■	▒	▒	■		horses, 6" x 10 = 60" (4 & 10 hot)
8-strand	▒	■	■	▒	■	■	■	■	■	▒		■		▒	■			▒	▒	■	■		▒	■	■		▒	■	■	▒	■	▒	▒	■		boundary/predator, 2-4-4-8-8-10-12 = 52" (2 & 4 hot)
6-strand	■	■	▒	■	▒	▒	▒	■	■	▒	▒	■		▒	■			▒	▒	■	■		▒	■	■		▒	■	■	▒	■	▒	▒	■		all livestock, 2-6-8-8-8-10-12 = 46" (alt. hot)
5-strand	■	■	▒	■	▒	▒	▒	■	■	▒	▒	■		▒	■		▒	▒	▒	■	■		■	▒	■		▒	■	■	▒	■	▒	▒	■		cattle, 8-8-10-10-12 = 46" (alt. hot)
3-strand	■	▒	▒					▒	■	▒	▒	■		▒	■		▒	▒	▒	■	■		■	▒		▒		■	■	▒	■	▒	▒	■		range, 12-14-18 = 44" (1 & 3 hot)
Field fence (high tensile)																																				
32" field fence w/ 2-3 strands of barbed on top	■	■	▒			▒	■	▒				■		▒	■			▒	▒	■	▒		▒	▒	■			■	▒	■	▒	▒				sheep, hold a few inches off ground to avoid rust
47" field fence w/ 2-3 strands of barbed on top	■	■	■		▒	▒	■	▒				■		▒	■			▒	▒	■	▒		▒	▒	■			■	▒	■	▒	▒				sheep & cattle, fasten off ground to avoid rust
78" game fence		▒	▒		■	▒		▒	■			■		▒	■			▒	▒	■	■		▒	▒				■	▒	■	▒	▒				vineyard & crop protection
Temporary/portable fence (electric)																																				
1-strand (ie. Hot Ribbon, Hottape)	▒	▒	▒						■	■	■	■	■	■	■	■		▒	■		■		■	▒		■		■	▒	▒	■	▒		■	■		rotational & seasonal requires livestock training
2-strand (ie. Bayguard, Polywire, Electro-twine)	■	▒	▒					▒	■	■	■	■	■	■	■			■	■		■		■	▒		■		■	▒	▒	■	▒		■	■		rotational & seasonal requires livestock training
3-strand (ie. Bayguard, Polywire, Electro-twine)	■	■	■					▒	■	■	■	■	■	■	■			■	■		■		■	▒		■		■	▒	▒	■	▒		■	■		rotational & seasonal requires livestock training

Legend
High Suitability
Medium Suitability
Low Suitability

For more information on grazing, check these sources

Riparian pastures incorporate carefully managed grazing along stream channels. It's a useful tool for ranchers to restore riparian areas without losing all floodplain grazing. Grazing can benefit some riparian systems by maintaining grass health and reducing invasive weeds, however riparian grazing plans are incredibly site specific. Timing the grazing to avoid impacts to new woody plants, nesting birds and aquatic wildlife; prevent erosion; and still harvest the forage while it has nutritional value to livestock requires skill and attention.

Natural Resources Conservation Service
707-794-1242. NRCS can provide technical assistance, funding and specifications for management tools including fencing, water development, seeding, stream crossings, manure management and grazing strategies.

University of California Cooperative Extension
415-499-4204. UCCE provides training and can assist with development of site-specific grazing management plans.

Marin County Agricultural Commissioner's Office
415-499-6700. Marin County can help with invasive weed removal resources.

Society for Range Management
The California-Pacific section lists Certified Rangeland Managers and newsletters available online.
http://www.casrm.org

Grazing Lands Technology Institute
Provides technical resources, research, and projects relevant to grazing.
http://www.glti.nrcs.usda.gov

Hedgerows

What is a hedgerow? A hedgerow is a line or group of trees, shrubs, perennial forbs, and grass that is planted along field edges, fencelines, drainage channels, property borders, and diverging land-uses. A native plant hedgerow uses plants adapted to your geographical region, which will attract a variety of insects, mammals, reptiles and birds. Farms and ranches around California are planting hedgerows as part of their overall management strategy. They provide year round habitat to beneficial insects, control soil erosion, and enhance water quality and retention.

A hedgerow can be installed to connect riparian or other valuable habitat areas, creating a corridor for animal movement. Native plants work extremely well in hedgerows because they provide numerous benefits while requiring little attention once they have established in 2-3 years. When considering a hedgerow installation on your property, determine your specific goals and relevant site variables. Planning, plant choices, and installation naturally follow.

Multiple benefits of native plant hedgerows include:

- Preventing soil erosion caused by excessive water runoff and wind
- Protecting water quality by reducing erosion
- Providing habitat to beneficial insects that control agricultural pests
- Providing habitat for pollinating insects
- Providing habitat for birds and wildlife
- Providing wildlife corridors when placed to connect vital habitat zones
- Minimizing weeds once larger shrubs and trees get established
- Providing a buffer between diverging land uses
- Minimizing issues of dust and spray drift
- Providing aesthetic beauty
- Providing privacy

Contact your local Resource Conservation District or the Natural Resources Conservation Service to inquire about cost-share opportunities for your project.

The Community Alliance with Family Farmers (CAFF) is assisting growers and ranchers to plan and install hedgerows. CAFF has relevant lists to help plan your project including: regionally appropriate plants to use, native plant nurseries in the North Coast, plants that attract beneficial insects, and consultants/contractors specializing in hedgerow and other restoration projects. Call Keith Abeles at (707) 823-6788 to obtain lists, get assistance or learn more.

For more information on hydrology and geomorphology, check these sources

Water in Environmental Planning
Dunne, Thomas and Leopold, Luna. 1978. WH Freeman & Co. This widely used text on water in the environment is a good introductory text. It covers hydrology, hydraulics, flood, hill slopes and watershed processes.

Applied River Morphology
Rosgen, Dave. 1996. Wildland Hydrology. This is an introduction to why rivers hav the shape and dimensions that they do. The book gives an overview of the kind of thinking river restoration professionals have to consider in planning projects.

Stream Corridor Restoration Principles, Processes, and Practices
Federal Interagency Stream Restoration Working Group. 1988. This is written by a collaboration of government agencies and provides a detailed and easy to use reference for restoration.
http://www.ntis.gov/products/bestsellers/stream-corridor.asp?loc=4-2-0

Water, Rivers and Creeks
Leopold, Luna. 1997. University Science Books. This book is a nontechnical introduction to those wanting to learn more about hydrology and water processes.

Restoring Streams in Cities
Riley, Ann. 1998. Island Press. This book offers history, background and lessons from real projects to teach stream restoration. It also contains an excellent summary of basic fluvial geomorphology principles.

University of California Cooperative Extension
Dairy Manure Management Series

Water Quality

Deanne Morse and Rick Bennett[1]

INTRODUCTION

The availability and quality of water, an essential element, should concern all users. Water quality is characterized by its potential beneficial use. Standards are based upon these beneficial uses. Beneficial uses include agriculture, human and animal consumption, industry, navigation, recreation, fisheries, shellfisheries and wildlife activities. Materials may degrade water quality and impact beneficial uses.

The Environmental Protection Agency (EPA) is required to establish primary drinking water standards (11). Standards have been established to protect beneficial uses and exist for substances known to cause a human health risk (toxins, pesticides). These standards have been established to prevent harm to the animal, plant, and water populations and are evaluated by monitoring physical and biological qualities of water. They are legislated as parts of Federal laws. Federal, state and regional water quality regulations are established to prevent the contamination of ground and surface waters and to restore the quality of contaminated waters for the desired beneficial uses.

The two types of waters that can be contaminated are groundwaters and surface waters. Groundwaters are located underground, while surface waters (lakes, streams and estuaries) are above the ground.

Contamination of water originates from either point or non-point sources. Point source pollution is identified as pollution from a given source. Pollutants are collected into and potentially discharged from a single area (i.e. pipe). Discharges from livestock operations can be a point source of pollution.

California's Porter Cologne Act initially was passed to protect waters from point source

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contaminations. Subsequently, the Federal Clean Water Act (initiated in 1972) (6) was authored to "restore and maintain the chemical, physical and biological integrity of the Nation's waters." The primary focus was industrial point sources of contamination. Through this act and its amendments (7), the chemical (nutrients and toxins) and physical (oxygen demand, temperature, turbidity and sediments) properties of waters are regulated. Increased emphasis on biological monitoring is anticipated. Biological monitoring includes evaluation of insects, fish and plant life within a surface water source.

Non-point source contamination is from a broad and diffuse area. A field that has runoff is a non-point source for pollution because a large area is responsible for the pollution load. Potentially, the entire field is contributing to the contamination, not a single point in the field. Most agricultural operations are considered non-point sources of pollution. This makes identification and assessment of the contaminant source difficult. The contamination cannot be easily associated with a specific process and can be intermittent.

Non-point source contamination of groundwater has avoided major regulation until recently due to physical size and the general tendency to involve multiple political jurisdictions (17). The 1987 amendments to the Clean Water Act addressed non-point source pollution (7).

Dairy waste materials can be classified as both point and non-point sources of contamination, depending on herd size, proportion of confinement (time and space), and manure handling practices. Dairy waste materials include manure (urine and feces), foodstuffs, bedding and wash waters. Milk team wash waters may contain dilute acids, alkalis, detergents, sanitizers and manure nutrients. Each source of waste has specific compounds which may be of concern environmentally and which could potentially contaminate water.

The primary manure nutrients related to groundwater contamination are nitrogen (N) and phosphorus (P). Nutrients applied to soils in excess of the plants' requirements build-up in the soil over time, especially in arid areas. These nutrients migrate downward through the soil with water and eventually collect in the groundwater. Surface water pollution can result from these same nutrients. Additionally, dissolved oxygen (DO), bacteria load and sediment can contribute to pollution, all of which can result from contamination by manure.

GROUNDWATER

The primary agricultural components of groundwater contamination are nitrates, salts, pesticides, petroleum products and fertilizers (16). These chemicals may flow through the soil with water to the water table. In the absence of adequate soil moisture, most contaminants are not able to migrate downward to groundwater. Therefore, attention to nutrient application, water management and chemical storage is critical for preventing groundwater contamination.

Nitrates

Nitrates in drinking water at levels exceeding 10 ppm of Nitrate-N are potentially dangerous, especially to newborn and young animals (13, 14). Nitrate has been responsible for inadequate gains in young calves and abortions in milking cows (3). Consumption of water with elevated nitrate can cause Blue baby syndrome" in infants (5) and respiratory dysfunction in young stock. Specifically, nitrate is converted to nitrite in the digestive tract. Nitrite reduces the oxygen-carrying capacity of the blood which may result in brain damage and even death in infants. The maximum tolerable level of Nitrite-N is 1. At this time, nitrate and nitrite remain unclassified with respect to their carcinogenicity. These agents are members of

Group D: inadequate or no animal evidence of carcinogenicity (12).

Nitrogen is applied to land in fertilizers, manure solids and manure water, irrigation waters and crop residues. With time, microorganisms in the soil can convert various forms of nitrogen into nitrate. If plants do not use all the nitrate and there is excess soil moisture, water will serve as the vehicle for downward flow of nitrate. It is by this mechanism that nitrates eventually enter the groundwater. Continued excess application of nitrogen to soil will almost inevitably result in nitrate leaching into groundwater where aquifers are recharged. Soil type, water and nutrient holding capacity determine how long it takes before excess nitrate enters the groundwater.

Salts

The concentration of soluble salt (salinity) in soil will increase when application rate exceeds crop use and nutrient removal. The amount and distribution of rainfall and irrigation, the type of soil and underlying strata, the evapotranspiration (ET) rates, and other environmental factors affect the movement and deposition of salts. In humid areas, dissolved mineral salts have been naturally leached from the soil and substrata by rainfall. In arid and semiarid regions, salts have not been removed by natural leaching and concentrate in the soil.

Excessive concentrations of sad in the soil come from various sources. Irrigation waters, soil amendments and nutrient applications can deposit more sags than most agricultural crops can use. As the water is consumed by plants or lost to the atmosphere by evaporation, the sags remain and become concentrated in the soil. The accumulation of sags in soil eventually is detrimental to plant growth if unmanaged. To offset this condition, some people apply excessive irrigation water to leach sags below the root zone. This practice can ultimately deliver sags to underlying aquifers or surface waters. Attention to irrigation and nutrient application practices is necessary to maintain cropland productivity over decades of use.

Pesticides

Herbicides, insecticides, and fungicides are used to control crop pests. Improper storage of pesticides and improper application rate and timing are responsible for the contamination of groundwater. It is illegal to dispose of outdated or illegal pesticides manure holding or treatment ponds or piles. The end fate of pesticides in these environments is not known and is potentially dangerous. Proper pesticide storage and application guidelines are best obtained through pesticide certification courses. Such courses are recommended before pesticides are used and as an update on current technology.

SURFACE WATER

Surface waters include lakes, streams, creeks, wetlands, and seasonal waterways (including annual creeks and streams) and estuaries. The direct discharge of wastes into a waterway requires a valid waste discharge permit and is prohibited unless the discharge can be shown not to degrade the receiving water. Additionally, direct discharge is not permitted if it will harm the biological integrity of the water. Elements of surface water contamination can include sediment, nitrogen, phosphorus, bacteria, toxins and chemical and biochemical oxygen demand effects on dissolved oxygen (16). Each component can affect the chemical and physical integrity of waterways and alter habitats for living organisms, thereby altering the biological integrity of water.

Dairy waste can infiltrate surface water in a number of ways. Damaging and illegal point source release of wastes occurs when waste storage ponds or similar structures leak or overflow into nearby waterways. Relatively small volumes of waste can cause detrimental chemical changes in the water.

The chemical alteration may be restored in a relatively short time. However, restoration of destroyed habitats for aquatic life in affected waterways may take months or years.

More subtle, yet significant, sources of accidental discharge in waterways can occur during rains. Heavy or constant rainfall can discharge waste into surface waters from manured areas or from fields that are fertilized with dry or fresh manures. Special care must be taken if manure must be spread during the rainy season.

An often overlooked source of waste is the high use areas of large pastures. High use areas around feeders, water troughs and gates and lack of vegetation and can build up significant amounts of manure. When exposed to moving water from rain or down slope flows, these soiled areas are a source of pollution to nearby waterways.

Sediment

Sediment is the single most prominent cause of surface water contamination in California (10). Sediment is the result of erosion, and it is the solid mineral and organic material in suspension that is transported by air, water, gravity or ice. Sheer, fill and gully erosion can create sediment. On dairies, overstocked pastures, inadequate corral management and poorly timed tillage practices can lead to sediment problems. Eroded soil is redeposited as sediment on the field it came from or transported away from the field in the runoff.

Sediment affects water usage in many ways. Sediment deposited in creeks and streams eventually ends up in reservoirs. Sediment accumulation reduces the holding capacity of reservoirs and may also cause streams to become more shallow. This alters the environment for aquatic organisms (15). Suspended solids reduce the amount of sunlight available to aquatic plants, cover fish spawning areas and food supplies and clog the filtering capacity of filter feeders and the gills of fish. Consequently, there is a reduction of fish, shellfish and plant populations and a decrease in the overall productivity of lakes, streams, estuaries and coastal waters.

The surface of a field is rich in nutrients and other chemicals because of fertilizer, manure and pesticide applications. Therefore, sediment which originates from surface soil has a higher potential for pollution than sediment from subsurface soils. Low density organic matter from field manure application is easily transported in flowing water. Consequently, sediment from cropland contains a higher percentage of finer and less dense particles than the soil from which it originated. Large particles are also readily removed from the soil surface because they are less cohesive.

Nutrients are also carried away with sediment soil particles. Pesticides, phosphorus and ammonium attach to and are transported with sediment. Eventually soil particles will release the bound chemicals on nutrients and contaminate the water. The speed at which this occurs will depend on existing physical chemical properties of the water.

Dissolved oxygen

Aquatic species utilize dissolved oxygen (DO) in respiration. Under normal environmental conditions the maximum DO concentration is 11 mg/l (milligrams per liter) or 11 ppm (parts per million) (18). When DO drops below 5 ppm, mortality occurs.

Biochemical oxygen demand (BOO) refers to the ability of organic material (dairy waste, decomposing bacteria, plants) to reduce the DO in water. Bacteria remove oxygen from water as they metabolize organic materials high in BOD. This oxygen depletion eventually results in the death of not only the bacteria, but of oxygen-dependent aquatic species. The subsequent decomposition of the

bacteria will further reduce DO concentration in water.

Nutrient-enriched waters stimulate algae production, which increases water turbidity, which decreases sunlight penetration through the water. Submerged aquatic vegetation provides habitat for small or juvenile fish and will die without sunlight. The loss of the vegetation can have severe consequences for the food chain.

Bacteria

Dairy waste, either fresh, dry or in liquid storage, may contain high concentrations of coliform bacteria which are potentially hazardous to cattle and human health. The standard value of coliform bacteria in fresh cow manure is 500 colony-forming units/pound of fresh manure (1). This value can increase rapidly in appropriate environments. Fecal coliforms are a problem to human drinking water if the bacteria are in high concentration. Manure is a potential contaminant of domestic wells. Fecal bacteria can infiltrate wells when the manure management system and domestic well are not properly maintained.

Rain runoff in coastal areas can move soil, manure, and associated bacteria to ocean waters. Elevated coliform counts can result in temporary closing of oyster farms by local Departments of Health Services (2). Coliform bacteria counts are used as an indicator of human sewage contamination. It is not known if the elevated coliform counts originated from human, lifestock or wildlife (deer, ducks, etc.) sources. Inexpensive, readily available methods do not exist to differentiate human from animal contributions to coliform count.

Nitrogen

Eutrophication (first steps to death) occurs in lakes, estuaries and coastal waters when undesirable bacteria and algae displace desirable bacteria and algae. Nitrogen is a potential contributor to this process, and thus a key link in the cycle which can result in a dying lake. Nitrogen availability usually is the limiting factor for plant growth in aquatic ecosystems. If nitrogen is limiting the growth of bacteria or plants, its addition to the water in the form of leaching or runoff will potentially increase the vegetative growth of the body of water. As the bacteria and plants grow, die and decompose, the water is stripped of oxygen. The resulting change in the oxygen content of the water will affect the survival of aquatic species found within that particular body of water.

Nitrogen is awed to soil primarily by applying commercial fertilizers and manure, by growing legumes, by incorporating crops, through irrigation water and, to a much lesser degree, through rain. The addition of nitrogen to the soil may be beneficial for crop yield. The most biologically important inorganic forms of nitrogen are ammonium (WHO), nitrate (NO3-), and nitrite (NO2). The chemical form of nitrogen determines its impact on water quality. Ammonium is the form of nitrogen which is of greatest concern to surface water quality.

Ammonium contributes to BOD and reduces DO concentration in water. It forms ammonium hydroxide in water and is extremely toxic to fish and aquatic life (8). Ammonium hydroxide occurs in more alkaline water (pH ~ 7.0) and in warmer stream bank waters. Ammonium hydroxide concentrations between 0.5 to 0.65 ppm have caused 50% mortality of trout within 5.5 hours (9). Waters with low DO and high ammonium hydroxide or other toxic agents are more toxic than waters with low DO alone.

Ammonium becomes absorbed by the soil and is lost primarily with eroding sediment. Dissolved ammonium in surface water at concentrations above 0.2 mg/1 may be toxic to fish, especially trout. Dry waste, however, contains little ammonium. The addition of moisture establishes an environment which

favors ammonium formation. Dry waste located in a dry stream bed can produce ammonia and ammonium as rains occur and water accumulates, resulting in fish kills.

Soil microorganisms can convert ammonia to nitrate-nitrogen. Nitrate-nitrogen is highly mobile and can move readily below the crop root zone, particularly in sandy soils. Nitrate can also be transported with surface runoff, but not generally in large quantities. Eventually, nitrate-nitrogen can be released from sediment and used by bacteria and algae for growth.

Phosphorus
The phosphorus content in most soils is low (between 0.01 and 0.2 percent by weight), and most of this phosphorous is not available for plant use. Phosphorous-containing manure and fertilizers are used to promote plant growth in phosphorous deficient soils. Excessive application of phosphorous can result in accumulation in soil, and when runoff and erosion occur, over-applied phosphorus can reach nearby surface waters. This is a particular problem when high-intensity storms increase the loss of inorganic phosphorus from croplands in the form of eroding sediments.

Phosphorus can be found in the soil in dissolved or particulate forms. Dissolved inorganic phosphorus (orthophosphate phosphorus) is probably the only form directly available to algae. Algae consume dissolved inorganic phosphorus and convert it to the organic form. Algae eventually die, reducing oxygen levels of water and resulting in death of aquatic organisms.

Unavailable phosphorus in the soil system can create water quality problems when it erodes with soil particles and is later released in streams. Phosphorus generally is the limiting nutrient for algae and bacterial growth in freshwater systems located in high rainfall, poor quality soil regions. In some estuary systems, both nitrogen and phosphorus can limit algae and bacterial growth. The addition of phosphorus as a non-point source pollutant can have an adverse effect in both freshwater and estuary systems because increased algal and bacterial growth decrease dissolved oxygen content in water.

Salts
Irrigation return flows provide the means for transporting the salts to the receiving streams or groundwater reservoirs. The total salt load carried by irrigation return flow is the sum of the original salt in the applied water plus the salt picked up from the soil. If the amount of salt in the return flow is low compared to the total stream flow, water quality may not be degraded. The process of water diversion for irrigation and the return of saline drainage water along a stream or river is not acceptable. This practice will progressively degrade the water quality downstream.

Pesticides
Pesticides or their degradation products may persist and accumulate in the aquatic ecosystems. Pesticides may harm the environment by eliminating or reducing populations of desirable organisms, including endangered species.

The amount of a field-applied pesticide that leaves a field in the runoff and enters a stream primarily depends on the time between application and the rainfall or irrigation as well as the intensity and duration of rainfall. Pesticide losses are greatest when rainfall is intense and occurs shortly after application and where such conditions favor water runoff and soil erosion. Pesticides can be transported to receiving waters either dissolved in water or attached to sediment.

Dairy Chemicals and Agents
Little is known about the toxicity of dairy sanitizers and cleaning agents. This toxicity is a factor of the concentration of the active forms of these compounds and how they

interact with other chemicals in the environment.

The use of copper sulfate foot baths is common on dairies. Elevated levels of copper have been found in dairy lagoon waters and in surface waters adjacent to fields irrigated with these waters. High copper levels have been found in estuaries near dairies on the North Coast (4).

SUMMARY

Maintaining and improving the quality of water degradation is critical for the long term viability of a farm site and is mandated by Federal, state and local regulations. Society's increased environmental awareness is a driving force behind much of the legislation. Manure and dairy waste nutrients must be managed appropriately to avoid surface and ground water contamination. Implementation of appropriate management practices can eliminate or reduce non-point source pollution to surface and groundwaters.

REFERENCES

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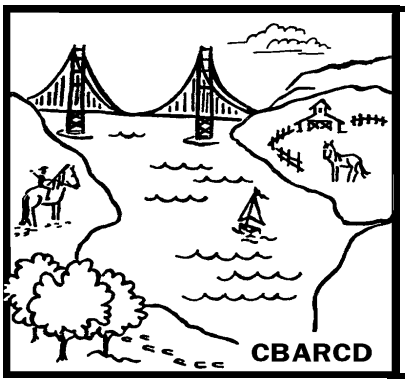
About this series...

This publication is part of a series on dairy manure management. The sections focus on specific issues relevant to the California dairy industry.

The purpose of individual sections is to provide current scientific information related to dairy manure management. Producers are required to integrate air, land, water, plant and animal resources. Each management decision may impact these separate but intertwined resources.

Factual, scientific information is needed by producers, regulators, planning commissions members, and citizens concerned about their environment. This series is designed to provide foundation knowledge about dairying and the environment. Further information is available through University of California Cooperative Extension.



Council of Bay Area Resource Conservation Districts

Equine Facilities Assistance Program

"Working with horse owners to protect San Francisco Bay Area water resources."

Horse Manure Management

Number 9 July 2000

Horses are a valued part of California's suburban and rural environment. Just as horse owners plan the input (feed) for horses, they need to plan for the output (manure). Horse facility owners should develop a waste management plan to ensure clean and safe facilities, protect creeks and ground water, reduce odors and insect breeding opportunities. The plan can be functional — not an elaboration creation. Document the manure use or disposal options you plan on using, such as utilizing manure as a soil amendment or hauling manure off-site. Consider visual impact, odor, health and safety implications, as well as economic costs and benefits in developing and implementing the waste management plan. Effective horse manure management helps protect water quality.

Benefits of implementing a comprehensive waste management plan:

- Healthier environment for horses
- Cleaner and safer work area
- Utilization of manure as a soil amendment
- Protect creeks and streams
- Reduce waste volume
- Reduce odors
- Reduce insect breeding opportunities
- Reduce neighbor complaints

Natural land features must be considered when developing a waste management plan. Evaluate slopes, soils, vegetation, and proximity to creeks and drainageways to avoid polluting water. With growing concern about groundwater protection, land characteristics below the soil surface also need evaluation.

A successful manure management plan involves collection, storage, and disposal or utilization.

Collection

- Clean-up manure from stalls and paddocks daily; scrape (or otherwise clean out) turn-outs and corrals regularly.
- Horses on pasture generally disperse their manure where it is recycled naturally by the land. If horses deposit manure in one area, periodically spread it around.

Storage

Manure must be properly stored to maintain good condition, be easy to handle, and avoid leaching nutrients to ground or surface water. Management measures include:

- Locate the storage facility away from creeks, ponds and wells.
- Storage facilities may be covered bins, sheds of concrete or lumber, piles covered with tarps, dumpsters, or covered garbage cans. The type and size of the storage facility depends on how much manure will be stored and the method of disposal or utilization. Include the volume of bedding when sizing a storage facility. Two cubic feet per day of manure and bedding is an estimate of what a 1000 lb. horse can generate.

- The storage facility may require a concrete base depending on the permeability of the soil.
- Be sure the area is convenient for loading and unloading. If motorized equipment will be used, construct the facility large enough and strong enough for the equipment.
- Clear out manure storage areas before the winter rains.
- Grading of the site may be necessary. Check regulations and required permits, and avoid working around environmentally sensitive areas like wetlands or creeks.

Control Drainage

Use drainage improvements to protect stored manure from rainfall, surface runoff and flooding.

- Use a cover to prevent stored manure and liquid drainage from manure piles (leachate) from entering creeks and waterways.
- Locate the storage facility on an impervious surface such as concrete, compacted clay, or plastic to reduce the potential for seepage into groundwater.
- Divert any runoff that does leave the storage site to a grass filter strip.

Utilization

- Manure can be applied to land as a fertilizer and soil amendment. Composed horse manure decreases the risk of spreading internal parasites and weed seeds.
- Composting manure and bedding materials reduces bulk, eliminates odor, improves handling qualities, and produces a valuable product that can be given away or used on the property. Composting requires sufficient nearly level space, equipment, labor, and a source of water. (See Fact Sheet #2 — *Composting Horse Manure*.)
- Large horse facilities might want to hire a consultant to help plan a workable, environmentally safe manure management system.

Disposal

- Local or regional "green waste" composters will accept manure for a fee.
- CALMAX (California Materials Exchange program) lists horse stables that have manure to give away. Contact is: (916) 255-2369 or www.ciwmb.ca.gov/calmax
- Hauling off manure can be expensive, but may be the only alternative. Neighbors, landscapers, gardeners, and nurseries may want horse manure, but they usually want composted or aged manure.
- Ask your local waste management/recycling authority if there is a list of outlets.

A sound manure management plan needs careful attention to detail. It uses principles from engineering, animal science, economics, and crop and soil science to maximize the value of using animal waste as a soil amendment and to minimize the potential for environmental damage. Also, anyone keeping a horse should be aware of zoning, health, and water quality regulations. Resource Conservation Districts, USDA Natural Resources Conservation Service, University of California Cooperative Extension, and private consultants offer assistance in the development of these plans.

References:

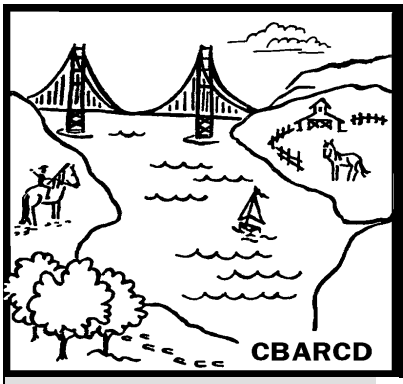
USDA Soil Conservation Service, Agricultural Waste Management Field Handbook, April 1992.

For more information contact:

Council of Bay Area RCDs
1301 Redwood Way, Suite 170
Petaluma, CA 94954
(707) 794-1242 ext 121

This fact sheet is part of a series prepared and published by the Council of Bay Area Resource Conservation Districts in cooperation with the USDA Natural Resources Conservation Service and the University of California Cooperative Extension. The Equine Facilities Assistance Program's goal is to protect San Francisco Bay Area water resources by assisting in effective management of possible non-point source pollutants associated with horses. Resource Conservation Districts (RCD) are non-regulatory, special districts governed by a volunteer board of directors. In addition to educational

This project has been funded in part by the United States Environmental Protection Agency Assistance Agreement No. C9-999414-96-1 to the State Water Resources Control Board and by Contract No. 7-028-252-0 in the amount of $255,000.00. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency or the State Water Resources Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.



Council of Bay Area Resource Conservation Districts

Equine Facilities Assistance Program

"Working with horse owners to protect San Francisco Bay Area water resources."

Conservation Measures to Reduce Non-point Source Pollution at Horse Facilities

Number 3 July 2000

Horse owners' responsible management of land and water resources improves horses' health, land productivity, property value, and relationships with neighbors while protecting the environment. Although horse facilities generate a small percentage of the Bay Area's total non-point source water pollutants, their high visibility draws attention. It is important for the horse community to demonstrate good stewardship of our natural resources.

Non-point source pollutants commonly associated with horses are:

- Sediment from soil erosion
- Organic matter, ammonia, nutrients and salts in horse waste (manure, urine and soiled bedding)

The siting of horse facilities near streams, in drainage swales that feed streams, and on steep slopes increases the likelihood of pollutants entering waterways. The basic strategies to prevent non-point source pollution are to:

1. Regularly clean-up and properly store and dispose of horse waste
2. Maintain moist and aerobic (where oxygen is present) conditions in paddocks to break down residual waste, however excessive wetness can cause hoof and disease problems
3. Keep "clean water clean" by diverting rainfall runoff around unvegetated and manured areas
4. Capture and contain "contaminated" rainfall runoff before it enters waterways

Visual observation during a heavy rain will help identify possible pollutant sources and routes of transport. With a little time and training horse owners can self-monitor their operations using simple water quality test kits.

If observations or tests indicate water quality impairment consider implementing one or more of the **conservation measures** outlined on back. Conservation measures do not need to be costly. Often, a slight change in operations will achieve the desired result.

Participating Resource Conservation Districts

Alameda County RCD
Contra Costa RCD
Marin County RCD
San Mateo County RCD
Southern Sonoma County RCD

Non-point source pollution consists of the diffuse discharge of pollutants that can occur over an extensive area. As water from rainfall, snowmelt, or human activity moves over and through the ground it picks up and transports natural and manmade pollutants, eventually depositing them into surface and ground water.

Water quality: a neutral term that relates to water's chemical, biological and physical characteristics. The quality of water often determines its specific use or its ability to support various beneficial uses.

For more information contact:

Council of Bay Area RCDs
1301 Redwood Way, Suite 170
Petaluma, CA 94954
(707) 794-1242 ext 121

A horse facility should consider the following conservation measures to limit water quality impacts:

Manure Management

1. Collect manure on a regular basis to limit the seepage of salts and nutrients into ground water, or the runoff of manure into waterbodies.
2. Store manure and soiled bedding in a manner that does not allow runoff or leaching from the storage area to affect water quality.
3. Implement an adequate on-site use or off-site disposal system for the waste.
4. During dry months, water,by sprinklers, areas where urine and manure accumulate to assist the aerobic breakdown of ammonium compounds.

Stream Protection

1. Do not allow horses unmanaged access to creeks, wetlands or other biologically sensitive areas. Create alternative sources for drinking water, shade and forage.
2. Preserve, enhance or recreate vegetated riparian zones to filter runoff, stabilize streambanks, reduce solar heating of creek water, and provide aquatic wildlife habitat. Even a zone of grass around waterways will help.
3. Design stream crossings that limit erosion.

Pasture Management

1. Manage pastures to prevent erosion.
2. Cross fence and graze pastures in rotation to allow grass time for regrowth.
3. Control horse trampling and churning of wet pasture.

Stormwater Runoff Management

1. Divert "clean" upslope runoff around corrals, paddocks, arenas, waste storage facilities, and other areas that are likely to contain horse waste or be void of vegetation. Diversion may lead to a concentration of runoff that can cause erosion unless it is adequately planned.
2. Employ a system of gutters, downspouts, and drains to convey "clean" roof runoff away from manured or bare soil areas in a non-erosive manner.
3. Route "contaminated" runoff from paddocks, corrals, arenas, and other areas void of vegetation or where horse waste is likely to accumulate, into a retention pond or an area with sufficient vegetation to filter the flow.
4. Do not allow horse wash water or irrigation runoff to enter directly into waterbodies.
5. Construct roads, parking areas, impervious surfaces, trails, and associated ditches and culverts to drain runoff in a non-erosive manner.

Other Conservation Measures

1. Determine correct application rates of fertilizer or manure to pastures.
2. Implement Integrated Pest Management techniques to reduce the use of pesticides.
3. Take steps to reduce the possibility of the airborne transport of pesticides, herbicides, and fungicides into waterbodies.
4. Plant or construct windbreaks around bare soil areas to reduce wind erosion and to provide shelter for wildlife.

Prepared by Alistair Bleifuss, Alameda County Resource Conservation District

This fact sheet is part of a series prepared and published by the Council of Bay Area Resource Conservation Districts in cooperation with the USDA Natural Resources Conservation Service and the University of California Cooperative Extension. The Equine Facilities Assistance Program's goal is to protect San Francisco Bay Area water resources by assisting in effective management of possible non-point source pollutants associated with horses. Resource Conservation Districts (RCD) are non-regulatory, special districts governed by a volunteer board of directors. In addition to educational

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For more information on manure management, check these sources

Horse Owners Guide to Water Quality Protection and
Horse Keeping: A Guide to Land Management for Clean Water
Available from Marin County Stormwater Pollution Prevention Program 415-49-6528

Natural Resources Conservation Service
707-794-1242. NRCS can provide technical assistance, funding and specifications for management tools including fencing, water development, seeding, stream crossings, manure management and grazing strategies.

Marin Horse Council
415-883-4621 ext 361

Native Plants

Native species should be used for replanting a riparian corridor. These plants provide attractive landscaping and habitat for native animal species. Local genetic plant stock is best adapted to local conditions. For example, oak trees that grow in flood prone areas are better adapted to saturated soil conditions than oaks from drier upland areas. Local plants form the base of the food chain and are part of the complex web between insects, birds, fish, and other species.

Native plants often require less water and are more resilient to insects and disease than many ornamental, non-native plants. Many are also good for erosion control.

Tips on planting natives

Observe the nearby native vegetation to identify what to plant. Plants that occur naturally along a creek are adapted to specific local conditions and will be the easiest to grow.

Native species that don't naturally occur in your area will require extra care and maintenance to become established.

Visit a native plant nursery to help select species that will thrive in your garden or on your streambank. Call Marin County Stormwater Pollution Prevention Program at 485-3363 for information on local plant sources.

Consult Grow It!: The Less Toxic Garden Guide for ideas on native, deer resistant, fire resistant, and drought tolerant plants, as well as those suitable for erosion control. Call Marin County Stormwater Pollution Prevention Program at 485-3363 for a free copy.

Care for your new plants during the first few years to help them become established. Dry season watering, regular weeding, and installing deer browse protectors will increase survival rates. Be sure to replant those plants that do not "take." Native plants do not need fertilizers and pesticides.

From *Creek Care A Guide for Urban Marin Residents*

Riparian trees and shrubs in urban Marin County

These native trees commonly grow in the freshwater reaches of the Marin County watersheds listed below. If you live in a tidal area or another watershed, or if you need help identifying plant species call Marin County Flood Control District at 499-6549.

- Novato Creek watershed: California bay, California box elder, coast live oak, Oregon ash, valley oak, and willow (red and yellow).

- Miller Creek watershed: California bay, California box elder, coast live oak, Oregon ash, valley oak, and willow (red and yellow).

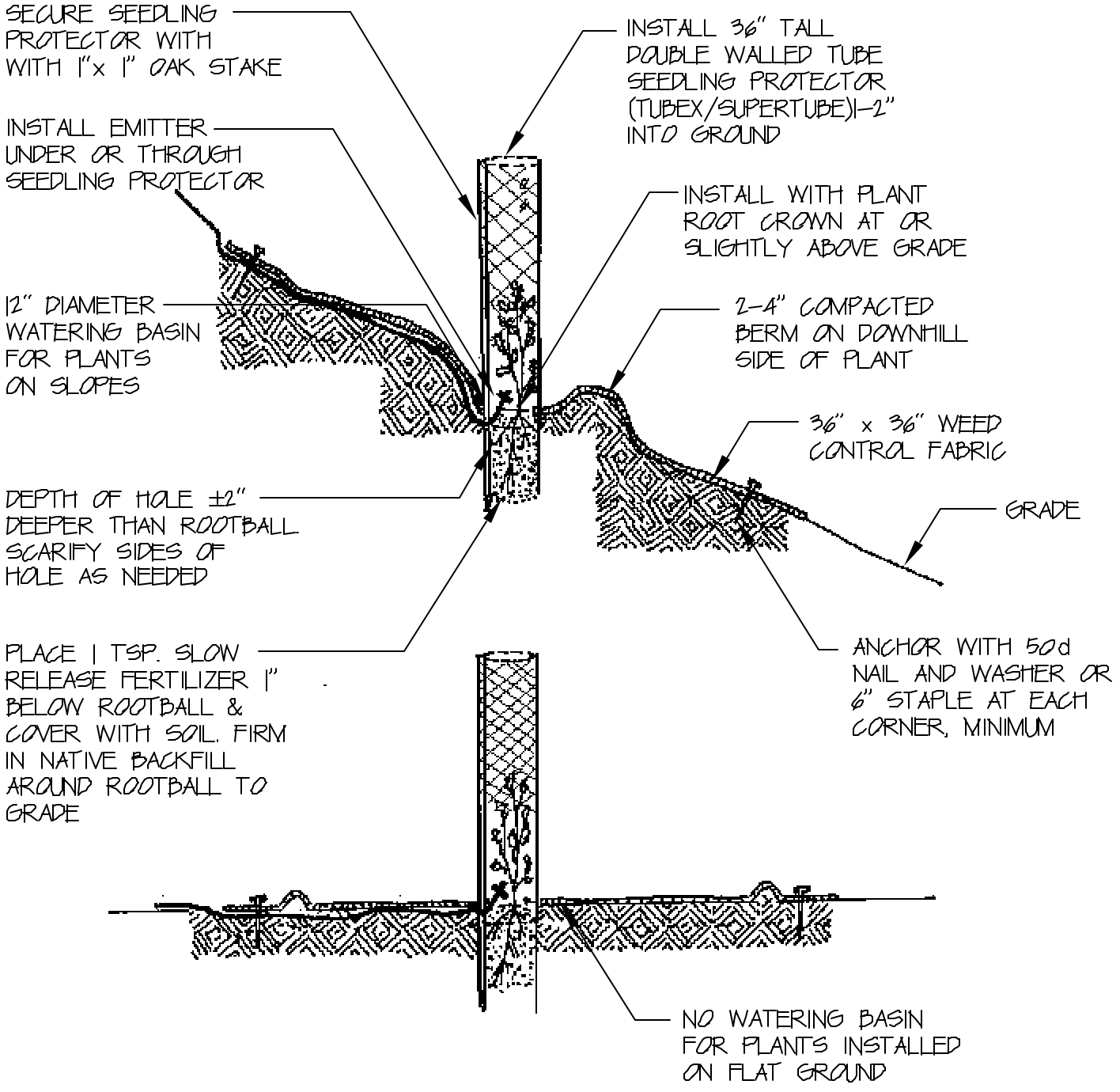
- Corte Madera Creek watershed: California bay, California box elder, coast live oak, Oregon ash, valley oak, white alder, and willow (red and yellow).

- Mill Valley Creek watershed: Big-leaf maple, California bay, coast redwood, tanbark oak and white alder.

Other common riparian trees are California black walnut California buckeye, California nutmeg, and red alder.

Common riparian shrubs include California blackberry, blue elderberry, California hazelnut, coffeeberry, dogwood, ninebark, salmonberry, snowberry, spice bush, thimbleberry, twinberry, toyon, western azalea, and willow (arroyo).

From *Creek Care A Guide for Urban Marin Residents*

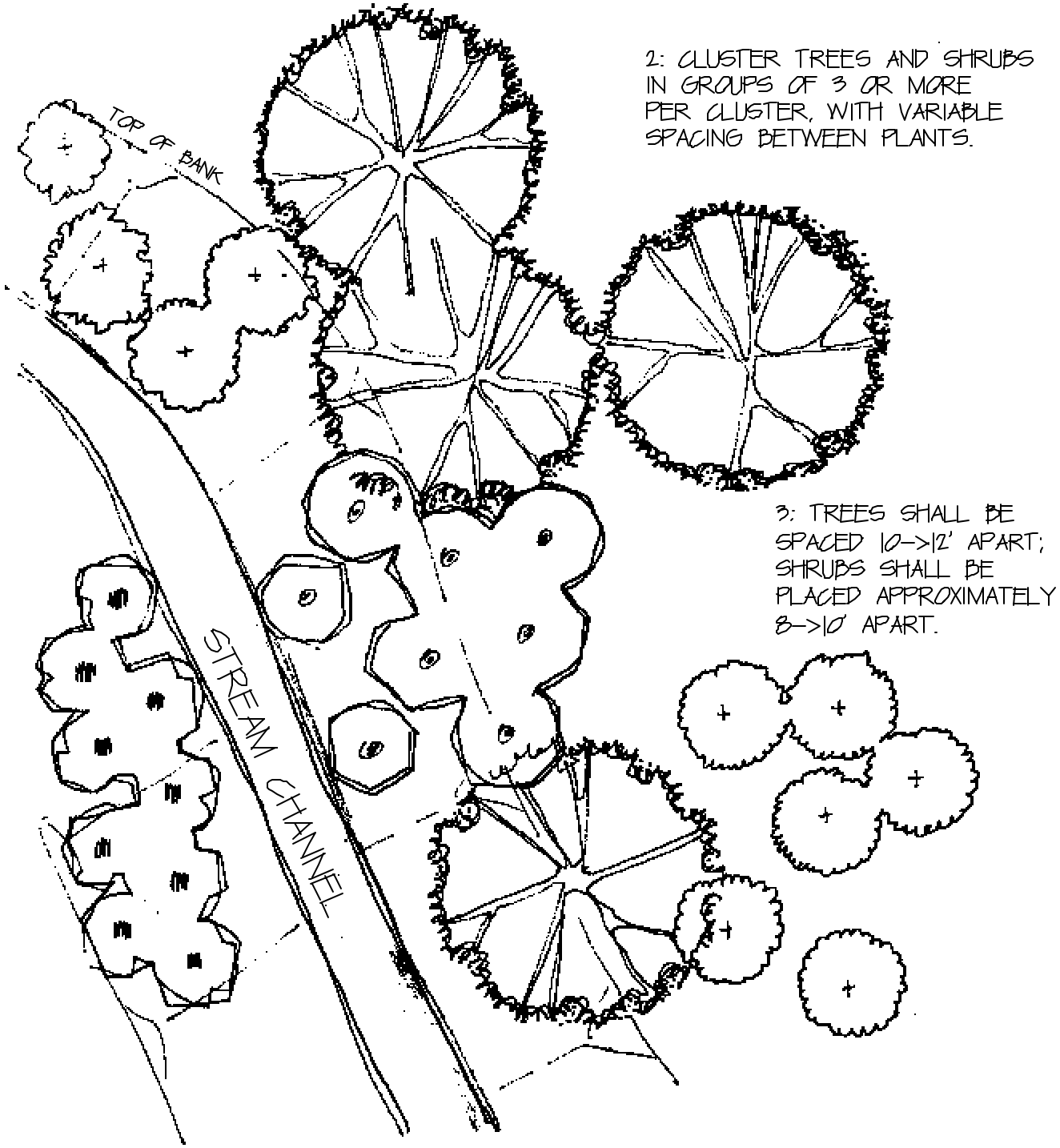


NOTE: REMOVE SEEDLING PROTECTOR AFTER 3 YEARS OR WHEN PLANT IS WELL ESTABLISHED.

PRUNUSKE CHATHAM, INC. P.O. BOX 828 OCCIDENTAL, CA 95465 (707) 874-0100	DATE: JUNE 1, 1999 SCALE: NTS CHECKED BY: HA DRAFTED BY: MH/DP DESIGNED BY: MH	BIOTECHNICAL TREATMENTS NATIVE SPECIES REVEGETATION	Sheet A

NOTES:

1. EXACT LOCATION OF PLANTS TO BE PIN-FLAGGED BY REVEGETATION SPECIALIST PRIOR TO INSTALLATION.



2: CLUSTER TREES AND SHRUBS IN GROUPS OF 3 OR MORE PER CLUSTER, WITH VARIABLE SPACING BETWEEN PLANTS.

3: TREES SHALL BE SPACED 10->12' APART; SHRUBS SHALL BE PLACED APPROXIMATELY 8->10' APART.

PRUNUSKE CHATHAM, INC. P.O. BOX 828 OCCIDENTAL, CA 95465 (707) 874-0100	DATE: JAN, 2000 SCALE: NTS CHECKED BY: HA DRAFTED BY: MH/DP DESIGNED BY: MH	WOOD PLANT CLUSTERING	SHEET 1

Creating pervious surfaces for new development and redevelopment

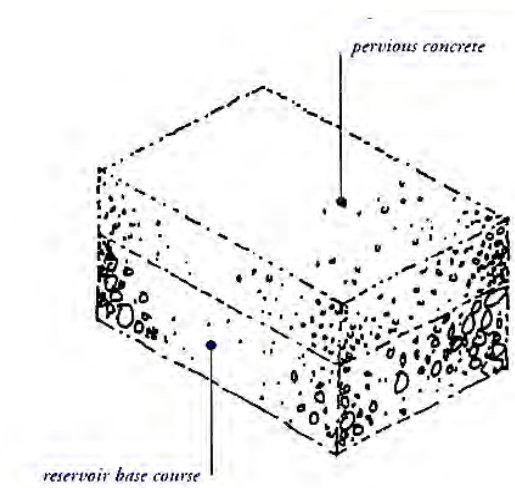
STRUCTURE TYPE:

PERMEABLE PAVEMENTS

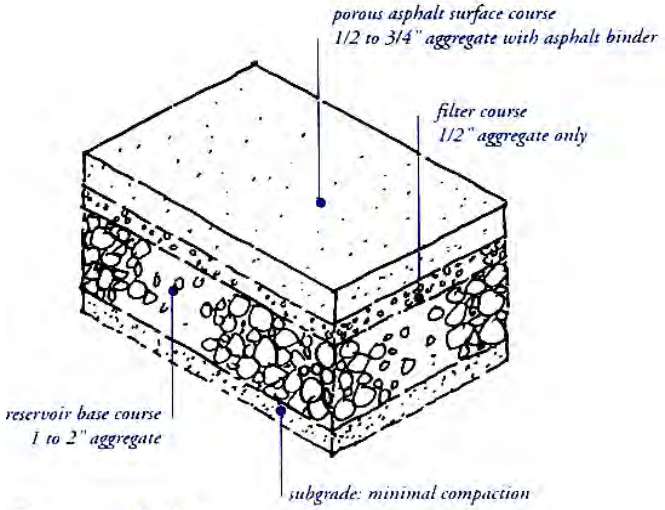
DESIGN METHOD

☐ = not good ⊡ = acceptable ■ = most desired

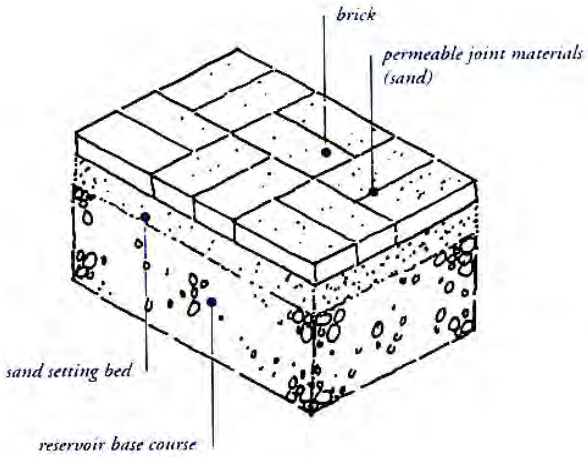
PARAMETER	SITE CONDITION	*Conventional Asphalt/Concrete*	Pervious Concrete	Porous Asphalt	Turf Block	Brick	Natural Stone	Concrete Unit Pavers	Crushed Aggregate	Cobbles
SOIL TYPE	Clay	⊡	☐	☐	⊡	⊡	⊡	⊡	■	■
	Loam	⊡	⊡	⊡	⊡	⊡	⊡	⊡	■	■
	Sandy	⊡	■	■	■	■	■	■	■	■
	Shallow Bedrock	⊡	■	■	■	■	■	■	■	■
SLOPE	0% to 3%	☐	⊡	⊡	■	■	■	■	■	■
	4% to 7%	☐	■	■	■	■	■	⊡	⊡	⊡
	8% to 12%	⊡	■	■	⊡	⊡	⊡	⊡	☐	☐
	>12%	⊡	■	■	☐	☐	☐	⊡	☐	☐
CLIMATE	NE County (Novato area)	⊡	■	⊡	■	⊡	■	■	■	■
	NW County (Tomales area)	⊡	■	⊡	■	⊡	■	■	■	■
	SE County (San Rafael to Sausalito areas)	⊡	■	⊡	■	⊡	■	■	■	■
	SW County (Woodacre to Point Reyes areas)	⊡	■	⊡	■	⊡	■	■	■	■
PROXIMITY TO WATER/ STORMDRAIN	>1,000 ft (usually rural areas)	⊡	■	■	■	■	■	■	■	■
	500 ft to 1,000 ft (usually rural, some urban areas)	⊡	■	■	■	■	■	■	■	■
	100 ft to 500 ft (usually urban, some rural areas)	⊡	⊡	⊡	■	⊡	■	■	■	■
	50 ft to 100 ft (usually urban areas)	☐	⊡	⊡	■	⊡	⊡	■	⊡	⊡
COST H = High M = Moderate L = Low	Initial	M	H	H	M	H	H	H	L	L
	Maintenance	L	H	H	H	M	M	M	M	M
Effectiveness For Reducing Runoff		☐	■	■	■	⊡	⊡	⊡	■	⊡
Durability/Life Span		■	⊡	⊡	⊡	■	■	■	☐	☐
"Start at the Source" 1999 Reference-Book Page Number(s)		N/A	47, 101	48,49 102	50, 104	50, 105	51, 106	51,52 107	52,53 108	53, 109



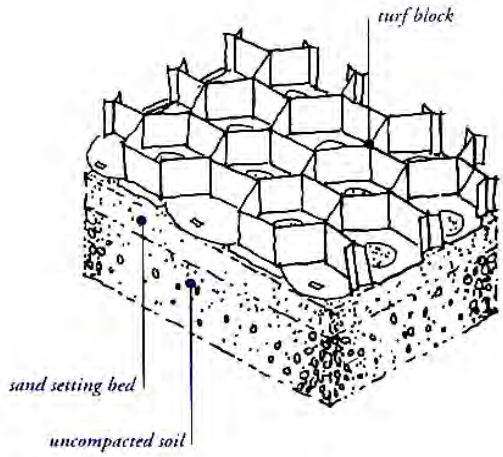
Pervious concrete



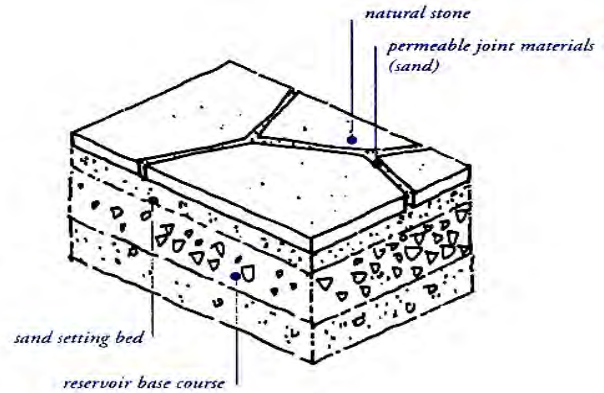
Porous asphalt



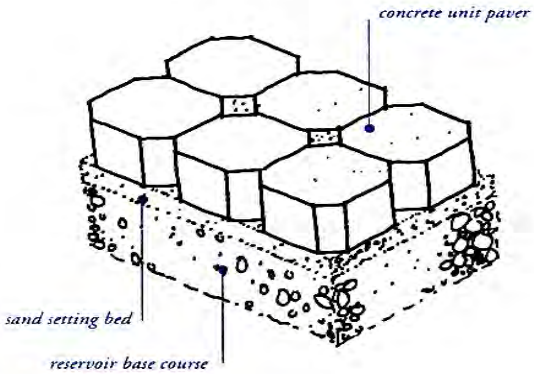
Brick



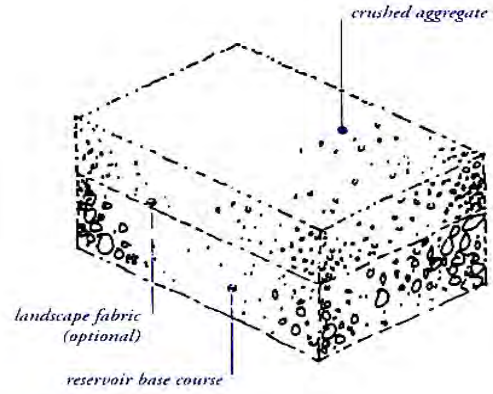
Turf block



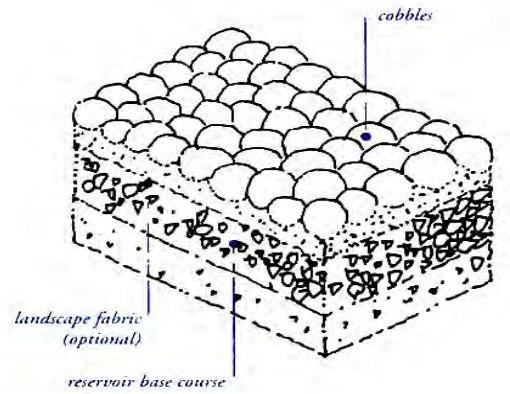
Natural stone



Concrete unit pavers



Crushed aggregate



Cobbles

For more information on permeable pavements, check these sources

Marin County Stormwater Pollution Prevention Program (MCSTOPPP)
415-499-6528 http://www.mcstoppp.org is a great starting point for local information related to Marin watersheds. MCSTOPPP's resources range from expertise in creek care, horses, hazardous wastes and gardens to technical documents, maps and contacts to the county.

Start at the Source
Bay Area Stormwater Management Agencies Association (BASMAA). 1997. An excellent and accessible handbook, lavishly illustrated, with specific recommendations for reducing stormwater runoff and increasing permeability. Available through their website at www.basmaa.org.

Riparian vegetation guidelines

Riparian vegetation stabilizes creek banks, cools water temperatures for aquatic life, and creates wildlife habitat. Vegetation is often removed for home building or landscaping. Vegetation removed by humans or high intensity storms should be replanted. Bare banks lead to excessive erosion and high rates of sedimentation.

- Build sheds, decks, and other structures away from creek banks. Check with local building departments to determine legal setbacks. Putting structures near the creek often requires that streamside vegetation be removed. This can lead to bank instability. If clearing is necessary, leave as much vegetation as possible, and replant with local native species.

- Leave a natural, unlandscaped buffer zone between structures and the creek bank. Don't extend yards to the edge of the bank.

- Plant native woody vegetation to protect creek banks against the force of flowing water. Select plants that already grow along the creek. Contact Marin County Stormwater Pollution Prevention Program for information on where to purchase native plants.

- Avoid planting invasive non-native plants. These plants may not provide good bank stability. They often take over, crowd out native species, and do not provide the same fish and wildlife habitat as native plants. Some plants to avoid are:

☹ Giant reed (Arundo donax)	☹ Bamboo
☹ Periwinkle (Vinca major)	☹ Pampas grass
☹ Scotch, French or Spanish broom	☹ German or English Ivy
☹ Himalayan blackberry	☹ Acacia
☹ Ice plant	☹ Tree-of-Heaven

- If removing non-native plants, use caution to minimize soil erosion. Whenever non-native plants are removed, replant with native vegetation.

From *Creek Care A Guide for Urban Marin Residents*

Marin County Resource Conservation District

PRBO Conservation through Science

USDA NRCS Natural Resources Conservation Service

Recommendations for Improving Riparian Bird Habitat on Private Lands in Marin County[1]

Developed by the *Marin Riparian Habitat Conservation Program*, updated December 2001

Top riparian bird species that breed in Marin and Sonoma:

Bank Swallow[2]
Swainson's Thrush
Warbling Vireo
Yellow Warbler[3]
Common Yellowthroat
Wilson's Warbler
Black-headed Grosbeak
Song Sparrow

Top riparian trees and shrubs (recommended for plantings):

Red & White Alder
California Bay Laurel
Box Elder
Arroyo[4], Red & Yellow Willow
Ribes spp. (e.g., gooseberry)
Red Elderberry
California Blackberry
Sword & Lady Fern

I. Site Selection

Recommendation	Explanation
Prioritize restoration sites according to their proximity to existing high quality sites.	High quality sites serve as population sources (i.e., high reproductive success) during the colonization of new sites.
Protect and restore riparian areas with intact adjacent upland habitats.	Upland habitat is used by many riparian species for breeding, dispersal, foraging, and gathering nesting material.
Prioritize sites with an intact natural hydrology or the potential to restore the natural processes of the system.	Flooding, point bar formation, and soil deposition are natural disturbances that help diversify the vegetative structure of a site.

II. Site Preparation

Recommendation	Explanation
Remove all existing non-native and invasive plant species prior to any restoration work.	Invasive species reduce the structural diversity of habitats by eliminating competitors.
Retain some dead or older trees (with the exception of invasive species) to promote occupancy by cavity nesters.	Cavity nesting species are often absent from new restoration sites due to the lack of mature trees.

III. Planting and Restoration

Recommendation	Explanation
Restore and manage riparian forests to promote structural diversity and volume of the understory.	Structural diversity enables species with different habitat needs to inhabit the same area.
Restore the full width of the riparian corridor and/or floodplain whenever possible. Space fences at a sufficient width to allow the stream to naturally meander over time.	Species richness, population size, and possibly reproductive success increase with the width of the riparian.
Use native plants from local genetic stock.	Locally adapted plants have higher survival rates and are favored by native birds.
Plant a minimum of two or more species of native trees. Avoid using only willows, even if they are different types.	Bird diversity increases with tree species richness, tree height, and tree girth.
Include plantings of native shrubs and other understory species in restoration design.	Most birds nest and forage within five feet of the ground. A thick understory yields more potential nesting/foraging sites.
Plant native forb and sedge species.	Grasses are also used as a nesting and foraging substrate.
Plant a mix of species in a mosaic design. Shrub patches should be interspersed with trees to achieve a semi-open canopy, and same species should be clumped together.	A semi-open canopy increases structural diversity and bird nesting success. Clumped vegetation of the same species is something that birds key into as optimal habitat.

[1] Adapted from: RHJV (Riparian Habitat Joint Venture). 2000. Version 1.0. The riparian bird conservation plan: a strategy for reversing the decline of riparian associated birds in California. California Partners in Flight. http://www.prbo.org/CPIF/Riparian/Riparian.html

[2] While rarely found in both Marin and Sonoma, Bank Swallows are still possible local breeders.

[3] Yellow Warblers have very few confirmed nest records in both counties. While unclear, their historical distribution may have been much higher, so their potential for future breeding may be significant.

[4] Arroyo willow has a tendency to creep into the streambed. While it might be objectionable to some, this process can increase the structural diversity of a site.

Promote the restoration of upland habitats adjacent to riparian areas, especially native oak-woodland.	Uplands provide key foraging/nesting habitat for many riparian species. Without it, some riparian species may be absent.
Connect patches of restored riparian habitat with strips of dense, continuous vegetation that are at least 3 to 10 meters wide.	These can serve and dispersal corridors and foraging habitat for riparian species, especially ones that fly only short distances.
Plant soft edges (gradual boundaries between different types of vegetation) along the margins of restored sites.	Soft edges (e.g., hedgerows, field margins) may have lower nest predation rates than areas with abrupt changes in vegetation.
Limit restoration activities to the non-breeding season (August to February).	To avoid destruction or disturbance of nests, fledglings, and nesting birds.

IV. Maintenance

Recommendation	Explanation
Discourage grazing and other disturbance events (mowing, disking, etc.) in all riparian areas during the bird-breeding season (March–July). If grazing is absolutely necessary, limit it to short periods of time between mid-August and October.	The breeding season is critical to maintaining the size of bird populations. Because many species nest on or near the ground, grazing directly damages bird nests and eliminates valuable nesting and foraging habitat.
If grazing is required *during the breeding season*, encourage landowners to begin grazing in March to prevent establishment of nests.	Early grazing prevents the establishment of nests by removing the substrate before nest construction begins.
Ensure that exclusion fences are properly maintained throughout the duration of the contract. If possible, seek additional funding to achieve this goal.	Fences are often damaged by cattle that break into the riparian zone. This is particularly detrimental between March and July, when many birds are nesting on or near the ground.

V. Information for Public Outreach *(for newsletters, publications, and direct communication)*

Recommendation	Explanation
Protect nesting birds and the understory during the breeding season (March-July).	Most people are unaware that birds actually nest on or near the ground, and that a thick understory is crucial to their ability to nest and rear young successfully.
Keep cattle out of the riparian zone, especially during the spring.	Cattle remove the understory and trample nests. This is especially detrimental when ground nests are present (Mar-Jul).
Control cats and other potential predators: • *Keep domestic cats indoors!* • Trap and neuter feral cats • Secure garbage & compost to reduce scavenging by wildlife	Domestic and feral cats are estimated to kill millions of birds every year, contributing significantly to their declines. Wildlife such as raccoons and skunks also serve as potential bird predators. Note that even well-fed cats can be avid hunters!
Feed birds responsibly: • Don't feed *jays, crows, magpies, cowbirds, and ravens* • Place feeders in cat free zones • Clean feeders frequently • Place feeders away from shrubs and bushes	Improper feeding can boost predator populations and help spread diseases. Special feeders designed for small birds can be purchased from selected suppliers.
Prevent birds from flying into house windows. Always use curtains or paste a cutout paper shape directly on the glass.	Placing a solid object directly behind widows prevents birds from flying into the glass and injuring themselves.
Create bird habitat for pest control.	Many birds are avid insect eaters and can help control agricultural pests. Owls and hawks may hunt pest rodents.

VI. Monitoring

Recommendation	Explanation
Conduct intensive long-term monitoring of birds and vegetation at selected sites.	Monitoring should continue for at least five years in order to properly assess demographic information and use the information to guide future practices.
Consider monitoring avian productivity at selected sites to assess true habitat value.	Species presence or absence may not be a sufficient means of determining restoration success. Breeding productivity can yield more detailed information on habitat quality.
Use standardized monitoring protocols.	Useful for comparing results across space and time.

Principles for the Ecological Restoration of Aquatic Resources from the Environmental Protection Agency.

Restoration - the return of a degraded ecosystem to a close approximation of its remaining natural potential - is experiencing a groundswell of support across the United States. The number of stream, river, lake, wetland and estuary restoration projects grows yearly. Current Federal initiatives call for a wide range of restoration actions, including improving or restoring 25,000 miles of stream corridor; achieving a net increase of 100,000 acres of wetlands each year; and establishing two million miles of conservation buffers. Many on-going or completed restoration projects now offer valuable lessons. To help build on these lessons and promote effective restoration, the Watershed Ecology Team of the Office of Wetlands, Oceans, and Watersheds has assembled the following list of principles that have been critical to the success of a wide range of aquatic resource restoration projects. These principles apply to different stages in the life of a restoration project - from early planning to post-implementation monitoring - and are offered here for use by a wide variety of people and organizations, ranging from Federal, State, Tribal, and local agencies to outdoor recreation or conservation groups, corporations, landowners, and citizens' groups.

These principles focus on scientific and technical issues, but as in all environmental management activities, the importance of community perspectives and values should not be overlooked. The presence or absence of public support for a restoration project can be the difference between positive results and failure. Coordination with the people and organizations that may be affected by the project can help build the support needed to get the project moving and ensure long-term protection of the restored area. In addition, partnership with stakeholders can also add useful resources, ranging from money and technical expertise to volunteer help with implementation and monitoring.

Restoration Guiding Principles

Preserve and protect aquatic resources. Existing, relatively intact ecosystems are the keystone for conserving biodiversity, and provide the biota and other natural materials needed for the recovery of impaired systems. Thus, restoration does not replace the need to protect aquatic resources in the first place. Rather, restoration is a complementary activity that, when combined with protection and preservation, can help achieve overall improvements in a greater percentage of the Nation's waters. Even with waterbodies for which restoration is planned, the first objective should be to prevent further degradation.

Restore ecological integrity. Restoration should reestablish insofar as possible the ecological integrity of degraded aquatic ecosystems. Ecological integrity refers to the condition of an ecosystem -- particularly the structure, composition, and natural processes of its biotic communities and physical environment. An ecosystem with integrity is a resilient and self-sustaining natural system able to accommodate stress and change. Its key ecosystem processes, such as nutrient cycles, succession, water levels and flow patterns, and the dynamics of sediment erosion and deposition, are functioning properly within the natural range of variability. Biologically, its plant and animal communities are good examples of the native communities and diversity found in the region. Structurally, physical features such as the dimensions of its stream channels are dynamically stable. Restoration strives for the greatest progress toward ecological integrity achievable within the current limits of the watershed, by using designs that favor the natural processes and communities that have sustained native ecosystems through time.

Restore natural structure. Many aquatic resources in need of restoration have problems that originated with harmful alteration of channel form or other physical characteristics, which in turn may have led to problems such as habitat degradation, changes in flow regimes, and siltation. Stream channelization, ditching in wetlands, disconnection from adjacent ecosystems, and shoreline modifications are examples of structural alterations that may need to be addressed in a restoration project. In such cases, restoring the original site morphology and other physical attributes is essential to the success of other aspects of the project, such as improving water quality and bringing back native biota.

Restore natural function. Structure and function are closely linked in river corridors, lakes, wetlands, estuaries and other aquatic resources. Reestablishing the appropriate natural structure can bring back beneficial functions. For example, restoring the bottom elevation in a wetland can be critical for reestablishing the hydrological regime, natural disturbance cycles, and nutrient fluxes. In order to maximize the societal and ecological benefits of the restoration project, it is essential to identify what functions should be present and make missing or impaired functions priorities in the restoration. Verifying whether desired functions have been reestablished can be a good way to determine whether the restoration project has succeeded.

Work within the watershed and broader landscape context. Restoration requires a design based on the entire watershed, not just the part of the waterbody that may be the most degraded site. Activities throughout the watershed can have adverse effects on the aquatic resource that is being restored. A localized restoration project may not be able to change what goes on in the whole watershed, but it can be designed to better accommodate watershed effects. New and future urban development may, for example, increase runoff volumes, stream downcutting and bank erosion, and pollutant loading. By considering the watershed context in this case, restoration planners may be able to design a project for the desired benefits of restoration, while also withstanding or even helping to remediate the effects of adjacent land uses on runoff and nonpoint pollution. For example, in choosing a site for a wetland restoration project, planners should consider how the proposed project may be used to further other related efforts in the watershed, such as increasing riparian habitat continuity, reducing flooding, and/or enhancing downstream water quality. Beyond the watershed, the broader landscape context also influences restoration through factors such as interactions with terrestrial habitats in adjacent watersheds, or the deposition of airborne pollutants from other regions.

Understand the natural potential of the watershed. A watershed has the capacity to become only what its physical and biological setting -- its ecoregion's climate, geology, hydrology, and biological characteristics -- will support. Establishing restoration goals for a waterbody requires knowledge of the historical range of conditions that existed on the site prior to degradation and what future conditions might be. This information can then be used in determining appropriate goals for the restoration project. In some cases, the extent and magnitude of changes in the watershed may constrain the ecological potential of the site. Accordingly, restoration planning should take into account any irreversible changes in the watershed that may affect the system being restored, and focus on restoring its remaining natural potential.

Address ongoing causes of degradation. Restoration efforts are likely to fail if the sources of degradation persist. Therefore, it is essential to identify the causes of degradation and eliminate or remediate ongoing stresses wherever possible. While degradation can be caused by one direct impact such as the filling of a wetland, much degradation is caused by the cumulative effect of numerous, indirect impacts, such as changes in surface flow caused by gradual increases in the amount of impervious surfaces in the watershed. In identifying the sources of degradation, it is important to look at upstream and up-slope activities as well as at direct impacts on the immediate project site. Further, in some situations, it may also be necessary to consider downstream modifications such as dams and channelization.

Develop clear, achievable, and measurable goals. Restoration may not succeed without good goals. Goals direct implementation and provide the standards for measuring success. Simple conceptual models are a useful starting point to define the problems, identify the type of solutions needed, and develop a strategy and goals. Restoration teams should evaluate different alternatives to assess which can best accomplish project goals. The chosen goals should be achievable ecologically, given the natural potential of the area, and socioeconomically, given the available resources and the extent of community support for the project. Also, all parties affected by the restoration should understand each project goal clearly to avoid subsequent misunderstandings. Good goals provide focus and increase project efficiency.

Focus on feasibility. Particularly in the planning stage, it is critical to focus on whether the proposed restoration activity is feasible, taking into account scientific, financial, social and other considerations. Remember that solid community support for a project is needed to ensure its long-term viability. Ecological feasibility is also critical. For example, a wetlands restoration project is not likely to succeed if the hydrological regime that existed prior to degradation cannot be reestablished.

Use a reference site. Reference sites are areas that are comparable in structure and function to the proposed restoration site before it was degraded. As such, reference sites may be used as models for restoration projects, as well as a yardstick for measuring the progress of the project. While it is possible to use historic information on sites that have been altered or destroyed, historic conditions may be unknown and it may be most useful to identify an existing, relatively healthy, similar site as a guide for your project. Remember, however, that each restoration project will present a unique set of circumstances, and no two aquatic systems are truly identical. Therefore, it is important to tailor your project to the given situation and account for any differences between the reference site and the area being restored.

Anticipate future changes. The environment and our communities are both dynamic. Although it is impossible to plan for the future precisely, many foreseeable ecological and societal changes can and should be factored into restoration design. For example, in repairing a stream channel, it is important to take into account potential changes in runoff resulting from projected increases in upstream impervious surface area due to development. In addition to potential impacts from changes in watershed land use, natural changes such as plant community succession can also influence restoration. For instance, long-term, post-project monitoring should take successional processes such as forest regrowth in a stream corridor into account when evaluating the outcome of the restoration project.

Involve the skills and insights of a multi-disciplinary team. Restoration can be a complex undertaking that integrates a wide range of disciplines including ecology, aquatic biology, hydrology and hydraulics, geomorphology, engineering, planning, communications and social science. It is important that, to the extent that resources allow, the planning and implementation of a restoration project involve people with experience in the disciplines needed for the particular project. Universities, government agencies, and private organizations may be able to provide useful information and expertise to help ensure that restoration projects are based on well-balanced and thorough plans. With more complex restoration projects, effective leadership will also be needed to bring the various disciplines, viewpoints, and styles together as a functional team.

Design for self-sustainability. Perhaps the best way to ensure the long-term viability of a restored area is to minimize the need for continuous maintenance of the site, such as supplying artificial sources of water, vegetation management, or frequent repairing of damage done by high water events. High maintenance approaches not only add costs to the restoration project, but also make its long-term success dependent upon human and financial resources that may not always be available. In addition to limiting the need for maintenance, designing for self-

sustainability also involves favoring ecological integrity, as an ecosystem in good condition is more likely to have the ability to adapt to changes.

Use passive restoration, when appropriate. "Time heals all wounds" applies to many restoration sites. Before actively altering a restoration site, determine whether passive restoration (i.e., simply reducing or eliminating the sources of degradation and allowing recovery time) will be enough to allow the site to naturally regenerate. Many times there are reasons for restoring a waterbody as quickly as possible, but there are other situations when immediate results are not critical. For some rivers and streams, passive restoration can reestablish stable channels and floodplains, regrow riparian vegetation, and improve in-stream habitats without a specific restoration project. With wetlands that have been drained or otherwise had their natural hydrology altered, restoring the original hydrological regime may be enough to let time reestablish the native plant community, with its associated habitat value. It is important to note that, while passive restoration relies on natural processes, it is still necessary to analyze the site's recovery needs and determine whether time and natural processes can meet them.

Restore native species and avoid non-native species. American natural areas are experiencing significant problems with invasive, non-native (exotic) species, to the great detriment of our native ecosystems and the benefits we've long enjoyed from them. Many invasive species outcompete natives because they are expert colonizers of disturbed areas and lack natural controls. The temporary disturbance present during restoration projects invites colonization by invasive species which, once established, can undermine restoration efforts and lead to further spread of these harmful species. Invasive, non-native species should not be used in a restoration project, and special attention should be given to avoiding the unintentional introduction of such species at the restoration site when the site is most vulnerable to invasion. In some cases, removal of non-native species may be the primary goal of the restoration project.

Use natural fixes and bioengineering techniques, where possible. Bioengineering is a method of construction combining live plants with dead plants or inorganic materials, to produce living, functioning systems to prevent erosion, control sediment and other pollutants, and provide habitat. Bioengineering techniques can often be successful for erosion control and bank stabilization, flood mitigation, and even water treatment. Specific projects can range from the creation of wetland systems for the treatment of storm water, to the restoration of vegetation on river banks to enhance natural decontamination of runoff before it enters the river.

Monitor and adapt where changes are necessary. Every combination of watershed characteristics, sources of stress, and restoration techniques is unique and, therefore, restoration efforts may not proceed exactly as planned. Adapting a project to at least some change or new information should be considered normal. Monitoring before and during the project is crucial for finding out whether goals are being achieved. If they are not, "mid-course" adjustments in the project should be undertaken. Post-project monitoring will help determine whether additional actions or adjustments are needed and can provide useful information for future restoration efforts. This process of monitoring and adjustment is known as adaptive management. Monitoring plans should be feasible in terms of costs and technology, and should always provide information relevant to meeting the project goals.

* * * * *

Notice: This document is intended to promote effective restoration approaches and practices. This document does not substitute for the Clean Water Act or EPA's regulations; nor is it a regulation itself. Thus, it cannot impose legally-binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA retains the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. EPA may change this guidance in the future.

This publication should be cited as: *USEPA, 2000. Principles for the Ecological Restoration of Aquatic Resources. EPA841-F-00-003. Office of Water (4501F), United States Environmental Protection Agency, Washington, DC. 4 pp.* To order single, free copies, call 1-800-490-9198 and request document number EPA841-F-00-003. The document is also on the OWOW Restoration Website at http://www.epa.gov/owow/wetlands/restore/

For more information on restoration, check these sources

Creek Care A Guide for Urban Marin Residents
Available from Marin County Stormwater Pollution Prevention Program 415-485-3363. http://www.mcstoppp.org/

California Salmonid Stream Habitat Restoration Manual
California Department of Fish and Game. 2003. This manual describes the technical methods for inventory, evaluation and restoration of salmonid habitat.

EPA Office of Wetlands, Oceans, and Watersheds
http://www.epa.gov/owow/

Watershed Restoration: A Guide for Citizen Involvement in California is an overview of the process involved in citizen restoration of watersheds. The guide provides examples of local projects and resources for additional information.
http://www.cop.noaa.gov/pubs/das/das8.PDF

Restoring Streams in Cities, by Ann Riley. 1998. Island Press. This book offers history, background and lessons from real projects to teach stream restoration.

Road system layout

In forest and ranch road planning, the concepts "less is best" and "avoid the worst" generally describe the most economical and environmentally sound approach to planning for road building and road system layout. Some of these important concepts are listed below:

1. Minimize total road miles in your watershed,
2. Minimize new road construction by using existing roads,
3. Minimize construction of permanent and seasonal roads; use temporary roads to minimize long-term maintenance and reconstruction costs and reduce environmental damage,
4. Strictly minimize the number of watercourse crossings,
5. Minimize cuts, fills and vegetation clearing by contouring roads across the landscape,
6. Minimize road work near the watercourse and lake protection zones, and on unstable areas, inner gorges and steep slopes,
7. Minimize road width,
8. Minimize road gradient,
9. Minimize the concentration of runoff on and from the new road, and
10. Avoid problem areas and serious obstacles, when possible.

From *Handbook for Forest and Ranch Roads.*

For more information on roads, check these sources

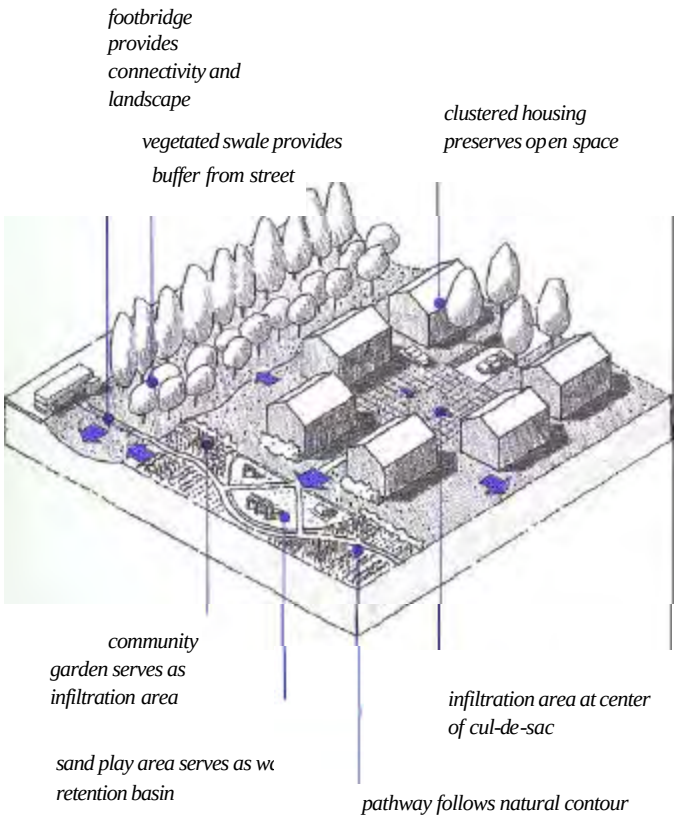
Handbook for Forest and Ranch Roads A Guide for planning, designing, constructing, reconstructing, maintaining, and closing wildland roads
Available from the Mendocino County Resource Conservation District 707-468-9223.

A Landowner's Guide to Building Forest Access Roads
www.na.fs.fed.us/spfo/pubs/stewardship/accessroads/accessroads.htm

MMWD Roads MOU.

FishNet 4C
FishNet 4C—Guidelines for protecting aquatic habitat and salmon fisheries for County Road Maintenance. Jan 2004.

Use drainage as a design element



Unlike conveyance storm drain systems that hide water beneath the surface and work independently of surface topography, a drainage system for stormwater infiltration can work with natural land forms and land uses to become a major design element of a site plan.

By applying stormwater management techniques early in the site plan development, the drainage system can suggest pathway alignment, optimum locations for parks and play areas, and potential building sites. In this way, the drainage system helps to generate urban form, giving the development an integral, more aesthetically pleasing relationship to the natural features of the site. Not only does the integrated site plan complement the land, it can also save on development costs by minimizing earthwork and expensive drainage structures.

From Start at the Source Residential Site Planning and Design Guidance Manual for Stormwater Quality Protection.

For more information on stormwater, check these sources

New Development and Redevelopment, Construction, Industrial and Commercial, and Municipal Stormwater Best Management Practice Handbooks.
The California Stormwater Best Management Practice Handbooks have provided excellent guidance to the stormwater community since their publication by the Stormwater Quality Task Force (SWQTF) in 1993. The SWQTF has initiated the Handbook Update Project to revise and update the Handbooks to reflect current practices, standards, and knowledge gained about the effectiveness of Best Management Practices (BMPs), and to make the Handbooks more accessible. Handbooks can be downloaded from the website and will be available to purchase soon. http://www.cabmphandbooks.com/

Start at the Source
Bay Area Stormwater Management Agencies Association (BASMAA). 1997. An excellent and accessible handbook, lavishly illustrated, with specific recommendations for reducing stormwater runoff and increasing permeability. Available through their website at www.basmaa.org.

Marin County Stormwater Pollution Prevention Program (MCSTOPPP)
415-499-6528 http://www.mcstoppp.org is a great starting point for local information related to Marin watersheds. MCSTOPPP's resources range from expertise in creek care, horses, hazardous wastes and gardens to technical documents, maps and contacts to the county.

SUDDEN OAK DEATH IN CALIFORNIA

Integrated Pest Management in the Landscape

Sudden oak death is the name given to an epidemic, first detected in 1995, that affects three true oak species—coast live oak (*Quercus agrifolia)*, California black oak (*Q. kelloggii*), and Shreve oak (*Q. parvula* var. *shrevei*)—and tanbark oak (*Lithocarpus densiflorus*). Additional species affected include rhododendron (*Rhododendron* spp.), madrone (*Arbutus menziesii*), California huckleberry (*Vaccinium ovatum*), California bay laurel (*Umbellularia californica*), California buckeye (*Aesculus californica*), bigleaf maple (*Acer macrophyllum*), toyon (*Heteromeles arbutifolia*), and manzanita (*Arctostaphylos* spp.). A previously undescribed pathogen, *Phytophthora ramorum*, has been identified as the infectious agent.

Figure 1. The rapid decline of oak trees in the landscape may signal sudden oak death.

The disease is currently known to exist in the coastal ranges in California, between Big Sur in Monterey County and southern Mendocino County. Sudden oak death has been confirmed in Alameda, Marin, Mendocino, Monterey, Napa, San Mateo, Santa Clara, Santa Cruz, Solano, and Sonoma counties. This disease has also been reported from several locations in southern Oregon. Within the affected counties, both the severity and occurrence of the disease vary considerably across the landscape. Infected trees are abundant in Marin, Mendocino, Monterey, Santa Cruz, and Sonoma counties. It is not known if the geographic distribution of infected trees is associated with climatic variables. Attempts to assess distribution patterns within California through surveys are currently under way. The numbers of infected and dead trees are suspected to be in the tens of thousands.

Before the recent discovery of sudden oak death in California, *P. ramorum* had not been known in North America. The pathogen was first reported in Europe in 1993 where it was infecting rhododendron (*Rhododendron* spp.) in nurseries but was not recognized as a new species until 1999. Death of oaks and tanbark oaks in areas of California outside the ten reported counties does not appear to be caused by this new *Phytophthora* species. Based on field observations and laboratory cultures, mortality of oaks and tanbark oaks outside the infested areas appears to be a result of the normally expected causes, and oaks in these areas are not dying at a greater rate than previously observed.

IDENTIFICATION

At present, the only definitive ways to diagnose a sudden oak death *Phytophthora* infection in a tree are by culturing the pathogen or by amplifying the DNA using PCR (polymerase chain reaction). No single field symptom is sufficient for diagnosis. Molecular probes for routine detection of the DNA of the pathogen are under development, though these may not discriminate between active and inactive infections. When trees with characteristic symptoms of sudden oak death are found within forests or woodlands where the disease is already confirmed, these trees are likely to be infected with *P. ramorum*. Infected trees are typically found in the proximity of other infected and dead trees (Fig. 1). To date, this disease has been found infecting oaks in forests, woodlands, and urban-wildland interfaces.

Symptoms of sudden oak death differ among the known hosts (Table 1). One characteristic of this *Phytophthora* infection in oaks and tanbark oaks is the sudden simultaneous leaf death on a major stem or an entire tree, an observation that gave rise to the term "sudden oak death." The occurrence of leaf death may occur a year or more after the initial infection by the pathogen and many months after the tree has been girdled.

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Agriculture and Natural Resources

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Table 1. Species Known to Be Infected by *Phytophthora ramorum* and Characteristic Symptoms.

Family/Species	External symptoms and indications
FAGACEAE	
Lithocarpus densiflorus (tanbark oak, tanoak)	Abnormal foliage is often the first symptom, showing dead leaves intermixed with green. Branch tips and basal shoots may wilt and turn brown ("shepherds' crook"), while the leaves on the rest of the stem remain green. When the tree dies, the foliage may turn color to reddish brown within weeks. Seeping cankers on the trunk usually within 6 feet of the ground, but sometimes much higher, can appear as red to brown stains, or as droplets, often translucent red, exuded from the intact bark. Dead lichens and moss may be evident as well as *Hypoxylon* fungi and red or white boring dust from bark beetles.
Quercus agrifolia (coast live oak)	Seeping from the lower trunk is the most reliable early symptom. This appears as red to brown stains, or often as hardened brown to red droplets. When the tree dies, the foliage may turn color to reddish brown within weeks. Bark beetle boring dust and *Hypoxylon* fungi may be present. Dead and stained moss may be evident.
Q. kelloggii (California black oak)	Seeping is the earliest visible symptom, but is often obscured by the fissured, dark brown, nearly black bark. The presence of bark beetles' boring dust and fruiting bodies of the fungus *Hypoxylon* may be more reliable indicators of infection. The deciduous habit of this species limits the usefulness of foliage conditions as an indicator of infection.
Q. parvula var. *shrevei* (Shreve oak)	Similar to those on coast live oak.
ERICACEAE	
Rhododendron spp.	Leaf spots and necrotic (dead) areas; twig and stem cankers.
Vaccinium ovatum (California huckleberry)	Leaves exhibit necrotic patches; both twigs and whole plants may die.
Arctostaphylos spp. (manzanita)	Leaf spots and necrotic areas; twig cankers and dieback.
Arbutus menziesii (madrone)	Leaf spots and necrotic areas; twig cankers and dieback.
CAPRIFOLIACEAE	
Lonicera hispidula (California honeysuckle)	Necrotic lesions on leaves.
Viburnum x *bodnantense*	Leaf wilting; infection on stem develops up from base.
HIPPOCASTANACEAE	
Aesculus californica (California buckeye)	Leaf spots and lesions on petioles.
ACERACEAE	
Acer macrophyllum (Big-leaf maple)	Leaf spots and necrosis on leaf margins.
LAURACEAE	
Umbellularia californica (California bay laurel)	Leaves have necrotic lesions.
RHAMNACEAE	
Rhamnus californica (California coffeeberry)	Leaf spots and necrotic areas; twig cankers and dieback.

Oaks

On coast live, California black, and Shreve oaks, the primary symptom is dark, hardened sap exuding from the main trunk, most often near the base of the trunk and up to about 6 feet above the ground (Fig. 2). These seeps ("bleeding") are always found above the soil level on the trunk and can also occur on exposed roots. Less frequently, this seeping is found much higher on the main stem. Seeps often appear to emerge through intact bark. They may take the form of discrete red, brown, and black droplets, viscous oozing, stalactite-like drips, and red to brown stains on the trunk. Mosses and lichens are killed where they are contacted by the exudate. Their death may often be the only reliable indication that a tree is seeping. The seeping is the external manifestation of an underlying, diseased area of the tree, referred to as a canker. Removal of the surface bark reveals discolored brown tissue, separated from healthy bark by

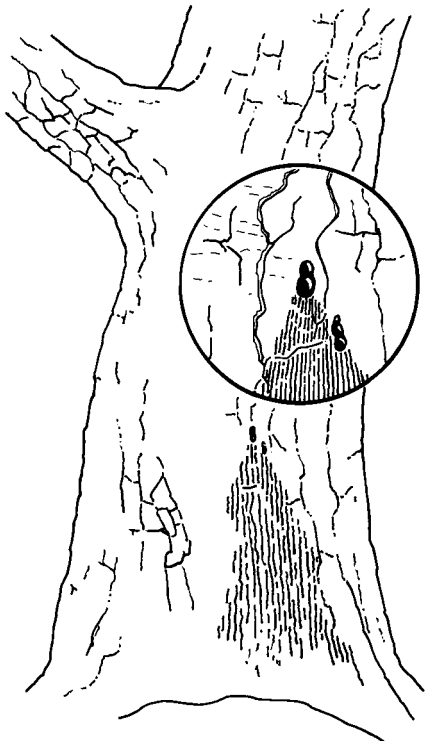

Figure 2. Diseased bark is a key symptom of sudden oak death on oak trees. *Inset:* Closeup of sap exuding from the trunk, causing bark discoloration.

a distinct black zone line. This zone line represents the active front of the *Phytophthora* infection. The foliage may appear healthy until shortly before it turns brown. Before turning brown, the leaves can be olive-green, pale green, and yellow-green for a period of weeks to months. Infected coast live oaks may also lose leaves before they die.

Tanbark Oaks

The most consistent initial symptoms in tanbark oaks are wilting branch tips and dead leaves interspersed among green leaves throughout the tree. Thus, a symptomatic tree may show a number of pale green, light brown, and darker brown leaves among the darker, evergreen leaves. Seeping is not a consistent characteristic of infected tanbark oaks, though this may be prominent on some trees. While understory and seedling tanbark oaks infected with sudden oak death *Phytophthora* may die without any external bark discoloration or bleeding, proof of infection has been determined by isolation of the pathogen from discolored areas in the cambium (tissue under the bark) of these trees. The pathogen has also been found on the leaves of these trees.

Infected trees with brown foliage are effectively dead, although there may be some sprouting from the tree bases. Many of these new shoots will wilt and die within a growing season.

Additional Indications of Sudden Oak Death. Oak and tanbark oak trees infected with sudden oak death can also be infested with bark beetles and have *Hypoxylon* fungus growing on the trunk. These secondary pests are not unique to trees with sudden oak death but can serve as a good indication that the tree is ailing.

Beetles in the family Scolytidae, such as the western oak bark beetle (*Pseudopityophthorus pubipennis*) and ambrosia beetles (*Monarthrum dentiger* and *M. scutellare*), may be associated with infected oaks and tanbark oaks in unusually large numbers. These insects are normally found in severely weakened and recently killed or fallen trees. The entrances to beetle tunnels closely track the seeping on the bark of trees bearing green foliage and are marked with red or white frass (wood residue from the beetle's tunneling activities) around and beneath the tunnel entrances. Extensive observations indicate that nearly all coast live oaks that die following infection with *P. ramorum* have been colonized by these beetles before dying.

Fruiting bodies of the fungus *Hypoxylon thouarsianum* are frequently found associated with both active and older seeping areas on the lower portions of the trunk of living oaks and tanbark oaks infected with sudden oak death *Phytophthora*. Fruiting bodies are somewhat flattened, dome-shaped structures (Fig. 3) that start out khaki green in color, but turn brown and then black as they age. These fruiting bodies indicate the presence of dead wood and are normally present on dead branches of living trees and on the trunks or branches of dead trees. In areas affected by sudden oak death, these fruiting bodies are rarely observed on the trunks of living trees in the absence of *P. ramorum* infection.

Other Hosts

Symptoms vary considerably among the other hosts and are primarily expressed in the leaves. *Rhododendron* species exhibit foliage symptoms, including brown spots and patches, particularly at the leaf tips. Twig and stem dieback are also common and may result in the death of plants. On huckleberry, the disease primarily causes twig and stem dieback, and ultimately, plant death. Leaves may exhibit necrotic patches leading quickly to abscission. In madrone, the symptoms are spots and necrotic areas on leaves, twig cankers, and stem dieback. Large branches and even entire trees may be killed. However, disease caused by *P. ramorum* is difficult to distinguish from cankers and twig dieback caused by *Nattrassia mangiferae* and *Fusicoccum aesculi*. Symptoms on manzanita appear to be similar to those on madrone. Bay laurel, buckeye, and big-leaf maple

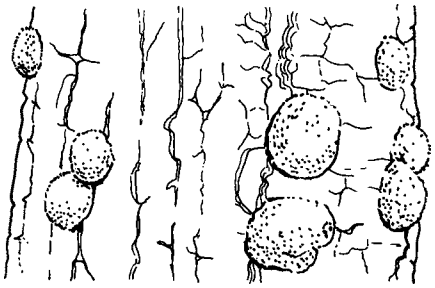

Figure 3. Fruiting bodies of *Hypoxylon* fungus on a tree trunk.

Other Conditions Confused with Sudden Oak Death

Other *Phytophthora* species (*P. cinnamomi*, *P. cactorum*, *P. citricola*) may cause seeping that resembles the symptoms of sudden oak death. This is especially true in irrigated landscapes. Even in areas where *P. ramorum* has been identified, a number of other pathogens are also capable of occasionally killing trees. Trees that are overwatered, located in low-lying areas, or stressed by soil compaction, root damage, or soil piled against the trunk may also appear to have sudden oak death but may be infected with *Armillaria mellea*.

Oaks and other hardwood species may develop a condition known as wetwood, which superficially resembles sudden oak death. Wetwood is distinguished by thin, watery, light to dark brown seeps, which are often associated with old branch holes or wounds, and they are usually found higher in the tree. *Phytophthora ramorum* does not appear to be dependent on pre-existing wounds or old branch stubs. Bark and ambrosia beetles have not been observed to be associated with wetwood seeping. This condition is not considered to be a serious health problem for trees.

Two fungal pathogens of oaks and tanbark oaks can produce crown symptoms similar to those of sudden oak death. *Diplodia quercina,* which causes oak branch dieback, is associated with drought and *Cryptocline cinerescens*, which causes oak twig blight, is associated with wet conditions. In conifer-growing areas, herbicide damage to tanbark oaks may be mistaken for *P. ramorum* infection.

leaves show necrotic lesions; lesions on petioles and small twigs have been noted on California buckeye. For these species, the foliage symptoms may be similar to other endemic diseases. Seeping has not been noted on these non-oak hosts.

DISEASE CYCLE

The biology, expression, and results of infection by *P. ramorum* can vary considerably among host species. The expression of symptoms is best understood for oaks and tanbark oaks but less so for shrubs such as rhododendron, huckleberry, and other known host tree species. In coast live oak, artificial inoculations of mature trees produced cankers up to 22 inches long (mean length 11 inches) within 16 weeks. Cankers in similarly inoculated tanbark oaks were up to 28 inches (mean length 18 inches). A number of inoculated trees were completely girdled (i.e., the infection spread around the entire circumference of the tree) by the pathogen during this 16-week period. Browning of the foliage occurred on several inoculated trees within one year. It is not clear whether viable spores are released from oaks and tanbark oaks. Where *P. ramorum* infects the leaves of host plants (particularly rhododendron, bay laurel, and tanbark oak), it has been found to readily produce spores on the leaf surface.

The vertical distribution of cankers on oaks and tanbark oaks and the presence of foliar and twig infections on other hosts is consistent with both aerial and rain splash modes of spore dispersal that are typical for many species of *Phytophthora*. There is no evidence for transmission by insects or other vectors.

Phytophthora ramorum appears to establish discrete infections in its hosts. In oak hosts, and especially in tanbark oaks, multiple independent cankers are common. These bark cankers may then expand and colonize more tissue, leading to girdling of the tree. Infection in the other hosts may be initiated in the leaves or stems.

DAMAGE

The ecological consequences of sudden oak death *Phytophthora* are unknown but certainly will be significant. Oak trees provide shelter for many animals, and their acorns are an important food source for wildlife. Sudden oak death is particularly prevalent in state parks and protected watersheds. Although other trees and woody species will likely grow in forests that have lost large numbers of oaks and tanbark oaks, they cannot replace these hardwood trees from an ecological point of view. There is also a serious potential for wildfires resulting from the buildup of fuel from large numbers of dead trees. The economic costs associated with losses of these trees from landscapes and forests will be considerable. The cost of removing a large dead tree can exceed $1,000, presenting financial hardships for some property owners. The economic value of the land may be reduced by 30 to 40 percent with the loss of the aesthetic value of the oaks.

MANAGEMENT

There is currently no known control for sudden oak death. The resting spores of other *Phytophthora* species are known to survive in soils for years and can be moved inadvertently in contaminated soil. *Phytophthora ramorum* has been isolated from plant debris in infested forests. It is likely that the spread of this pathogen in California has been facilitated by the activities of hikers, bikers, and vehicles, as well as by horses and deer. Preventing the movement of plant material (foliage and wood) may slow the spread of this pathogen to areas that are not infested. The lack of knowledge about the reproductive biology of this newly isolated species argues for restrictions on movement of such materials. Plants obtained from commercial nurseries may also serve as a means of spreading the pathogen.

There are no prospects for saving trees infected with *P. ramorum* in forested habitats. For infected plants in landscaped settings, preliminary research suggests that control of this disease may be possible in the future. Because fungicides can help control other *Phytophthora* species in trees, experiments are underway to test such materials against this new *Phytophthora* species. In rhododendrons, *P. ramorum* may be controllable using treatments registered for use on other *Phytophthora* species. However, insufficient data are available to make recommendations at this time.

The seeping symptoms of trees infected by other *Phytophthora* species can be very similar to those of sudden oak death. Reducing the excess water supply to a tree often can control these better-known *Phytophthora* species. The new *Phytophthora* has been isolated from hillsides in campgrounds, state parks, and recreation areas and does not appear to require overirrigation or low-lying wet areas to infect trees.

The influence of bark beetles on the progression of sudden oak death disease in trees infected with *Phytophthora ramorum* is unknown. Although insecticides are registered for the management of bark beetles on oaks, their use is not recommended for the management of bark beetles associated with sudden oak death at this time.

Dead trees are susceptible to structural failure because of infection by native decay fungi and wood-boring beetles, resulting in limb and trunk breakage. Therefore, trees killed by *P. ramorum* in residential areas should be cut down. The wood should be stored on site where possible and treated in a manner that dries it as rapidly as possible. Solarizing the wood by covering it with a clear plastic tarp in a location where it is exposed to sun will help kill the pathogen. This wood should not be moved from its source into regions where sudden oak death has not been reported. Movement within areas of infection should be minimized.

FURTHER READING

Garbelotto, M., P. Svihra, and D. M. Rizzo. 2001. Sudden oak death syndrome fells three oak species. *Calif. Agric.* 55 (1):9-19.

Kelly, N. M., and B. A. McPherson. 2001. Multi-scale approaches taken to SOD monitoring. *Calif. Agric.* 55 (1): 15-16.

McPherson, B. A., D. L. Wood, A. J. Storer, P. Svihra, D. M. Rizzo, N. M. Kelly, and R. B. Standiford. 2000. Oak mortality syndrome: Sudden death of oaks and tanoaks. Tree Note 26, August 2000. California Department of Forestry and Fire Protection.

Svihra, P., N. K. Palkovsky, and A.J. Storer. 2000. Sudden Oak Death: The Facts as We Know Them. Pest Alert #4, December, 2000. Univ. of Calif. Coop. Exten., Marin Co.

ONLINE RESOURCES

http://cemarin.ucdavis.edu/index2.html
(Sudden oak death information from Marin County)

http://camfer.cnr.berkeley.edu/oaks
(Monitoring sudden oak death in California)

http://www.suddenoakdeath.org
(California Oak Mortality Task Force Web page)

http://danr.ucop.edu/ihrmp
(University of California Integrated Hardwood Range Management Program Web page)

http://www.cnr.berkeley.edu/SOD/garbelotto/english/campus.html
(Sudden oak death information from University of California at Berkeley)

http://pi.cdfa.ca.gov/pqm/manual/455.htm
(State restrictions regarding wood infected with sudden oak death and regulatory sampling procedures)

For more information contact the University of California Cooperative Extension or agricultural commissioner's office in your county. See your phone book for addresses and phone numbers.

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To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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For more information on watershed community efforts, check these sources

California Environmental Resources Evaluation System (CERES)
This information system developed by the California Resources Agency to facilitate access to a variety of electronic data describing California's rich and diverse environments. http://ceres.ca.gov

For the Sake of the Salmon (FSOS)
A regional organization committed to supporting and assisting multi-stakeholder watershed focused efforts, raising awareness and building consensus amongst those who are concerned about the fate of our salmon. The FSOS website has many resources for watershed groups including an electronic newsletter, tips on forming and running a watershed group, funding, and links to other groups and agencies. http://www.4sos.org

Urban Creeks Council of California
A statewide non-profit organization working to preserve, protect, and restore urban streams and their riparian habitat. http://www.urbancreeks.org

Watershed Planning Guide
A guide to the planning process for various stakeholders in a watershed. The guide is designed to help stakeholders through the process of assessment, analysis and implementation of a restoration project.
http://www.coastalconservancy.ca.gov/Publications/ws_planning_guide.pdf

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Funding Sources
A variety of funding opportunities are available to assist watershed groups in their efforts. These range from local, state, and federal sources to foundations and private organizations. Funding is available for assessments, implementation, construction, monitoring, capacity building, organizational development, outreach, training, and for a variety of other watershed related tasks. The following websites are a good place to start looking for the appropriate source:

Regional Water Quality Control Boards: The North Coast (Region 1) and San Francisco Bay (Region 2)
Websites contain comprehensive lists of state, federal, and Region Board funding opportunities, as well as links to other useful sites.
http://www.swrcb.ca.gov/rwqcb1/ OR http://www.swrcb.ca.gov/rwqcb2/

NOAA Restoration Center:
The Community-based Restoration Program partners with national and regional organizations to promote fishery habitat restoration around the coastal US. Their website contains links to 19 partnerships and detailed information about the opportunities available. There are also links to non-NOAA funding opportunities.
http://www.nmfs.noaa.gov/habitat/restoration/index.html

U.S. Environmental Protection Agency:
The Wetlands, Oceans, and Watersheds branch of the EPA contains useful information on federal sources and a searchable on-line database. "The Catalog of Federal Funding Sources for Watershed Protection Web site is a searchable database of financial assistance sources (grants, loans, cost-sharing) available to fund a variety of watershed protection projects."
http://www.epa.gov/owow/watershed/funding.html

United States
Environmental Protection
Agency

Office of Water
Office of Wetlands,
Oceans and Watersheds (4502T)

EPA 843-F-01-002c
March 2002

Functions and Values of Wetlands

Dave Davis

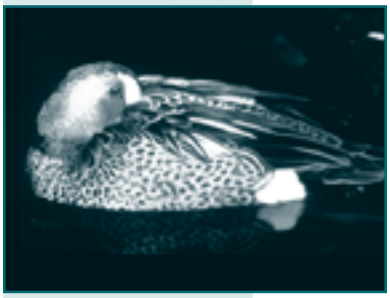
Long regarded as wastelands, wetlands are now recognized as important features in the landscape that provide numerous beneficial services for people and for fish and wildlife. Some of these services, or functions, include protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, and maintaining surface water flow during dry periods. These beneficial services, considered valuable to societies worldwide, are the result of the inherent and unique natural characteristics of wetlands.

Wetlands are considered valuable because they clean the water, recharge water supplies, reduce flood risks, and provide fish and wildlife habitat. In addition, wetlands provide recreational opportunities, aesthetic benefits, sites for research and education, and commercial fishery benefits.

Functions Versus Values

Wetland functions include water quality improvement, floodwater storage, fish and wildlife habitat, aesthetics, and biological productivity. The value of a wetland is an estimate of the importance or worth of one or more of its functions to society. For example, a value can be determined by the revenue generated from the sale of fish that depend on the wetland, by the tourist dollars associated with the wetland, or by public support for protecting fish and wildlife.

Although large-scale benefits of functions can be valued, determining the value of individual wetlands is difficult because they differ widely and do not all perform the same functions or perform functions equally well. Decision-makers must understand that impacts on wetland functions can eliminate or diminish the values of wetlands.



Water storage. Wetlands function like natural tubs or sponges, storing water and slowly releasing it. This process slows the water's momentum and erosive potential, reduces flood heights, and allows for ground water recharge, which contributes to base flow to surface water systems during dry periods. Although a small wetland might not store much water, a network of many small wetlands can store an enormous amount of water. The ability of wetlands to store floodwaters reduces the risk of costly property damage and loss of life—benefits that have economic value to us. For example, the U.S. Army Corps of Engineers found that protecting wetlands along the Charles River in Boston, Massachusetts, saved $17 million in potential flood damage.

Water filtration. After being slowed by a wetland, water moves around plants, allowing the suspended sediment to drop out and settle to the wetland floor. Nutrients from fertilizer application, manure, leaking septic tanks, and municipal sewage that are dissolved in the water are often absorbed by plant roots and microorganisms in the soil. Other pollutants stick to soil particles. In many cases, this filtration process removes much of the water's nutrient and pollutant load by the time it leaves a wetland. Some types of wetlands are so good at this filtration function that environmental managers construct similar artificial wetlands to treat storm water and wastewater.

Red-osier dogwood

Biological productivity. Wetlands are some of the most biologically productive natural ecosystems in the world, comparable to tropical rain forests and coral reefs in their productivity and the diversity of species they support. Abundant vegetation and shallow water provide diverse habitats for fish and wildlife. Aquatic plant life flourishes in the nutrient-rich environment, and energy converted by the plants is passed up the food chain to fish, waterfowl, and other wildlife and to us as well. This function supports valuable commercial fish and shellfish industries.

The Great Flood of 1993 in the upper Mississippi River Basin caused billions of dollars in property damage and resulted in 38 deaths. Historically, 20 million acres of wetlands in this area had been drained or filled, mostly for agricultural purposes. If the wetlands had been preserved rather than drained, much property damage and crop loss could have been avoided.

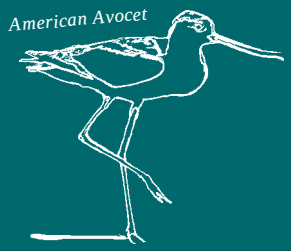
DID YOU KNOW?

- In 1991 wetland-related ecotourism activities such as hunting, fishing, bird-watching, and photography added approximately $59 billion to the national economy.
- According to the Pacific Coast Federation of Fishermen's Associations, almost $79 billion per year is generated from wetland-dependent species, or about 71 percent of the nation's entire $111 billion commercial and recreational fishing industry in 1997.
- An acre of wetland can store 1–1.5 million gallons of floodwater.
- Up to one-half of North American bird species nest or feed in wetlands.
- Although wetlands keep only about 5 percent of the land surface in the conterminous United States, they are home to 31 percent of our plant species.

Steve Delaney

Seventy-five percent of commercially harvested fish are wetland-dependent. Add shellfish species and that number jumps to 95 percent.

The Wetland Fact Sheet Series



Wetlands Overview
Types of Wetlands
Functions & Values of Wetlands
Threats to Wetlands
Wetland Restoration
Funding Wetland Projects
Wetland Monitoring & Assessment
Sustainable Communities
Volunteering for Wetlands
Teaching about Wetlands

For more information, visit www.epa.gov/owow/wetlands.

Wetland Resources

On the Internet

Ecosystem Valuation ..... www.ecosystemvaluation.org

Economic Valuation of Wetlands ..... www.ramsar.org/lib_val_e_index.htm

In Print

Restoration, Creation, and Recovery of Wetlands: Wetland Functions, Values, and Assessment, R.P. Novitzki, R.D. Smith, and J.D. Fretwell. United States Geological Survey Water Supply Paper 2425. Available on-line at http://water.usgs.gov/nwsum/WSP2425/functions.html.

Technical Aspects of Wetlands: Wetland Hydrology, Water Quality, and Associated Functions, Virginia Carter. United States Geological Survey Water Supply Paper 2425. Available on-line at http://water.usgs.gov/nwsum/WSP2425/hydrology.html.

Wetlands Functions and Values. Visit the North Carolina State University Water Quality Group's on-line informational database, WATERSHEDSS, at http://h2osparc.wq.ncsu.edu/info/wetlands/funval.html.

For more information on wetlands, check these sources

EPA Office of Wetlands, Oceans, and Watersheds
http://www.epa.gov/owow/

Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy
Committee on Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy; National Research Council. 1992. This book outlines a national strategy for aquatic restoration, with practical recommendations, and features case studies of aquatic restoration activities around the country. The committee examines: Key concepts and techniques used in restoration, common factors in successful restoration efforts, threats to the health of the nation's aquatic ecosystems, approaches to evaluation before, during, and after a restoration project and the emerging specialties of restoration and landscape ecology. Available from the National Academy of Sciences website:
http://www.nap.edu/catalog/1807.html?se_side

Woody Debris

Natural debris in the creek—branches, logs, and root wads—creates food and shelter for fish and wildlife. Woody debris may need to be repositioned, removed, or partially removed if it threatens life or property. Because removing woody debris can degrade fish habitat, it is important to observe a situation before taking action. It's often best to take small, incremental steps toward resolving a problem.

When Should Woody Debris Be Modified or Removed?

Sometimes woody debris may have to be repositioned, or partially or totally removed. Before taking action, weigh the benefits of habitat creation with any threats to life or property. Observe the situation. It's often best to take small, incremental steps toward resolving a problem.

How much erosion is created? Woody debris should be left in the stream or repositioned, unless it is actually threatening life or property or speeding up natural erosion.

- If fallen trees or branches are causing bank erosion, trim the portion of the woody debris that is above the water. Try to leave the main stem or root wad intact. Don't cut wood into shorter than 3 or 4-foot sections.
- Move obstructions out of the main creek flow and secure debris to the bank.
- Move logs and branches only if they are redirecting the creek against streambanks and blocking culverts.

Is there clearly a barrier to fish? Most fish can swim around or through woody debris barriers, especially with good water flows. Woody debris should be removed only when it's known that fish can't swim through. Removing barriers requires Streambed Alteration Agreements from the Department of Fish & Game.

Is stream flow obstructed? Woody debris may have to be repositioned to be parallel to the stream flow or removed if it spans the width of the creek, or creates significant ponding or sediment deposition.

Can woody debris be added to the creek? Don't add woody debris to the creek unless it falls in naturally. Make sure debris is secure and not free floating. Don't add leaves or garden clippings.

If you have questions or need technical assistance, contact the California Department of Fish and Game at (707) 944-5500; or the Marin County Department of Public Works, Flood Control District at (415) 499-6528.

Reprinted with permission from "How You Can Help Improve Coho Salmon and Steelhead Habitat" by the Marin Municipal Water District, Corte Madera, Ca.

APPENDIX C

SUMMARY OF PERMITS REQUIRED IN MARIN COUNTY WATERSHEDS

SUMMARY OF PERMITS REQUIRED FOR WORK IN CREEKS AND RIVERS IN CALIFORNIA

Work in creeks and rivers in California is regulated by several public agencies, including the U.S. Army Corps of Engineers (Corps) under §404 of the federal Clean Water Act, the Regional Water Quality Control Boards (RWQCB) under §401 of the federal Clean Water Act and the state's Porter-Cologne Act, the California Department of Fish and Game (DFG) under §1600 et seq. of the Fish and Game Code, and the local city or county where the project takes place. If water is to be diverted or impounded from a surface or underground stream or other body of water, a permit or registration may be needed from the State Water Resources Control Board, Division of Water Rights (California Water Code §1200 et seq.). Dams may require written approval from the California Department of Water Resources, Division of Safety of Dams (California Water Code §6000 et seq.).

U.S. Army Corps of Engineers §404 Nationwide and Individual Permits:
Under §404 of the federal Clean Water Act, the Corps regulates discharges of dredged or fill material into any channel that is a navigable water of the U.S. or its tributary or that has real or potential interstate commerce value.[1] A channel is defined as a watercourse that has a bed and bank with an ordinary high water mark (OHWM)[2]. Functionally, the Corps regulates nearly all creeks and rivers. Nationwide Permits (NWPs) have been developed to allow projects that meet specific criteria and that do not result in adverse environmental effects; other projects that do not meet the criteria for a NWP must apply for an Individual Permit. In California, Corps offices are located in San Francisco, Sacramento, and Los Angeles. The Sacramento District website at http://www.spk.usace.army.mil/cespk-co/regulatory/ includes a link to an online application form with instructions that can be used for any of the three districts. The San Francisco District's homepage is at http://www.spn.usace.army.mil/. See http://www.spl.usace.army.mil/ for information specific to the Los Angeles District.

Regional Water Quality Control Board §401 Certifications:
Under §401 of the federal Clean Water Act, the Corps is required to meet state water quality regulations prior to granting a §404 permit for work in a creek or river. In California, this is accomplished by application to the local RWQCB for certification that the requirements have been met. There is a $500-2,250 fee for this application, and the RWQCB may impose conditions to insure that the project does not result in negative environmental impacts. Consult the map at http://www.swrcb.ca.gov/regions.html for contact information.

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1 On January 9, 2001, the U.S. Supreme Court ruled in Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers ("SWANCC") that use of isolated waters by migratory birds may not constitute the *sole* basis for Corps jurisdiction under §404.

2 The Corps has jurisdiction over all perennial and intermittent streams and over ephemeral streams that have an ordinary high water mark (OHWM). District Engineers use their judgment on a case-by-case basis to determine whether an OHWM is present. Ephemeral streams are defined as having flowing water only during, and for a short duration after, precipitation events; they are located above the water table year-round.

Regional Water Quality Control Board Waste Discharge Requirements:
When a project involves work in a stream that is not subject to regulation under §404 of the federal Clean Water Act, the project may require issuance or a waiver of Waste Discharge Requirements (WDRs) under the state's clean water act, known as the "Porter Cologne Act." The application form is the same as for the §401 Certification, and the filing fee is also $500-2,250. Consult the map at http://www.swrcb.ca.gov/regions.html for contact information.

California Department of Fish and Game §1600 Streambed Alteration Agreements:
Under §1601 (public projects) and §1603 (private projects) of the California Fish and Game Code, DFG has jurisdiction over any activity in a creek or river in which there is at any time an existing fish or wildlife resource or from which such resources derive benefit. Projects affecting or potentially affecting such resources must obtain an agreement from DFG, which usually imposes conditions to protect the environment. See http://www.dfg.ca.gov/1600/ for application, instructions, and current filing fees.

County and City Regulations:
Activities in creeks or rivers may require local streambed alteration agreements. Local regulations should be researched as part of project planning. A grading permit is required from Marin County for movement of over 250 cubic yards of earth or any movement of earth within, or along the banks of, any watercourse or within 50 feet from the top of any watercourse at locations within the "city-centered corridor" or 100 feet from the top of bank of any watercourse at locations within the "inland rural corridor" as identified within the Marin countywide plan. A grading permit may be required for other activities that involve creating cut or fill slopes, or removing or plowing under vegetation on slopes exceeding 15%. For more information, see http://www.ordlink.com/codes.marinco/.

State Water Resources Control Board, Division of Water Rights:
If water from a surface or underground stream or other body of water is taken for storage or direct use on non-riparian land, a registration or permit must be obtained from the State Water Resources Control Board, Division of Water Rights (California Water Code §1200 et seq.).

Registration of Small Domestic Use or Livestock Stockpond Appropriation
For direct diversion of not more than 4,500 gallons or storage of not more than 10 acre-feet per annum, a Registration of Small Domestic Use or Registration of Livestock Stockpond Appropriation application form may be used; the filing fee is $100. These registrations must be renewed every 5 years; the renewal fee currently is $50. The lawn or garden irrigation area under a Small Domestic Use registration must be 0.5 acres or less.

Application to Appropriate Water by Permit
For direct diversion of more than 4,500 gallons, storage of more than 10 acre-feet per annum, or irrigation of more than 0.5 acres, an Application to Appropriate Water by Permit must be used. The Water Right Application fee is $100, and there is a California Department of Fish & Game Water Right Filing Fee of $850. Other costs include preparation of environmental documents required by the California Environmental Quality Act (CEQA) and a water availability document.

Forms and application information are found at http://www.waterrights.ca.gov/forms/.

California Department of Water Resources, Division of Safety of Dams:
Construction or enlargement of dams that are 25 feet or more in height that store more than 15 acre-feet of water and/or dams that store 50 acre-feet or more of water that are more than 6 feet high require written approval of the plans and specifications by the California Department of Water Resources, Division of Safety of Dams, P.O. Box 942836, Sacramento, CA 94236-0001 (California Water Code §6000 et seq.).

Bridge Permits:
Marin County requires a building permit for construction of most bridges. However, depending on the location of the bridge, additional approval may be necessary from the Department of Public Works or Flood Control. A Department of Fish and Game streambed alteration permit may also be needed.

Pesticide Use Permits:
Pesticide use permits are available from the County Agricultural Commissioner's Office at (415) 499-6700. A permit is required for the application of restricted use pesticides. Applicators must pass a test before a permit is issued

Other Regulations:
The above agencies are required to comply with a host of other regulations, including, but not limited to, the California Environmental Protection Act (CEQA), the National Environmental Policy Act (NEPA), the state and federal Endangered Species Acts (ESA), the Historic Preservation Act, and the Coastal Zone Management Act. Typically, compliance also involves consultation with the U.S. Fish and Wildlife Service (USFWS), the Native American Heritage Commission, and the Office of Historic Preservation (OPR) through its California Historical Resources Information System (CHRIS). The National Marine Fisheries Service (NMFS) must be consulted when listed anadromous fish are potentially present.

Some other useful websites include:

CEQA Statutes and Guidelines: http://ceres.ca.gov/ceqa/. See Guidelines' Appendices for forms and timeline.

NEPA Regulations: http://es.epa.gov/oeca/ofa/nepa.html.

NOAA Fisheries ESA Program: http://www.nmfs.noaa.gov/prot_res/esahome.html.

USFWS ESA Program: http://endangered.fws.gov/index.html.

California Natural Diversity Data Base: http://www.dfg.ca.gov/whdab/html/cnddb.html.

Native American Heritage Commission (NAHC): http://www.nahc.ca.gov.

Office of Historic Preservation (OHP): http://www.ohp.parks.ca.gov/.

California Historical Resources Information System (CHRIS): link is on OHP page.

APPENDIX D

SPECIAL STATUS ANIMAL AND PLANT SPECIES KNOWN FROM MARIN COUNTY

TABLE 1a.
SPECIAL-STATUS ANIMAL SPECIES KNOWN FROM MARIN COUNTY

Common Name (*Scientific Name*)	Status Federal/State	Number of Occurrences in 2001 CNDDB Records	Habitat
ANIMALS			
Amphibians/Reptiles			
Green sea turtle (*Chelonia mydas*)	T / –	0	Open ocean.
Northwestern pond turtle (*Clemmys marmorata marmorata*)	– / CSC	8	Streams/ponds/lakes.
Leatherback sea turtle (*Dermochelys coriacea*)	E / –	0	Open ocean.
Loggerhead sea turtle (*Caretta caretta*)	T / –	0	Open ocean.
California red-legged frog (*Rana aurora draytonii*)	FT / CSC	8	Forests/woodlands/grasslands and streamsides.
Foothill yellow-legged frog (*Rana boylii*)	– / CSC	3	Streams with rocky substrate.
Birds			
Tricolored blackbird (*Agelaius tricolor)* (nesting colony)	– / CSC	5	Freshwater marsh and surrounding fields.
Great egret (*Ardea alba*) (rookery)	– / –	9	Colonial nester in large trees.
Great blue heron (*Ardea herodias*) (rookery)	– / –	7	Colonial nester in trees, cliff-sides, marshes.
Burrowing owl (*Athene cunicularia)* (burrow sites)	– / CSC	2	Open grasslands/scrub.
Western snowy plover (*Charadrius alexandrinus nivosus*) (nesting)	FT / CSC	5	Nesting along sandy beaches and shorelines
Northern harrier (*Circus cyaneus)* (nesting)	– / CSC	1	Nesting in marsh and low shrubs.
Back swift (*Cypsefloides niger)* (nesting)	– / CSC	1	Nesting on cliffs and behind falls.
Yellow warbler (*Dendroica petechia brewsteri*) (nesting)	– / CSC	1	Nesting in willows and riparian cover.
Snowy egret (*Egretta thula*) (rookery)	– / –		Colonial nester in trees, cliff-sides, near marshland.
White-tailed kite (*Elanus leucurus*) (nesting)	– / FP	1	Nesting in grassland/marshland with trees.
Tufted pufin (*Fratercula cirrhata*)	– / CSC		Colonial nester on off-shore islands/cliffs.
Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)	– / CSC	14	Salt and brackish water marsh.
California black rail (*Laterallus jamaicensis coturniculus*)	– / ST; FP	14	Coastal saltmarsh.

Common Name (*Scientific Name*)	Status Federal/State	Number of Occurrences in 2001 CNDDB Records	Habitat
Black-crowned night heron (*Nycticorax nycticorax*) (rookery)	– / –		Colonial nester in trees/shrubs near marshland.
Ashy storm-petrel (*Oceanodrama homochroa*) (rookery)	– / CSC	1	Colonial nester on off-shore islands.
Osprey (*Pandion haliaetus*) (nesting)	– / CSC	1	Nesting in trees associated with water bodies.
California clapper rail (*Rallus longirostris obsoletus*)	FE / SE	12	Salt and brackish marsh.
Northern spotted owl (*Strix occidentalis caurina*)	FT / –	23	Forest and woodland.
Fish			
Tidewater goby (*Eucyclogorius newberryi*)	FE/ CSC	7	Brackish water, marsh/bays.
Tomales roach (*Lavinia symmetricus ssp. symmetricus*)	– / CSC	1	Tributaries of Tomales Bay.
Coho salmon (*Oncorhynchus kisutch*)	FT / SE	2	Spawns in freshwater streams.
Steelhead trout (*Oncorhynchus mykiss*)	FT/CSC	0	Spawns in freshwater streams.
Invertebrates			
Tomales isopod (*Caecidotea tomalensis*)	– / –	3	Freshwater marsh/ponds.
Monarch butterfly (*Danaus plexippus*) (colonies)	– / –	26	Overwinters in blue gum eucalyptus.
Williams' bronze shoulderband (*Helminthoglypta arrosa williamsi*)	– / –	1	Known only from Hogg Island.
Peninsula coast range shoulderband snail (*Helminthoglypta nickliniana awania*)	– / –	1	Known only from Point Reyes headland.
Ricksecker's water scavenger beetle (*Hydrochara rickseckeri*)	– / –	1	Aquatic habitat/pools and ponds.
Mission blue butterfly (*Icaricia icarioides missionensis*)	FE / –	1	Shrubs/grasslands with lupine host.
Bumblebee scarab beetle (*Lichnanthe ursina*)	– / –	3	Coastal dunes.
Tiburon micro-blind harvestman (*Microcina tiburona*)	– / –	2	Serpentine outcrops near spring/seeps.
Myrtles silverspot (*Speyeria zerene myrtleae*)	E / –		Scrub/grassland with larval host.
California freshwater shrimp (*Syncaris pacifica*)	FE / SE	4	Freshwater streams with undercut banks.
Mammals			
Pallid bat (*Antrozous pallidus*)	– / CSC	3	Roosts in protected locations.

Common Name (*Scientific Name*)	**Status Federal/State**	**Number of Occurrences in 2001 CNDDB Records**	**Habitat**
Point Reyes mountain beaver (*Aplodontia rufa phaea)*	– / CSC	9	Springs/ seeps with dense cover.
Guadalupe fur seal (*Arctocephalus townsendi*)	T / T; FP	0	Open ocean, beaches.
Sei whale (*Balaenoptera borealis*)	E / –	0	Open ocean.
Blue whale (*Balaenoptera musulus*)	E / –	0	Open ocean.
Finback whale (*Balaenoptera physalus*)	E / –	0	Open ocean.
Townsend's western big-eared bat (*Corynorhinus townsendii townsendii*)	– / CSC	2	Roosts in protected locations.
Grey whale (*Eschrichtius robustus*)	E / –	0	Open ocean.
Stellar seal lion (*Eumetopias jubatus*)	T / –	0	Open ocean, beaches.
Southern sea otter (*Enhydra lutris nereis*)	FT / FP	1	Nearshore marsh habitat.
Salt marsh harvest mouse (*Reithrodontomys raviventris*)	FE / SE; FP	10	Coastal saltmarsh.
Angel Island mole (*Scapanus latimanus isularis*)	– / CSC		Coastal scrub/prairie on Angel Island.
Point Reyes jumping mouse (*Zapus trinotatus orarius*)	– / CSC	0	Coastal scrub/grassland from Point Reyes.

TABLE 1b.
SPECIAL-STATUS PLANT SPECIES KNOWN FROM MARIN COUNTY

Common Name (*Scientific Name*)	Status Federal/ State/CNPS	Number of Occurrences in 2001 CNDDB Records	Habitat
PLANTS			
Pink sand-verbena (*Abronia umbellata ssp. breviflora*)	SC / – / 1B	2	Coastal dunes/stand.
Blasdale's bent grass (*Agrostis blasdalei*)	SC / – / 1B	10	Coastal dunes/scrub/prairie.
Point Reyes bent grass (*Agrostis clivicola var punta-reyesensis*)	SC / – / –	10	Coastal scrub/prairie/ coniferous forest.
Sonoma alopecurus (*Alopecurus aequalis var sonomensis*)	FE / – / 1B	7	Freshwater marsh/riparian scrub.
Napa false indigo (*Amorpha californica var napensis*)	– / – / 1B	0	Forest/chaparral/woodland.
Bent-flowerred fiddleneck (*Amsinckia lunaris*)	– / – / 1B	0	Coastal bluff scrub/woodland/ grassland.
Mt. Tamalpais manzanita (*Arctostaphylos hookeri ssp. montana)*	SC / – / 1B	17	Chaparral/grassland.
Marin manzanita (*Arctostaphylos virgata*)	– / – / 1B	17	Coniferous forest/chaparral.
Coastal marsh milk-vetch (*Astragalus pynostachyas var p.*)	– / – / 1B	0	Dunes/marshes/swamps.
Point Reyes blennosperma (*Blennosperma nanum var. robustum*)	SC / SR / 1B	13	Coastal prairie/scrub.
Small groundcone (*Boschniakia hookeri*)	– / – / 2	2	Coniferous forests.
Thurber's reed grass (*Calamagrostis crassiglumis*)	SC / – / 2	4	Coastal scrub/freshwater marsh.
Tiburon mariposa lily (*Calochortus tiburonensis*)	FT / ST / 1B	1	Serpentine grassland.
Coastal bluff morning-glory (*Calystegia purpurata ssp. saxicola*)	– / – / 1B	0	Dunes/coastal scrub.
Swamp harebell (*Campanula californica*)	SC / – / 1B	24	Bogs/ferns/ marshes in coniferous forest.
Flaccid sedge (*Carex leptalea*)	– / – / 2	0	Bogs/fens/meadows/seeps.
Lyngbye's sedge (*Carex lyngbyei*)	– / – / 2	0	Marshes/swamps.
Tiburon indian paintbrush (*Castilleja affinis ssp. neglecta*)	FE / ST / 1B	9	Serpentine grassland.
Humbolt Bay owl's clover (*Castilleja ambigua ssp. humboldtiensis*)	SC / – / 1B	1	Coastal saltmarsh.
Mt. Vision ceanothus (*Ceanothus gloriosus var. porrectus*)	SC / – / 1B	10	Coniferous forest/coastal scrub/prairie.
Mason's ceanothus (*Ceanothus masonii*)	SC / SR / 1B	6	Chaparral/serpentine.
San Francisco Bay spineflower (*Chorizanthe cuspidata var. cuspidata*)	SC / – / 1B	3	Coastal scrub/prairie/dunes.

Common Name (*Scientific Name*)	Status Federal/ State/CNPS	Number of Occurrences in 2001 CNDDB Records	Habitat
Woolly-headed spineflower (*Chorizanthe cuspidata var. villosa*)	– / – / 1B	5	Coastal scrub/prairie/dunes.
Sonoma spineflower (*Chorizanthe valida*)	FE / SE / 1B	1	Coastal prairie.
Franciscan thistle (*Cirsium andrewsii*)	– / – / 1B	0	Forest/coastal bluff scrub/prairie/ coastal scrub.
Mt. Tamalpais thistle (*Cirsium hydrophilum var. vaseyi*)	SC / – / 1B	8	Forest/chaparral.
Raiche's red ribbons (*Clarkia concinna ssp. raichei*)	SC / – / 1B	1	Coastal bluff scrub.
Round-headed chinese houses (*Collinsia corymbosa*)	– / – / 1B	0	Coastal dunes.
Point Reye's bird's beak (*Cordylanthus maritimus ssp. palustris*)	SC / – / 1B	19	Coastal saltmarsh/dunes.
Soft bird's beak (*Cordylanthus mollis spp. mollis*)	FE / SR / 1B	2	Coastal saltmarsh.
Baker's larkspur (*Delphinium bakeri*)	PE / SR / 1B	1	Coastal scrub.
Yellow larkspur (*Delphinium luteum*)	PE / SR / 1B	5	Chaparral/coastal scrub/prairie.
Western leatherwood (*Dirca occidentalis*)	– / – / 1B	6	Forest/chaparral/woodland.
Supple daisy (*Erigeron supplex*)	– / – / 1B	2	Coastal bluff scrub/prairie.
Moss (*Fissidens pauperculus*)	– / – / 1B	0	Forest floor along coast.
Marin checker lily (*Fritillaria affinis var tristulis*)	– / – / 1B	14	Coastal bluff scrub/prairie.
Fragrant fritillary (*Fritillaria liliacea*)	SC / – / 1B	13	Coastal scrub/prairie/ grassland.
Dune gilia (*Gilia capitata ssp. chamissonis*)	– / – / 1B	0	Dunes/coastal scrub.
Wooly-headed gilia (*Gilia capitata ssp. tomentosa*)	– / – / 1B	0	Coastal bluff scrub/outcrops.
Dark-eyed gilia (*Gilia millefoliata*)	– / – / 1B	0	Coastal dunes.
San Francisco gumplant (*Grindelia hirsutula var. maritima*)	– / – / 1B	0	Coastal bluff scrub/coastal scrub/ grassland.
Diablo helianthella (*Helianthella castanea*)	– / – / 1B	0	Forest/chaparral/woodland/ coastal scrub/grassland.
Short-leaved evax (*Hesperevax sparsiflora var. brevitolia*)	– / – / 2	0	Coastal bluff scrub/dunes.
Marin western flax (*Hesperolinon congestum*)	FT / ST / 1B	12	Chaparral/grassland.
Santa Cruz tarplant (*Holocarpha macradenia*)	T / E / 1B	0	Coastal prairie/coastal scrub/ grassland.

Common Name (*Scientific Name*)	Status Federal/ State/CNPS	Number of Occurrences in 2001 CNDDB Records	Habitat
Kellogg's horkelia (*Horkelia cuneata ssp. sericea*)	SC / – / 1B	2	Confierous forest/coastal scrub/ chaparral.
Point Reyes Horkelia (*Horkelia marinensis*)	SC / – / 1B	3	Coastal scrub/prairie/dunes.
Thin-lobed horkelia (*Horkelia tenuiloba*)	– / – / 1B	5	Coastal scrub/chaparral.
Baker's goldfields (*Lasthenia macrantha ssp. bakeri)*	– / – / 1B	0	Coniferous forest/coastal scrub.
Perennial goldfields (*Lasthenia macrantha ssp. macrantha*)	– / – / 1B	0	Coastal bluff scrub/dunes/coastal scrub.
Beach layia (*Layia carnosa*)	FE / SE / 1B	10	Coastal dunes.
Tamalpais lessingia (*Lessingia micradenia var. micradenia*)	SC / – / 1B	4	Chaparral/grassland in serpentine.
Maison's lilaeopsis (*Lilaeopsis masonii*)	SC / SR / 1B	1	Fresh and brackish marsh.
Coast lily (*Lilium maritimum*)	– / – / 1B	0	Forest/prairie/coastal scrub/marshes/ swamps.
Point Reyes meadowfoam (*Limnanthes douglasii ssp. sulphurea*)	SC / SE / 1B	8	Freshwater marsh/prairie/seeps.
Rose linanthus (*Linanthus rosacerus*)	– / – / 1B	0	Coastal bluff scrub.
Tidestrom's lupine (*Lupinus tidestromii*)	FE / SE / 1B	8	Coastal dunes.
Marsh microseris (*Microseris paludosa*)	– / – / 1B	0	Forest/woodland/coastal scrub/ grassland.
Baker's navarretia (*Navarretia leucocephala ssp. bakeri*)	– / – / 1B	1	Woodland/seeps/pools/grassland/ forest.
Marin County navarretia (*Navarretia rosulata*)	– / – / 1B	10	Coniferous forest/chaparral.
White-rayed pentachaeta (*Pentachaeta bellidiflora*)	FE / SE / 1B	5	Grassland on serpentine.
North Coast phacelia (*Phacelia insularis var. continentis*)	SC / – / 1B	3	Coastal bluff scrub/dunes.
Point Reyes rein orchid (*Piperia elegans ssp. decurtata*)	– / – / 1B	0	Coastal bluff scrub only from Pt. Reyes National Seashore.
Hairless popcorn flower (*Plagiobothrys glaber*)	/ / 1A	0	Meadows/seeps/marshes/swamps.
North Coast semaphore grass (*Pleuropogon hooverianus*)	SC / SB / 1B	3	Forest/steeps.
Marin knotweed (*Polygonum marinense*)	SC / – / 3	3	Marshes/swamps.
Tamalpais oak (*Quercus parvula var. tamalpaisensis*)	– / – / 1B	0	Coniferous forest only on Mt. Tamalpais.
California beaked-rush (*Rhynchospora californica*)	SC / – / 1B	1	Bogs/marshes/seeps/confierous forest.

Common Name (*Scientific Name*)	Status Federal/ State/CNPS	Number of Occurrences in 2001 CNDDB Records	Habitat
Point Reyes checkerbloom (*Sidalcea calycosa ssp. rhizomata*)	– / – / 1B	9	Marshes/swamps.
Marin checkerbloom (*Sidalcea hickmanii ssp. viridis*)	SC / – / 1B	3	Chaparral.
Purple-stemmed checkerbloom (*Sidalcea malviflora ssp. purpurea*)	– / – / 1B	0	Forest/prairie.
Tamalpais jewel-flower (*Streptanthus batrachopus*)	SC / – / 1B	5	Confierous forest/chaparral.
Mt. Tamalpais jewel-flower (*Streptanthus glandulosus ssp. pulchellus*)	– / – / 1B	9	Chaparral/grassland.
Santa Cruz microseris (*Stebbinsoseris decipiens*)	SC / – / 1B	3	Forest/chaparral/coastal scrub/ prairie.
Tiburon jewel-flower (*Streptanthus niger*)	FE / SE / 1B	2	Grassland on serpentine.
Showy Indian clover (*Trifolium amoenum*)	FE / – / 1B	3	Grassland/coastal bluff scrub.
San Francisco owl's clover (*Triphysaria floribunda*)	SC / – / 1B	14	Coastal prairie/grassland.

STATUS DESIGNATIONS

Federal:
FE = Listed as "endangered" under the federal Endangered Species Act.
FT = Listed as "threatened" under the federal Endangered Species Act.
PE = Proposed for federal listing as "endangered".
PT = Proposed for federal listing as "threatened".
C = A candidate species under review for federal listing. Candidates include taxa for which the USFWS has sufficient biological information to support a proposal to list as endangered or threatened.
SC = Species of Concern; formerly considered a candidate species for listing by the USFWS.

State:
SE = Listed as "endangered" under the California Endangered Species Act.
SR = Listed as "rare" under the California Endangered Species Act.
ST = Listed as "threatened" under the California Endangered Species Act.
CP = California fully protected species; individual may not be possessed or taken at any time.
CSC = Considered a species of special concern by the CDFG; taxa have no formal legal protection but nest sites and communal roosts are generally recognized as significant biotic features.

CNPS:
1A = Plants of highest priority; plants presumed extinct in California.
1B = Plants of highest priority; plants rare and endangered in California and elsewhere.
3 = Plants requiring additional information; a review list.
4 = Plants of limited distribution; a watch list.

Source: Marin County Community Development Agency. *Biological and Wetland Protection Technical Background Report*. Prepared by Environmental Collaborative and Nichols • Berman. April 2002.

APPENDIX E

TOMALES BAY WATERSHED STEWARDSHIP PLAN: A FRAMEWORK FOR ACTION

Chapter III, A Framework for Watershed Stewardship
Chapter IV, Action Plan Implementation

Tomales Bay Watershed Stewardship Plan:

A Framework for Action

Prepared by:

Tomales Bay Watershed Council

July 2003

III. A FRAMEWORK FOR WATERSHED STEWARDSHIP

These goals are intended to guide future programs and projects, and to assist funding organizations in ascertaining our needs at the watershed scale. These goals drove the development of the Action Plan, which identifies high, medium and low priority activities in the Tomales Bay Watershed Stewardship Plan.

A. GOALS AND OBJECTIVES

Goal A. Ensure water quality in Tomales Bay and tributary streams sufficient to support natural resources and sustain beneficial uses (as defined in the attached glossary).

Objective 1: Improve water quality in Tomales Bay and tributary streams through reductions in sediment, pathogens, mercury and nutrient loading - with the specific objectives of protecting all beneficial uses, and removing Tomales Bay from the 303(d) list of impaired waterbodies by attaining state and federal water quality standards. A benchmark for success in reducing pathogen levels will be a reduction in shellfish harvest closures by increasing the rainfall threshold and reducing the minimum duration of shellfish harvest closures. Benchmarks for sediment, nutrients and mercury will be developed as regulatory agencies further develop reduction plans for these pollutants.

Objective 2: Restore and maintain adequate high quality freshwater flow to Tomales Bay and tributary streams.

Objective 3: Reduce potential for other contaminants in Tomales Bay.

Goal B. Restore and preserve the integrity of natural habitats and native communities.

Objective 1: Restore and protect populations of native species in the Tomales Bay watershed.

Objective 2: Control invasive non-native species in the Tomales Bay watershed.

Objective 3: Restore and protect habitats of native species in the Tomales Bay watershed.

Objective 4: Restore and protect the hydrologic integrity of the Tomales Bay watershed.

Goal C. Develop strategies to implement the Plan and to protect the watershed.

Objective 1: Encourage comprehensive planning to address watershed issues and facilitate interagency coordination and cooperation.

Objective 2: Monitor implementation of this plan. Develop recommendations for public policies and programs to achieve the goals of the Plan.
Objective 3: Define the role of the Council in helping to ensure implementation and achievement of Plan goals.

***Objective 4*:** Involve and educate the public to become watershed stewards.

B. ACTION PLAN

> *"[It] is our privilege as residents of this watershed, working together to strengthen the place we share. And this work is our most valuable legacy for those who will follow us."*
>
> -- Michael Mery, Point Reyes Station

The Action Plan defines activities needed to achieve the goals of the Watershed Stewardship Plan. These activities may be undertaken voluntarily, and we have identified lead and supporting partners for each task and we look to those entities to act. Some of the recommended actions are already being implemented, while others have yet to be initiated. The Council will support implementation of this Plan, taking on specific programs and projects that are beyond the mission or capacity of individual organizations/agencies or established partnerships. The Council will also continue to provide a forum where programs and projects are discussed and evaluated. Prunuske Chatham, Inc. provided preliminary cost estimates as a starting point in the development of future proposals, some of which appear in Appendices A and B.

At this time, there is sufficient information to undertake many appropriate management and restoration actions through implementation of the recommendations contained in this Plan. In the future, additional assessment will be useful in guiding us towards more effective and efficient policies and programs; however, due to the complex nature of this natural system, we will continue to depend on the best available information and professional judgment if our efforts to manage human impacts on this system are to be timely.

Action 1.0 Develop a coordinated and comprehensive water quality monitoring plan for Tomales Bay and tributary streams.

Clean water is essential to aquatic, coastal and marine environments. In the Tomales Bay watershed, water quality and healthy aquatic habitats are influenced by tidal circulation, by activities that occur nearby on land, and by pollutants delivered via surface run-off and subsurface seepage. A comprehensive long-term monitoring program is needed to document baseline conditions and identify trends for pollutants of concern. Pollutants refers to human created or induced alterations in the physical, biological or chemical character of water thereby producing undesirable environmental results, as well as the standard evaluation of substances effecting human health. Monitoring would provide the information needed to evaluate water quality in the bay and its tributaries, as well as the efficacy of projects to reduce non-point sources of pollution, management practices intended to improve water quality, and educational programs. It is anticipated that considerable energy and capital will be expended to improve water quality and it is essential to have a scientifically valid database to determine action efficiency. In this way, adaptive management and conservation strategies based on the most current and best available monitoring data can be incorporated into future actions in the watershed to improve water quality and watershed health.

The development of a comprehensive water quality monitoring program is only the first step in watershed monitoring for Tomales Bay. Along with baseline monitoring (to characterize existing conditions) and effectiveness monitoring (to determine the success of existing or newly implemented projects or management practices), bio-indicators should be identified and monitored. Lists of monitoring and assessment recommendations are included in Appendix A: Water Quality Status and Trends Report, and Appendix B: Erosion and Sedimentation in the Tomales Bay watershed for consideration in the development of a comprehensive water quality monitoring plan. In addition, it is necessary to monitor and evaluate land-use practices and other human influences on tributaries to the bay, uplands, riparian corridors, wetlands and along the bay shores. Voluntary landowner monitoring will provide important information about the effectiveness of projects on private lands. Together, these monitoring activities will provide the framework for adaptive management, which will increase the effectiveness of our actions.

Some components of this program can be carried out by existing agencies if the components fit into an agency's specific directives and goals. Others will need to be carried out by organizations outside the regulatory network (such as academic institutions and non-profit groups). However, without a central group to coordinate activities, monitoring efforts will continue to serve specific goals rather than lead to an overall understanding and improvement in the health of Tomales Bay. The Bay Institute, which oversees and coordinates a long-term water quality monitoring program for San Francisco Bay, or the Morro Bay and Tillamook Bay National Estuary Programs, could be used as a model for such a group.

Purpose:

- Obtain high quality baseline data describing the concentrations of contaminants in the waters of Tomales Bay and tributary streams, and to increase understanding and awareness of water quality problems in the watershed.

- Measure effectiveness of management practices implemented on public and private lands to reduce sediment, bacteria and nutrient delivery, and other non-point sources of pollution.
- Increase understanding of water quality problems in the watershed including the impacts of septic systems, sewage ponds and landfills on the water quality of Tomales Bay and tributaries.
- Identify temporal and spatial changes in the bay and tributary streams. Determine seasonal, annual and long-term trends in chemical, physical (e.g. sedimentation), and bacteriological water quality in Tomales Bay and the tributary streams.
- Determine whether water quality, and sediment contamination and supply, in Tomales Bay and tributary streams are in compliance with objectives established in the San Francisco Bay RWQCB's Basin Plan, Marin Countywide Plan, Local Coastal Program, Shellfish Protection Act, etc.
- Provide adequate information and recommendations to result in water quality improvements to reduce shellfish harvest closures during winter rain events by reducing run-off containing high concentrations of coliform bacteria. Evaluate and revise minimum required closure period for shellfish grown in Tomales Bay based on data.
- Provide a database on water quality that is compatible with data being developed in ongoing studies in Tomales Bay and tributary streams.
- Provide a clearinghouse and monitoring database for use by landowners, stakeholders, regulatory agencies, watershed managers and the general public through such media as the Internet (web page), published reports and readily available, computer searchable databases.
- Provide volunteer monitoring opportunities for local communities and schools

Lead:
The Tomales Bay Watershed Council, via its Water Quality Committee, will be the lead in the development of this Water Quality Monitoring Plan.

Core group of program partners:
California Department of Health Services, Regional Water Quality Control Board, Marin County Environmental Health Services, U.C. Cooperative Extension, Salmon Protection and Watershed Network, Tomales Bay Agricultural Group, Tomales Bay Shellfish Technical Advisory Committee, Gulf of the Farallones National Marine Sanctuary, California Department of Fish and Game, Pacific Coast Learning Center, Point Reyes National Seashore, Point Reyes National Seashore Association, Tomales Bay State Park, shellfish growers, Marin Municipal Water District, Inverness Public Utility District, North Marin Water District, U. S. Geological Service, U.S. Environmental Protection Agency, ranchers, private landowners and local non-governmental organizations.

I. High priority, short-term activities for developing a coordinated and comprehensive water quality monitoring plan for Tomales Bay and tributaries. Please note that some of these activities are interrelated and do not necessarily to occur in this exact order. See reference year following each step.

- ***Purpose:*** Define the purpose and identify the questions to be answered with this monitoring plan. (2003) Cost estimate: $5,000

- ***Status:*** Summarize historic and current water quality monitoring efforts and data. Collect data on sources of pollution, and develop initial database. Identify pollutants of concern and water quality problems in Tomales Bay watershed. (2003). Cost estimate: has been initiated using planning funds

- ***Trends:*** Identify trends, based on historical and current data. (2004). Cost estimate: $15,000

- ***Regulatory status:*** Determine which agencies have regulatory responsibility for development of best management practices, specific contaminant monitoring, enforcement of the Clean Water Act, etc. Identify actions already taken by those agencies. (2003-2004). Cost estimate: $5,000-10,000

- ***Prioritize:*** List and rank known and potential sources of pollutants of concern. (2003-2004). Cost estimate: $5,000-10,000

- ***Fill data gaps:*** Identify gaps in existing data and incompatibilities between databases. Decide how to fill data gaps. (2003-2004). Cost estimate: $5,000-10,000

- ***Develop a water quality and quantity monitoring plan*:** The plan should identify the questions to be answered, outline the approaches to take, describe the limitations, estimate the costs, and develop a sampling plan. The plan is likely to include monitoring to develop a baseline, to support existing actions (e.g. development of a TMDL), and to evaluate current monitoring tools and methods, and the implementation of remediative actions. The plan shall identify lead(s) for implementation, and have an adaptive management component. (Start 2003-2004, on-going for the life of the monitoring program). Cost estimate: $90,000

- ***Database:*** Continue development of the database stated under Step 2 that will allow for long-term trend analysis. Design a framework to support maintenance and updating of database. (Start in 2003, on-going for the life of the program). Cost estimate: $35,000

- ***Funding:*** Work with leads to identify and secure adequate funding for equipment, monitoring and sampling, staffing and related needs. (Begin 2003, on-going for the life of the monitoring program). Cost estimate: $15,000

- ***On-going coordination:*** Identify a central organization to coordinate existing water quality monitoring efforts going on in the watershed and to serve as a "clearinghouse." (Begin 2003, on-going for the life of the monitoring program). Cost estimate: $40,000 per year

- ***Implementation and analyses:*** Facilitate implementation of the monitoring program and support on-going efforts. Analyze trends. Develop recommendations for actions to improve water quality. (Implement the water quality monitoring program in 2004, on-going for the life of the program). Cost: unknown at this time

- ***Indicator Species and/or systems as a measure of water quality and overall "health" of the bay:*** Determine if there are resources to develop indictor species and/or systems for Tomales Bay. If so, the Council will work with technical advisors to identify indicators of watershed function. Thresholds and warning levels for indicators should be developed. (2004-2005). Cost: unknown at this time

These activities will be successful if they achieve these results. Specific criteria will be developed on a project basis:

1. Easy-to-use water quality database for Tomales Bay and tributaries.
2. Practical understanding of water quality problems, sources of pollution and primary loading routes to Tomales Bay and tributary streams by end of 2004.
3. Preliminary list of prioritized projects to reduce sources of contaminants by end of 2004. This list should be updated as the long-term monitoring program uncovers new information.
4. Recommendations for best management practices and restorative actions to improve water quality in Tomales Bay and tributary streams.

Action 2.0 Support implementation of practices and projects that will reduce nonpoint sources of water pollution and enhance habitats in Tomales Bay and its watershed.

During the past 20 years, significant steps have been taken on private and public lands to improve water quality and aquatic and terrestrial habitats in the Tomales Bay watershed. The momentum that has been created by partnerships between private landowners, local agencies and organizations has resulted in an increased understanding of water quality issues, the condition of Tomales Bay and tributary streams, and linkages between sources of pollutants and water quality. In addition, these activities have improved local awareness about native habitats in the bay and watershed. Future collaboration will be necessary to maintain this progress and to increase these local programs.

Sources of water pollution in the Tomales Bay watershed include agricultural run-off with elevated levels of nutrients, sediment and bacteria; recreational activities and stormwater run-off that contribute pathogens and environmental toxins; groundwater contamination related to septic systems and storage ponds; and heavy metal pollutants from mines and marine facilities. BMPs are methods to control pollution sources and to maintain the integrity of a watershed ecosystem. BMPs offer private and public landowners the opportunity to change unsustainable management practices, and may preclude enforcement of environmental regulations by state and federal agencies. BMPs have been identified for road construction and grading; road crossings and culverts; septic system construction and maintenance; agricultural activities (including grazing, dairy operations, waste storage facilities, pasture fertilization, tilling and planting); mariculture; recreation; weed management; forest management and others. Most BMPs are subject to revision as research and experience lead to improvements, and as some practices become more technically or financially feasible (sometimes due to the availability of technical or financial support). When BMPs alone are not sufficient to protect water quality and sensitive habitats, it may be necessary to set limits on use.

In many cases, private landowners who have implemented BMPs not only improved water quality, and riparian and aquatic habitats, they have also improved the economic viability/sustainability of their enterprises. For example, agricultural operators who collect and spread manure can reduce both potential sources of water quality contamination and the costs associated with fertilization and transportation of animal wastes. Similarly, implementing BMPs for culvert installation and road grading has resulted for many landowners in lower maintenance costs associated with poorly draining road surfaces and culvert failure.

Future projects and programs to improve and protect water quality and habitats in the watershed will require the participation and collaboration of private and public partners. As with habitat restoration, water quality benefits accrue not only to local communities, but also to the millions of visitors that come to the watershed each year, to future generations to come, and to the many species for which the bay and watershed provide critical habitat.

Future habitat restoration measures will require the on-going participation of and financial support for private and public landowners to implement best management practices. These management practices will include measures to reduce and contain the introduction and spread of invasive non-native species. During the next decade, the SWQCB and RWQCB will be developing TMDLs for pollutants of concern, and looking to local partnerships for assistance in implementing these plans to reduce water pollution. The continued support for and encouragement of community participation through voluntary management measures to resolve pollution problems will be a critical component to our success. These recommendations are intended to promote the protection of water quality and recognized beneficial uses of the bay and tributaries, habitats and species, and human health.

Purpose:

- Improve water quality and habitats in the Tomales Bay watershed.
- Protect human health.
- Benefit species of local interest (a list which will be developed by the Council)
- Improve sustainability of human activities; including residential needs, agriculture, and mariculture.
- Comply with local, state and federal laws and regulations.
- Achieve regional and national water quality goals.

I. High priority, short-term activities to reduce non-point sources of pollution and to improve aquatic habitats to be implemented and maintained:

- Implement projects to control livestock access to creeks as needed. Develop improved BMPs for animal waste management based on information derived from water quality monitoring programs on ranches and dairies.

  Partners: Marin Resource Conservation District, Natural Resource Conservation Service, property owners, Tomales Bay Agricultural Group, U. C. Cooperative Extension, Marin Agricultural Land Trust, County of Marin, State Coastal Conservancy

- Support implementation, funding, and assessment of BMPs on agricultural lands, and in residential and commercial areas, especially where riparian and upland habitats may be affected.

  Partners: Tomales Bay Agricultural Group, U.C. Cooperative Extension, Marin Resource Conservation District, Point Reyes National Seashore, Regional Water Quality Control Board, Natural Resources Conservation Service, State Coastal Conservancy, California Department of Fish and Game, Marin Agricultural Land Trust, Marin County Building and Planning Depts., Marin County Dept. of Public Works, Tomales Bay Watershed Council

- Provide adequate facilities to handle recreational sources of human waste.

  Partners: Point Reyes National Seashore, California State Parks, recreational users, Marin County, Interagency Group, Golden Gate National Recreation Area

- Support community-based septic evaluation, improvement, management and monitoring programs. Consider alternative options for on-site treatment of human waste. Promote outreach, education and funding to achieve these programs. Include outreach to new homeowners, realtors, etc.

  Partners: East Shore Planning Group, Interagency Group, Department of Health Services, Marin County, Regional Water Quality Control Board, homeowners, Tomales Bay Watershed Council, Tomales Bay Shellfish TAC, Salmon Protection and Watershed Network, Coastal Conservancy, Village Associations

- Improve and implement upland BMPs to reduce erosion, sediment and nutrient runoff, and to reduce and control the introduction and spread of invasive non-native species.

  Partners: landowners, National Park Service, California State Parks, Marin Resource Conservation District, Natural Resource Conservation Service, Tomales Bay Agricultural Group, U.C. Cooperative Extension, State Coastal Conservancy, Marin Municipal Water District, Marin County, SPAWN, Marin Agricultural Land Trust

- Assess ecological effects of agriculture on Tomales Bay and its watershed, and support implementation of best management practices and related projects.

  Partners: Marin Resource Conservation District, Tomales Bay Agricultural Group, U.C. Cooperative Extension, Natural Resource Conservation Service, Marin County, State Coastal Conservancy, PRBO, Tomales Bay Watershed Council

- Assess ecological effects of mariculture on Tomales Bay, and support implementation of BMPs and related projects.

  Partners: Department of Health Services, California Department of Fish and Game, aquaculture industry, U.C. Davis Sea Grant, San Francisco State University (Romberg Tiburon Center)

- Assess ecological effects of recreational uses of Tomales Bay and its watershed, and support implementation of BMPs and related projects.

  Partners: Recreational outfitters, Point Reyes National Seashore, California State Parks, Department of Health Services, California Department of Fish and Game, Marin County, State Coastal Conservancy, Tomales Bay Watershed Council

- Assess ecological effects of non-recreational uses of Tomales Bay, and support implementation of BMPs and related projects.

  Partners: Gulf of the Farallones National Marine Sanctuary, Coast Guard, Point Reyes National Seashore, Department of Health Services, California Department of Fish and Game, Marin County, Tomales Bay Watershed Council

- Provide outreach and support to avoid future dumping of dirt into streams and wetlands along roads during county, state, federal and private road maintenance activities; and develop BMPs.

  Partners: Tomales Bay Watershed Council, CalTrans, National Park Service, landowners, Marin County, Pacific Gas & Electric Co., landscapers, construction workers, Salmon Protection and Watershed Network

- Support additional funding for local organizations and agencies (e.g. Marin RCD, SPAWN, PRNS, TBA, Marin County, Trout Unlimited, and others) to implement projects consistent with the Council's water quality and habitat goals and objectives.

  Partners: Tomales Bay Watershed Council and its member organizations and watershed partners

- Develop and support enforcement of grading standards that better protect Tomales Bay.

  Partners: Marin County (Department of Public Works, Building Department), CalTrans, Regional Water Quality Control Board

- Support educational efforts targeting road owners and managers about design, maintenance and management of roads to protect water quality. Educate homeowners, contractors and public agencies about erosion control and stream crossings.

  Partners: Tomales Bay Watershed Council, CalTrans, Marin County (Dept. of Public Works), property owners, Marin Municipal Water District, Salmon Protection and Watershed Network, Point Reyes National Seashore, Association of Bay Area Governments

- Support County and State funding for a USDA Conservation Reserve Enhancement Program (CREP) to provide conservation easements for riparian area enhancement.

  Partners: Natural Resources Conservation Service, Tomales Bay Shellfish TAC, State Coastal Conservancy, Tomales Bay Watershed Council

- Support programs to promote sustainable farming (e.g. the California Dairy Quality Assurance Program, Salmon Safe and Fish Friendly Farming).

  Partners: Marin Resource Conservation District, U.C. Cooperative Extension, State Coastal Conservancy, Tomales Bay Agricultural Group, Tomales Bay Watershed Council

- Provide outreach to landowners and public agencies about importance of road construction and maintenance to minimize changes in natural runoff patterns. Support funding for improved road management.

  Partners: Marin Resource Conservation District, County of Marin (Dept. of Public Works, Planning Dept.), CalTrans, Marin Municipal Water District, National Park Service, Natural Resources Conservation Service, Salmon Protection and Watershed Network

- Implement stream crossing best management and construction practices using hydrologic inventories and prioritization. Replace or maintain culverts to benefit salmonids, streams and wetlands.

  Partners: National Park Service, CalTrans, landowners, Marin County, State Coastal Conservancy, Salmon Protection and Watershed Network

II. Medium and long-term activities to reduce non-point sources of pollution and to improve aquatic habitats:

- Reassess and evaluate effectiveness of BMPs and projects implemented. Adapt priorities and recommendations based on this reassessment.

  Partners: Tomales Bay Watershed Council

- Develop a management plan for recreational uses in the Tomales Bay watershed that impact water quality. Support implementation of these practices and related projects.

  Partners: Point Reyes National Seashore, California State Parks, Marin County, Tomales Bay Watershed Council, recreational users

- Reduce water quality impacts of boating on Tomales Bay. Support implementation of these practices and related projects.

  Partners: Recreational users and outfitters, U.S. Coast Guard, California Department of Fish and Game, Gulf of the Farallones National Marine Sanctuary, California Coastal Commission, Marin County, National Park Service.

- Manage water quality impacts of mariculture on Tomales Bay. Support implementation of these practices and related projects.

  Partners: Mariculturists, California Department of Fish and Game, Department of Health Services, Regional Water Quality Control Board, Gulf of the Farallones National Marine Sanctuary, U.C. Cooperative Extension

- Identify regulatory agencies with jurisdiction in Tomales Bay and the watershed. Develop a watershed directory which includes contact information for relevant agencies and organizations.

  Partners: Tomales Bay Watershed Council, Strategies Committee

- Promote interagency coordination for efficient issuance of environmental restoration permits.

  Lead: Marin Resource Conservation District

  Partners: Council, Marin County, Sustainable Conservation, Natural Resource Conservation Service, State Coastal Conservancy, JARPA

Associated cost estimates:

Fencing $4.50/linear foot
Construction of livestock water access $5,000-$10,000 each, includes design
Stream crossings (not including bridges) $5,000-$8,000 each
Rock headcut repair $120/ton placed
Willow wall for stream bank stabilization $110/linear foot
Brush mattress for streambank stabilization $135/linear foot

These activities will be successful if they achieve these results. Specific criteria will be developed on a project basis:

1. Increased support and capacity for implementation of BMPs on private and public lands in the watershed.
2. Measurable improvements in water quality in Tomales Bay and tributary streams.
3. Measurable improvements in the health of terrestrial and aquatic habitats in Tomales Bay and its watershed.
4. Population growth in diminished native species.
5. Improved management and containment of invasive, non-native species.

Action 3.0 Assess, protect and restore key habitats for species of local interest.

Some species that are resident of or migratory through the Tomales Bay watershed are of particular local interest, though no comprehensive list of such species currently exists. Such a list might include native and non-native species, state and federally listed species, and species that are indicators of ecosystem health. In order to increase our understanding of the current condition and trends in the bay and watershed, such a list will be developed to provide a framework for monitoring fluctuations in these local populations.

According to a recent report by the CDFG, exotic species, habitat destruction and fragmentation are the largest threats to the survival of endangered species (California's Living Marine Resources: A Status Report, 2001). During the last two decades, projects on private and public lands to address habitat loss and degradation have lead to significant watershed benefits that include successfully reducing erosion rates and sedimentation of streams in parts of the watershed; neotropical migratory bird habitat enhancement; and increases in streamflows and aquatic habitat quality in lower Lagunitas Creek watershed.

Although some habitats in the Tomales Bay watershed are relatively healthy, many have been seriously compromised and need to be restored. For example, the construction of large dams and reservoirs in the Lagunitas and Walker Creek watersheds has resulted in the loss of more than half of their historic spawning grounds for coho salmon and steelhead trout. Development, sedimentation, and destruction of riparian vegetation threaten what remains. Overall, little is known about the extent and distribution of invasive exotic species in the Tomales Bay watershed; however, some species or groups of organisms (e.g. rangeland plants) have been surveyed and efforts are underway to reduce their distribution and to improve containment.

Today, more than 30 threatened and endangered species inhabit or migrate through the Tomales Bay watershed. It is estimated that over 10% of the annual wild coho salmon remaining in central California coastal watersheds use Lagunitas Creek and tributary streams for spawning and rearing, and local populations of the endangered red-legged frog are relatively strong. Walker Creek watershed supports steelhead trout and freshwater shrimp; however we do not know the size or significance of these populations. In addition, more than 600 native and endemic plant species have been identified on the Point Reyes Peninsula. Important populations of neotropical migratory birds also exist locally in riparian and coast scrub habitats. Future assessments will be necessary to guide and evaluate habitat enhancement activities. A list of assessment recommendations is included in Appendix B: Erosion and Sedimentation in the Tomales Bay as a starting point for future discussion about habitat assessment priorities.

Voluntary protection of habitats on private and public lands has been critical in maintaining the diversity of the Tomales Bay watershed. Habitat restoration has been supported by local agencies using public funding to match the investments of private landowners. The policies in the Marin Countywide Plan and the Local Coastal Program have also supported the preservation of habitats and open space. As a result, significant restoration work has been

completed on private and public lands, and habitat improvement is being monitored. If these efforts are to continue, they will need the continuing financial and technical support of regulatory agencies and other organizations as well as political support within local communities. Habitat restoration should not only protect dependent species, but also maintain open spaces and protect critically sensitive areas for the overall health and function of the watershed. These recommendations are intended to define actions and programs the Council can implement or support to protect the Tomales Bay ecosystem.

Purpose:

- Benefit local species, including: endemic, threatened and endangered species, and other species of special concern.
- Increase knowledge of local biodiversity and habitat needs to better manage and protect these species, and to improve understanding of locally extirpated species,
- Support habitat conservation on private and public lands, and the implementation of sustainable management practices.
- Monitor existing habitats and populations.
- Monitor invasive, non-native species to guide management and containment.
- Support inventories, continued and needed research for species of local concern to assess and document biodiversity and habitats within the watershed.

I. High priority, short-term activities to develop a habitats and species database.

Lead:

In coordination with local scientists, the Tomales Bay Watershed Council will facilitate the creation of a program to collect, synthesize, analyze and guide and coordinate habitat assessment and restoration activities in the watershed.

Core group of program partners:

Point Reyes National Seashore, PRBO Conservation Science, Audubon Canyon Ranch, NOAA Fisheries, California Department of Fish and Game, State Coastal Conservancy, U.C. Davis and Extension, Bodega Marine Laboratory, U.S. Fish and Wildlife Service, S.F State University (Romberg Tiburon Center), Marin Conservation League, California State Parks, Marin Municipal Water District, Marin Resource Conservation District, Natural Resource Conservation Service, Salmon Protection and Watershed Network, Regional Water Quality Control Board, Gulf of the Farallones National Marine Sanctuary, local non governmental organizations and scientists.

- ***List:*** Develop criteria and create a list species of local interest.
  Cost estimate: $5,000

- ***Database:*** Facilitate consolidation of existing information on distribution and abundance of species of local interest in the watershed. Support development of a coordinated database and clearinghouse for this information with other partners.
  Cost estimate: $40,000

- ***Inventory and Map:*** Coordinate inventories and mapping of distribution and extent of key habitat types. Consolidate existing data and information. Identify inventory needs.

  Cost estimate: to be determined in 2004.

- ***Invasive Exotic Species:*** Describe distribution and abundance of priority invasive non-native species. Consult the California Exotic Pest Plant Council and the Native Plant Society in developing this program. Prioritize containment and control of invasive non-native species, and implement management practices and monitor to evaluate effectiveness.

  Additional partners: Core group above and the Agricultural Commissioner's office, Marin County, Marin Agricultural Land Trust, and State Coastal Conservancy.

  Cost estimate: to be determined 2004.

II. High priority, on-going activities to benefit habitat conservation and enhancement:

- Restore salmonid habitat and remove barriers to migration. Assess condition of salmonid and freshwater shrimp habitats. Specifically, identify limiting factors for salmonids and freshwater shrimp populations in Lagunitas Creek and analyze the limiting factors for salmonids in Walker Creek and other tributaries with historic runs.

  Lead: Marin Municipal Water District or Marin Resource Conservation District or Tomales Bay Watershed Council

  Partners: Point Reyes National Seashore, Salmon Protection and Watershed Network, Regional Water Quality Control Board, California Department of Fish and Game, State Coastal Conservancy, Marin County, Trout Unlimited, Tomales Bay Association, private landowners and others

  Schedule: 2 years for each study

  Cost estimate: $150,000 - $300,000 each

- Support inventories and other studies of species of local interest and habitat assessments to identify habitat function, enhancement priorities and limiting factors.

  Partners: Tomales Bay Watershed Council and core group

- Help landowners to protect and enhance riparian and wetland habitats. Promote and assist in coordination of all types of voluntary restoration efforts and projects.

  Partners: Tomales Bay Watershed Council and core group

- Provide incentives and support for habitat protection and enhancement.

  Partners: The core group

- Assure that regulated water releases by agencies and other entities with impoundments in the watershed are sufficient to sustain downstream cold water aquatic communities.
  Partners: The core group

- Assess current water flow conditions and develop a plan to increase water flows if necessary to restore key habitats.
  Partners: The core group

III. Medium and long-term activities to benefit habitat conservation and enhancement:

- Ensure optimal streamflow to sustain native aquatic communities through water conservation and range management where feasible.
  Partners: The core group and private landowners

- Ensure optimal streamflow patterns to sustain native aquatic communities by limiting the impacts of development (e.g. residential, commercial, public works and water) where feasible.
  Partners: The core group and local organizations (e.g. Marin Agricultural Land Trust, Inverness Public Utilities District, etc.)

- Support funding for wetland protection and conservation easements on public and private lands.
  Partners: Marin Agricultural Land Trust, Natural Resources Conservation Service, Marin Resource Conservation District, California Department of Fish and Game, State Coastal Conservancy, Nature Conservancy, Audubon Canyon Ranch, U.S. National Park Service, State Parks, Trust for Public Lands, Marin County Open Space District, Environmental Action Committee of West Marin, landowners, and other local organizations

- Identify policies that can be added to the Marin Countywide Plan that would include but not be limited to:
  1. limiting the size of new residential structures by requiring that they fit current scale and size of existing structures in residential areas;
  2. focusing development within current town boundaries;
  3. preserving viewsheds;
  4. protecting our natural resources;
  5. discouraging fragmentation of agricultural lands;
  6. supporting mariculture; and
  7. supporting programs to keep large agricultural parcels intact.

  Lead: Tomales Bay Watershed Council via the Strategies Committee
  Partners: Marin County, village associations, local organizations

- Support policies that protect open space and agricultural land uses that are consistent with and contribute to watershed goals.

  Partners: Marin Agricultural Land Trust, Marin County, village associations, Environmental Action Committee of West Marin, Salmon Protection and Watershed Network, Tomales Bay Watershed Council

- Support land uses that are consistent with and contribute to watershed goals.

  Partners: Marin County, village associations, Environmental Action Committee of West Marin, Council, Salmon Protection and Watershed Network, state and federal agencies

- Survey conservation programs, priorities and funding needs of land conservation entities in the watershed. Develop recommendations regarding gaps in land conservation efforts and comprehensive funding needs in the watershed to ensure that important watershed habitats are being protected. Promote agency and NGO cooperation to increase efficiency.

  Lead: Tomales Bay Watershed Committee - Strategies Committee

  Partners: Marin Agricultural Land Trust, Audubon Canyon Ranch, Parks, PRBO, State and Federal agencies, California Department of Fish and Game/Wildlife Conservation Board, Marin County Open Space District

- Protect unique habitats such as Tomales Dunes, coastal prairie and coastal scrub.

  Partners: Landowners, Environmental Action Committee of West Marin, Natural Resources Conservation Service, Audubon Canyon Ranch, National Park Service, Trust for Public Lands, State Coastal Conservancy, PRBO, Tomales Bay Association, Marin County

- Protect and enhance native oak woodlands and other hardwood forests, and encourage restoration through outreach and support to private landowners.

  Partners: landowners, National Park Service, California State Parks, State Coastal Conservancy, Pacific Gas & Electric Co., Natural Resources Conservation Service, U.C. Cooperative Extension

- Protect and promote restoration of proper functioning and hydrology of streams and floodplains.

  Partners: Point Reyes National Seashore, Marin County, California Coastal Commission, California Department of Fish and Game, NOAA Fisheries, landowners, CalTrans, Salmon Protection and Watershed Network, Coastal Conservancy, Audubon Canyon Ranch, Environmental Action Committee of West Marin, Marin Resource Conservation District, Natural Resources Conservation Service

- Evaluate and optimize tidal circulation in leveed marshes.

  Partners: National Park Service, State Lands Commission, landowners, Gulf of the Farallones National Marine Sanctuary, Audubon Canyon Ranch, California State Parks, California Department of Fish and Game

These activities will be successful if they achieve these results. Specific criteria will be developed on a project basis:

1. Practical understanding of existing habitats within the Tomales Bay watershed.
2. Practical understanding of distribution and abundance of local species of interest.
3. Practical understanding of distribution and abundance of invasive non-native species.
4. Measurable terrestrial and aquatic habitat improvements on public and private lands, and within Tomales Bay and tributary streams.
5. Demonstrable improving trends in habitat and species diversities in the Tomales Bay watershed.
6. Demonstrable reduction in weed cover on range and grasslands in the watershed.
7. Development of strategies to restore and protect habitat diversity in Tomales Bay and the watershed.
8. Recommendations for prioritized habitat restoration and enhancement projects including potential funding sources.

Action 4.0 Promote and support public outreach and education about Tomales Bay and its watershed.

The Tomales Bay watershed comprises a diverse community of private and public landowners, villages and residents from the slopes of Mount Tamalpais to the town of Tomales and eastward to Chileno Valley. By working together with an expanded sense of community, we can protect the aquatic and terrestrial habitats that are essential to Tomales Bay as well as preserving the culture and heritage of the region. An aggressive public outreach and educational program directed at residents and visitors to the watershed will be essential to the reduction of the impacts of ever-intensifying patterns of usage.

Action 4 calls for the involvement of all residents and users of the watershed to take an active role in the realization of the Plan's goals. Local communities and the public in general must be given every opportunity to support the implementation of this Plan though participation in programs, and through media events that reach out to all interest groups.

Purpose:

- Encourage public awareness and participation in developing and implementing this watershed plan.
- Increase public awareness of priority watershed issues.
- Increase public awareness about efforts to reduce nonpoint source pollution.
- Increase public awareness about opportunities to support and assist with endeavors to protect the bay and watershed.
- Support watershed education in local schools.
- Promote volunteer efforts.
- Promote watershed stewardship.

Lead:

The Tomales Bay Watershed Council, via its Outreach Committee, will be the lead to undertake the high priority, short-term activities.

I. High priority, short-term activities to increase public awareness and involvement in watershed stewardship.

- Seek public input on future amendments to the Tomales Bay Watershed Stewardship Plan.
  Partners: Tomales Bay Watershed Council member organizations and watershed partners

- Enhance existing Council website and expand links to other local sites.
  Partners: Tomales Bay Watershed Council member organizations and watershed partners

- Submit periodic articles to local newspapers and give interviews to radio stations. Promote outreach efforts in Spanish.

  Partners: Tomales Bay Watershed Council member organizations and watershed partners

- Facilitate information sharing about Tomales Bay and the surrounding watershed by sponsoring regular "State of the Bay" conferences, and create a repository for proceedings.

  Partners: U. C. Davis, Sea Grant Marine Advisor

- Support outreach efforts to private landowners regarding incentive programs to reduce non-point source water pollution and habitat fragmentation.

  Partners: Marin Resource Conservation District, Marin County, Natural Resource Conservation Service, Salmon Protection and Watershed Network, Sierra Club, Gulf of the Farallones National Marine Sanctuary, State Coastal Conservancy

- Promote education and outreach to encourage responsible human recreational activities which can disturb wildlife, and dissemination of information about existing policies to protect marine mammals, shorebirds, sensitive plant communities, etc.

  Partners: Tomales Bay Watershed Council member organizations and watershed partners

- Develop an educational flyer/brochure about watershed conservation, collaborative efforts by local stakeholders, and restoration efforts to place at locations visible to the community and visitors, including: bed & breakfasts, state and national parks, inns and other commercial establishments including kayaking companies, Lawson's Landing, Miller Park, Marshall Store, oyster companies, and restaurants.

- Support project-based learning efforts such as those organized by STRAW, West Marin School, SPAWN, Adopt-A-Watershed, etc.

  Partners: Tomales Bay Watershed Council member organizations and watershed partners

- Develop and disseminate an updated bibliography of scientific literature on Tomales Bay.

  Partners: Sea Grant Marine Advisor- UC Davis, U.C.Cooperative Extension, Tomales Bay Association

- Continue an annual newsletter to be sent out to all residents in the watershed, and consider combining with local organizations' newsletters to increase visibility and readership. Post Council newsletter electronically on the Council website, and if possible on other websites.

- Develop a list of volunteer opportunities in the watershed- avenues for active engagement. Include this material in our outreach materials and website. Query local groups and agencies on their volunteer needs and programs.

II. Medium and long-term activities to increase public awareness about watershed stewardship:

- Promote education and outreach to encourage water conservation and the importance of installing common household low-water usage appliances (e.g. low flow toilets), and use of appropriate landscaping practices (e.g. planting native, drought tolerant plants).
  Partners: Marin Municipal and North Marin Water Districts, Marin County

- Promote watershed education at schools and summer camps in West Marin.
  Partners: Tomales Bay Watershed Council, Point Reyes National Seashore Association, Students and Teachers Restoring A Watershed (STRAW), Salmon Protection and Watershed Network, Shoreline Unified School District, Lagunitas and Nicasio School Districts, school staff and science teachers, students, Gallery Route 1, State Coastal Conservancy

- Support development and dissemination of watershed-based curricula to local schools. Promote and enhance watershed education efforts at local schools.
  Partners: Tomales Bay Watershed Council, Point Reyes National Seashore Association, Tomales Bay State Park, Salmon Protection and Watershed Network, Gulf of the Farallones National Marine Sanctuary, STRAW, Shoreline Unified School District, Lagunitas and Nicasio School Districts, Gallery Route 1, Tomales Bay Association, State Coastal Conservancy

- Promote watershed educational outreach opportunities including hikes, tours, seminars, etc. Participate in and support existing efforts. Provide information on on-going volunteer opportunities with partners in the watershed (i.e. SPAWN, PRBO, MALT, Marin RCD, PRNS, Audubon Canyon Ranch, etc.)
  Partners: Tomales Bay Watershed Council, Outreach Committee

- Promote stewardship through annual land steward award.
  Partners: Environmental Action Committee of West Marin, Tomales Bay Association

- Hold tours of demonstration projects.
  Partners: Marin Resource Conservation District, Marin Agricultural Land Trust, Salmon Protection and Watershed Network, Environmental Action Committee of West Marin, Marin County

- Develop stewardship education packets.
  Partners: Marin Resource Conservation District, Natural Resource Conservation Service, Tomales Bay Watershed Council

- Develop a "coffee table" book featuring the Tomales Bay watershed.
  Partners: Tomales Bay Watershed Council - Outreach Committee, Point Reyes National Seashore, others

Cost estimate: $20,000 estimated annual budget for Council outreach activities

These activities will be successful if they achieve these results. Specific criteria will be developed on a project basis:

1. Creation and dissemination of watershed education materials to communities in West Marin using different media on a regular basis during 2002-2004.
2. Development and maintenance of a website to facilitate education and information sharing about Tomales Bay and its watershed during 2002-2004.
3. Sustained community participating and interest in the Council's watershed planning activities.

IV. ACTION PLAN IMPLEMENTATION

> *"Every Day I feel lucky to live and work here. It is only natural to want to protect Tomales Bay, its hills, streams, forests, and wildlife- and also the vitality of its communities, its small villages, and its farmlands."*
>
> -- Ellen Straus, Dairy Rancher

A. Partnerships and Collaboration

There are many different actions needed for a healthy watershed. These actions include community outreach and education about watershed stewardship, habitat restoration, political advocacy, promotion of incentive programs to support the voluntary efforts of private landowners, and regulatory enforcement. By working together through partnerships, local communities, agencies and organizations can protect and improve the health of Tomales Bay and its watershed. Through monitoring, we can increase our effectiveness and engage in adaptive management as we progress towards our goals.

The Council will support implementation of this Plan, taking on specific programs and projects that are beyond the mission or capacity of individual organizations/agencies or established partnerships. The collective resources of the members of the Council are necessary for successful and timely planning, assessment and implementation of watershed restoration activities. Working together within the Council will help ensure the most protective and cost-effective watershed enhancement efforts, and the extensive work ahead requires the support of residents and the communities in West Marin. The Council will also continue to provide a forum where programs and projects are discussed and evaluated. The Council provides a venue for the expression of concerns and ideas for the collective management of this watershed and supports any effort to achieve the Plan goals.

To facilitate improved collaboration and coordination between agencies, and to promote partnerships between with other stakeholders in the watershed in the future, the Council will:

- Work with agencies to facilitate needed communication and information dissemination between and within agencies.
- Host an annual or semi-annual meeting of agencies to evaluate progress for priority activities identified by the Council, and identify needs and gaps.
- Provide feedback/comment on planning efforts of local, state and federal agency partners as requested.
- Invite relevant agencies to present at monthly Council meetings and host community meetings as necessary.

B. Future Steps for the Tomales Bay Watershed Council

The Council is committed to continuing its activities during the next 5 years as it develops needed programs and recommendations to guide restoration, assessment and monitoring activities in the watershed. To date the Council's organizational structure has supported the development of this Plan, and during the next year the existing Council will evaluate its own structure to identify how it can best facilitate implementation of the recommendations within this Plan in the future.

1.0 Council priorities

In the future, the Council will provide necessary support to partners in the watershed to ensure meaningful and effective progress towards the Council's vision for the future. In addition, the following table summarizes the activities for which the Council is the lead, and these activities will be the Council's priorities during the next three years. The Tomales Bay watershed is a dynamic system. As issues evolve, as social, political and economic realities change, and as available funding for watershed planning and stewardship waxes and wanes, the Council will reconsider its priorities and modify its direction and focus as needed. Tomales Bay Watershed Council priorities for the next three years are captured in Table 1.

2.0 Administrative Activities

The Council will consider its future role in the Tomales Bay watershed and existing administrative needs during the next year, and will develop a strategic work plan to this end. More specifically, we wish to establish a Council that can:

- Encourage comprehensive resource planning and facilitate interagency coordination and cooperation to achieve Plan goals.
- Continually update the *Tomales Bay Watershed Stewardship Plan* with new assessment data, monitoring and restoration project reports, and recommendations for future action.
- Monitor implementation of this Plan.
- Identify opportunities to influence and support local, state and federal policies that help to achieve the Plan's goals.
- Provide a forum for stakeholders, the public, regulatory agencies and research groups to interact and facilitate implementation of TMDL plans and other programs affecting the health of the bay and watershed.
- Support activities of local agencies and organizations to implement projects and programs to reduce the impacts human activities on the watershed and bay.
- Encourage interaction between stakeholders
- Facilitate volunteer programs to assist with research, restoration and monitoring projects.
- Promote understanding of Tomales Bay and its watershed through outreach and education.

Table 1. Tomales Bay Watershed Council Priorities 2003-2005

Activity	*Timeline*
1. Undertake Action 1, the development of a water quality monitoring plan for Tomales Bay and tributary streams.	Begin Sept. 2003, Plan due Dec. 2004*****
2. Develop a salmonid assessment and restoration priorities report for the Tomales Bay watershed, including criteria for salmonid restoration project selection.	Due December 2003*****
3. Work with lead agencies on 3-5 high priority activities in the Action Plan, and facilitate needed action by these parties.	Due December 2003*****
4. Develop a Strategic Work Plan for the Council and revisit the Coordinated Resource Management Planning (CRMP) process and as an option for facilitating future programs/projects.	Due January 2004*****
5. Advise on the development and implementation of the Lagunitas Creek Watershed Improvement Program in collaboration with the Marin RCD.	On-going 2003-2006*****
6. Finalize the Draft Habitats and Species Appendices, promote public review and amend them to this Plan. Consider Marin County's Survey of Recreational Impacts on Tomales Bay for amendment to this Plan.	Due July 2004
7. Develop and distribute a summary of current activities to improve and protect water quality and habitats in the Tomales Bay watershed, including: project/program description and location, lead(s), funding, timeline, etc. Update this list annually.	Due July 2004
8. Support implementation of the Pathogen TMDL for Tomales Bay by disseminating information to watershed stakeholders and hosting community meetings.	On-going 2003-2005
9. Undertake education and outreach activities specified in Action 4.	On-going 2003-2005*****
10. Host a State-of-the-Bay Conference	2005

****Note:*** *The above activities with an asterisk by the due dates are partially or entirely funded by grant awards received from California Department of Fish and Game, State Water Resources Control Board (Prop. 13 Program), and Marin Community Foundation. Project due dates are established in each of the respective contracts.*

I. High priority, short-term activities for the Council to undertake in development of a strategic plan. See reference year following each step.

- Define capacity and structural needs of the Council for facilitation of Plan implementation. Determine future organizational structure, membership, staffing needs, funding, operating rules and procedures, etc. needed to sustain the Council for 5 years. Identify the issues that must be addressed for the Council to remain a vital stewardship organization for Tomales Bay planning and protection activities. (2003)

  Lead: Tomales Bay Watershed Council and committees

  Partners: federal/state/local agencies, local non-governmental organizations, community members

- Define roles and responsibilities of Council members and other stakeholders related to Plan implementation. Consider spectrum of activities that include technical advising, financial contributions, organizational support, political networking, etc. (2003)

  Lead: Tomales Bay Watershed Council and committees

  Partners: federal/state/local agencies, local organizations, community members

- Develop a budget and funding strategy to support the Council and Plan implementation considering high priority short-term actions proposed in this Watershed Stewardship Plan. Consider internal capacity to acquire funding for basic administrative and organizational needs from member agencies and organizations; foundations for long-term and programmatic support, and grant opportunities for projects. (2003)

  Lead: Tomales Bay Watershed Council - Executive and Funding Committees and fund-raising experts

- Define a regular meeting schedule that members and participants support to facilitate collaboration between stakeholders, information sharing and opportunities for public involvement in the planning process. Authorize and monitor action-oriented committees to carry out the Action Plan between these meetings. (2003)

  Lead: Tomales Bay Watershed Council - Executive Committee

II. Medium priority, medium-term activities

- Amend this Watershed Stewardship Plan. Expand existing appendices with data analysis, assessment and project information, etc. Revisit and revise as needed priority recommendations. Include a process to adapt management recommendations based on the results of monitoring activities (2003-2005).

  Lead: Tomales Bay Watershed Council and committees

- Consider regional issues and other models for watershed planning. Invite planning experts to address Council on regional issues, projected growth and development, and related impacts. Include national and state parks, Association of Bay Area Governments, Marin County, local academic institutions, the State Coastal Conservancy, California Coastal Commission. Review the effectiveness of watershed planning efforts elsewhere and invite experts to address the Council regarding these programs. Involve the State Coastal Conservancy, Morro Bay and/or Tillamook National Estuary Projects, U.S. EPA, Monterey Bay Water Quality Protection Program, and others as determined. (2003-2004)
  Lead: Tomales Bay Watershed Council - Strategies Committee

- Identify and review existing laws, zoning, policies and regulations as they relate to Plan goals to assure their appropriateness and effectiveness. Identify gaps or needs within the existing framework. Develop recommendations for revision on an as needed basis.
  Lead: Tomales Bay Watershed Council - Strategies Committee

These activities will be successful if they achieve these results. Specific criteria will be developed on a project basis:

1. Significant enhancement of the Council's structural, programmatic and financial capacities.
2. Annual progress towards implementation of the recommendations in the Watershed Stewardship Plan.
3. Sustained collaboration and networking among watershed stakeholders.

APPENDIX F

References

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Many of the references mentioned in this document are available free of charge through the Klamath Resource Information System (KRIS). The Klamath Resource Information System is a watershed based resource which pulls together information on fisheries and water quality. The information is available as PDF or HTML files on the web or distributed on CD. The KRIS West Marin-Sonoma project covers many of the watersheds and resources described in this document. To access the KRIS West Marin-Sonoma project visit http://www.krisweb.com.

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ESTERO AMERICANO

For more information on the Estero Americano or to locate the references listed below contact the following:

Gold Ridge Resource Conservation District
20 Barlow Lane
Sebastopol, Ca 95472
Phone: (707) 823-4662

National Resources Conservation Service
Petaluma Service Center
1301 Redwood Way, Suite 170
Petaluma, CA 94954
Phone: (707) 664-8593

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STEMPLE CREEK/ESTERO DE SAN ANTONIO WATERSHED

For more information on the Stemple Creek/Estero de San Antonio watershed or to locate the references listed below contact the following:

Marin County Resource Conservation District
P.O Box 1146
Point Reyes Station, CA 94956
Phone: (415) 663-1170

National Resources Conservation Service
Petaluma Service Center
1301 Redwood Way, Suite 170
Petaluma, CA 94954
Phone: (707) 664-8593

Southern Sonoma County Resource Conservation District
1301 Redwood Way, #170
Petaluma, CA 94954
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TOMALES BAY

For more information on the Tomales Bay watershed including the east and west shore tributaries or to locate the references listed below contact the following:

Audubon Canyon Ranch
Cypress Grove Research Center
Post Office Box 808
Marshall, CA 94940
Phone: (415) 663-8203

Marin County Resource Conservation District
P.O Box 1146
Point Reyes Station, CA 94956
Phone: (415) 663-1170

Tomales Bay Watershed Council
P. O. Box 447
Point Reyes Station, CA 94956
Phone: (415) 663-9092

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WALKER CREEK WATERSHED

For more information on the Walker Creek watershed or to locate the references listed below contact the following:

Marin County Resource Conservation District
P.O Box 1146
Point Reyes Station, CA 94956
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Marin Municipal Water District
220 Nellen Avenue
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Tomales Bay Watershed Council
P. O. Box 447
Point Reyes Station, CA 94956
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National Resources Conservation Service
Petaluma Service Center
1301 Redwood Way, Suite 170
Petaluma, CA 94954
Phone: (707) 664-8593

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STAFFORD LAKE WATERSHED

For more information on the Stafford Lake watershed contact the following:

North Marin Water District
999 Rush Creek Place
Novato, CA 94948
Phone: (415) 897-4133

REFERENCES

No references specific to this watershed have been identified.

LAGUNITAS CREEK WATERSHED

For more information on the Lagunitas Creek watershed or to locate the references listed below contact the following:

Marin Municipal Water District
220 Nellen Avenue
Corte Madera, CA 94925
Phone: (415) 945-1455

Marin County Resource Conservation District
P.O Box 1146
Point Reyes Station, CA 94956
Phone: (415) 663-1170

Tomales Bay Watershed Council
P. O. Box 447
Point Reyes Station, CA 94956
Phone: (415) 663-9092

National Park Service
Point Reyes National Seashore
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BOLINAS LAGOON WATERSHED

For more information on the Bolinas Lagoon watershed or to locate the references listed below contact the following:

Audubon Canyon Ranch
Bolinas Lagoon Preserve
4900 Highway One
Stinson Beach, CA 94970
Phone: (415) 868-9244

Marin County Open Space District
3501 Civic Center Dr., Rm. 415
San Rafael, CA 94904
Phone: (415) 499-7000

Mount Tamalpais State Park
801 Panoramic Highway
Mill Valley, CA 94941
Phone: (415) 388-2070

National Park Service
Golden Gate National Recreation Area
Fort Mason Building 201
San Francisco, CA 94123
Phone: (415) 561-4700

National Park Service
Point Reyes National Seashore
Point Reyes, CA 94956
Phone: (415) 464-5100

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Williams, P. and C.K. Cuffe. 1994. The Management Implications of the Potential for Closure of Bolinas Lagoon. Shore & Beach.

WEBB CREEK WATERSHED (STEEP RAVINE)

For more information on the Webb Creek watershed contact the following:

National Park Service
Golden Gate National Recreation Area
Fort Mason Building 201
San Francisco, CA 94123
Phone: (415) 561-4700

Mount Tamalpais State Park
801 Panoramic Highway
Mill Valley, CA 94941
Phone: (415) 388-2070

REFERENCES

No references specific to these watersheds have been identified.

LONE TREE CREEK AND COLD STREAM WATERSHEDS

For more information on Lone Tree Creek and Cold Stream watersheds contact the following:

National Park Service
Golden Gate National Recreation Area
Fort Mason Building 201
San Francisco, CA 94123
Phone: (415) 561-4700

REFERENCES

Moss Landing Marine Laboratories. 1996. Highway One--Lone Tree Slide Marine Environmental Monitoring Program, Moss Landing Marine Laboratories, Report to Caltrans.

REDWOOD CREEK WATERSHED

For more information on the Redwood Creek watershed or to locate the references listed below contact the following:

Marin Municipal Water District
220 Nellen Avenue
Corte Madera, CA 94925
Phone: (415) 945-1455

Mount Tamalpais State Park
801 Panoramic Highway
Mill Valley, CA 94941
Phone: (415) 388-2070

National Park Service
Golden Gate National Recreation Area
Fort Mason Building 201
San Francisco, CA 94123
Phone: (415) 561-4700

National Park Service
Muir Woods National Monument
Mill Valley, CA 94941
Phone: (415) 388-2596

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Smith, J.J. 1994. Abundance of Coho and Steelhead in Redwood Creek in 1994. Unpublished document prepared for the Golden Gate National Recreation Area.

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TENNESSEE VALLEY/RODEO LAGOON WATERSHEDS

For more information on the Tennessee/Rodeo Creek watershed contact the following:

National Park Service
Golden Gate National Recreation Area
Fort Mason Building 201
San Francisco, CA 94123
Phone: (415) 561-4700

REFERENCES

No references specific to this watershed have been identified.

APPENDIX 1-R

MEASURING EFFECTS OF THE COUNTYWIDE PLAN ON MARIN'S ECOLOGICAL FOOTPRINT, MARCH 2006

MARIN COUNTYWIDE PLAN

Measuring Effects of the Countywide Plan on Marin's Ecological Footprint

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March 2006

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Measuring Marin's Ecological Impact

Marin County is known for its distinctive natural setting and community support for environmental causes.

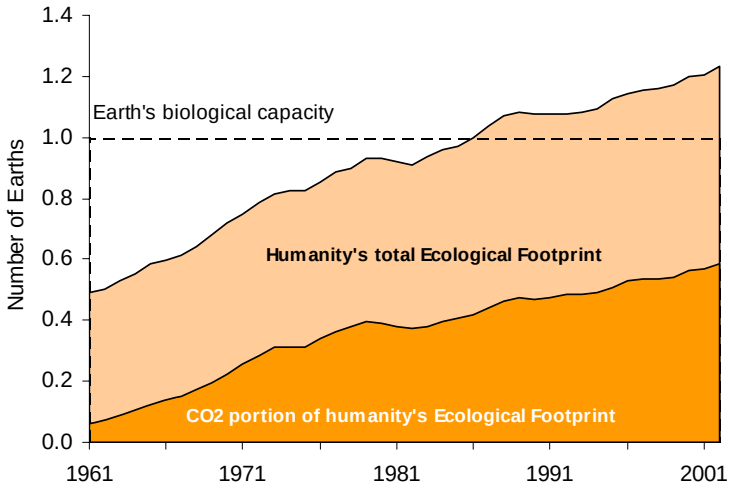
From the early efforts of the Marin Open Space District to the county's current membership in the Cities for Climate Protection Campaign, Marin's long history of conservation and environmentally-aware planning and development has served as a model for cities and counties throughout the Bay Area and the nation.

Continuing in this tradition, the current update to Marin's Countywide Plan adopts sustainability as a guiding principle, and offers programs and targets that provide a solid foundation for continuing the transition towards sustainable development in Marin County.

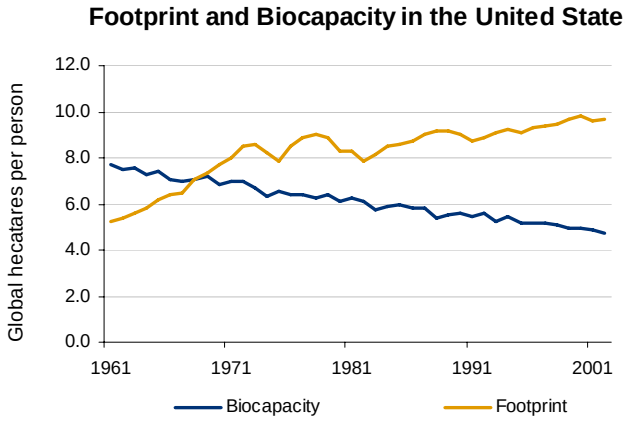
To what extent will successful implementation of these programs and targets and actually reduce Marin's demand on ecosystems? One way to answer this question is to evaluate how consumption of ecological resources and services will change, using a measure known as the Ecological Footprint.

What is the Ecological Footprint?

There are many ways to measure our impact on nature. One of the most widely used metrics is the *Ecological Footprint*, an accounting tool first developed in the early 1990s. A Footprint measures ecological demand associated with human activities in terms of the area of biologically productive land and sea required to provide the resources being used and to absorb the wastes generated, given current technology. This area is reported in "global acres," acres adjusted to reflect world-average biological productivity.



Footprint (demand) can be compared to *biocapacity* (supply), a measure of the total biologically productive area available. Globally, the average person's Footprint is 5.4 global acres, while only 4.4 global acres are available per person. Even less would be available if some of this area was left for the use of wild species.



Global "overshoot" - humanity's Footprint exceeding world biocapacity - began in the mid-1980s and has been growing steadily since. Now at 23%, overshoot is possible in the short-term by harvesting more resources than nature can replace each year or by allowing wastes, such as carbon dioxide (CO2), to accumulate in the biosphere. If overshoot continues, ecosystems become depleted and are at risk of collapse.

In the United States today, the average Footprint per person is more than twice the domestic biocapacity available per person. The Footprint has increased steadily over the past 40 years, largely due to increased use of energy and associated emissions of carbon dioxide (the energy Footprint is discussed in more detail on page 4). At the same time the biocapacity available per person in the U.S. has decreased, primarily because of population growth.

Today, over 24 global acres are needed to support the consumption of the average U.S. resident; if everyone on the globe were to consume at this level, we would need more than five planets.

Marin County's Ecological Footprint

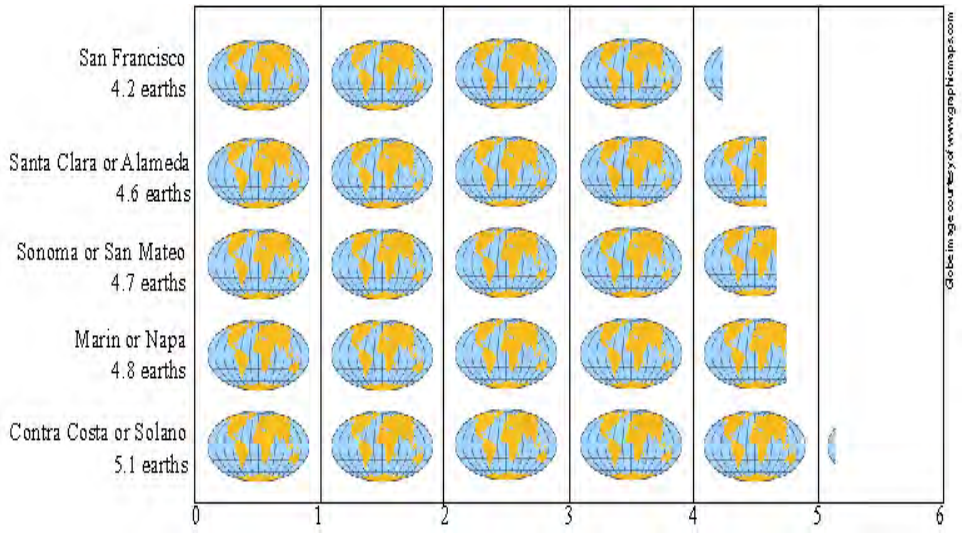
In 2001 Marin County became one of the first municipalities to calculate its Ecological Footprint, which measured at 27 global acres per person, slightly higher than that of the average American and more than double that of many industrialized European countries. How do countries like France, Germany and Italy achieve their high standards of living with significantly lower demands on ecosystems?

To some extent, people in these countries simply consume less than U.S. residents. The average resident of France, for example, uses 1.3 global acres of timber land each year for everything from telephone poles to wood furniture to the daily newspaper. The average resident of the United States uses 3.2 global acres of timber land to provide these same types of products.

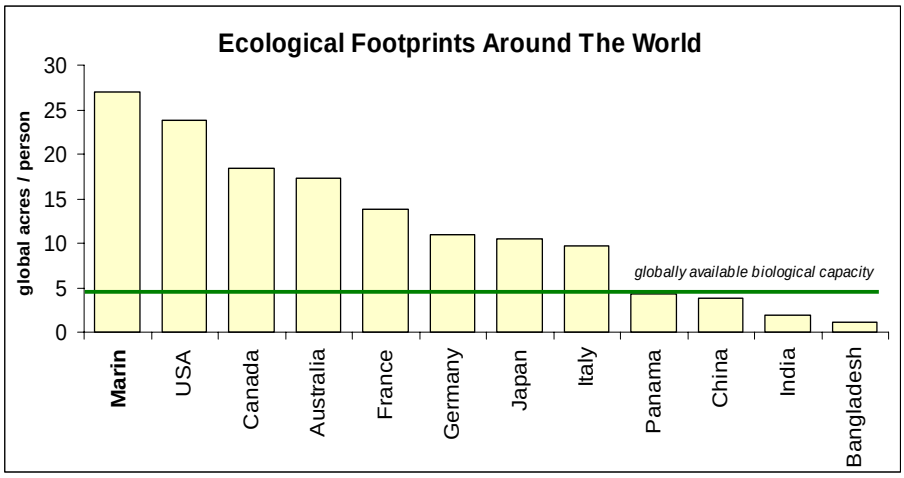
While much of a person's Footprint is determined by individual decisions and activities, a significant portion also depends on the consumption patterns of the country they live in. County, state, and federal government activities - providing education, health and military services, for example - require the use of resources, and these are reflected in the Ecological Footprint of every Marin resident. Individual decisions, such as how fuel efficient a car to buy, influence the size of one's Footprint, as do collective decisions, such as whether transportation funds are used to build highways or bike lanes.

By calling for county-wide programs that will encourage both individual and collective Footprint savings, Marin's Countywide Plan exemplifies the type of actions that will be necessary if we are to reduce global overshoot and achieve a prosperous and ecologically sustainable future

Figure ## Number of Earths that would be required if everyone had the Footprint of a County in the Bay Area



Source: Regional Progress Report, Redefining Progress



Sources: Redefining Progress, Sustainable Sonoma County, World Wide Fund for Nature

Greenhouse Gas

Human activities powered by fossil fuels such as coal, oil, and natural gas cause the waste product carbon dioxide (CO_2) to be released into the air. By far, the largest contributors to these emissions both worldwide and in Marin County are vehicle traffic and energy use in buildings.

Some of these emissions are absorbed by the oceans. The energy Footprint is the area of forest land required to absorb the remaining CO_2 emissions if they are not to accumulate in the atmosphere. Energy land is the single largest component of the Ecological Footprint in most industrialized countries, including the United States.

Marin has already taken steps towards decreasing its energy Footprint, including joining the Cities for Climate Protection Campaign (CCP), and completing a comprehensive study on local sources of carbon dioxide emissions and the potentials for reduction. The Countywide Plan sets a target of reducing carbon dioxide emissions by 15-20% by the year 2015.

Climate and Carbon

- Humanity's single largest demand on ecosystems comes from emissions of carbon dioxide.
- Globally, humanity's energy Footprint grew 700% in the past 40 years.
- The area required to sequester Marin residents' CO_2 emissions makes up 62% of the county's total Footprint.
- Energy use in buildings is responsible for 44% of Marin's greenhouse gas emissions. 53% comes from transportation.
- In the year 2000, Marin County emitted over 2.6 million tons of carbon dioxide.
- Marin County has a total energy Footprint of 1.6 million global acres.

One ton of carbon dioxide has a Footprint of 0.67 global acres, the amount of land area required to sequester one ton of this greenhouse gas each year. Marin County's energy land Footprint, for the energy used in transportation and buildings, is 1.6 million global acres. A 20% reduction in this total Footprint would produce a savings of 320,000 global acres.

Programs to Reduce Carbon Dioxide Footprint

Many different types of activities and programs can reduce Marin's carbon dioxide emissions. The most important ways to reduce emissions are through (1) changes in transportation patterns and (2) energy efficiency and conservation in buildings, both commercial and residential. Actions focused specifically on carbon dioxide and other greenhouse gas emissions can be found in programs in the Atmosphere and Climate section of the Countywide Plan.

Programs and policies that call for more specific activities that can have an impact on carbon dioxide emissions are described in the TRANSPORTATION and ELECTRICITY pages in this report. Important transportation-related policies include TR-1 through TR-4. Significant energy reductions can be realized through policies EN-1 through EN-3in the Energy and Green Buildings sections.

From Here to There

- Marin residents drive over 2 billion miles each year.
- Transportation is responsible for more than half of Marin's greenhouse gas emissions.
- The average gasoline car in Marin gets 22 miles to the gallon. Increasing this by 10 mpg would save 200,000 global acres of Footprint each year.
- Nearly half of Marin residents work outside the county.
- Two-thirds of Marin commuters drive to work alone, 11% carpool, and 10% take public transit.
- Driving an average car 12,000 miles a year produces an energy Footprint of over three global acres.

Getting Around Marin County

Fossil fuel-burning vehicles contribute significantly to Marin's Ecological Footprint. In the United States, transportation accounts for approximately one third of the total energy Footprint.

The modes of transportation with the highest Footprints are air and car travel, which emit the most carbon dioxide per passenger mile. Carpooling with another person halves the Footprint of driving per person, while commuting by bus has only one-fourth the Footprint of driving alone. Walking or biking have almost zero Footprint–in addition to the health benefits!

Changing the relative use of different modes of transportation, such as driving alone, carpooling or public transit, can contribute significantly to reducing the overall Footprint of Marin. The County has set targets for decreases in the percentage of single drivers, and for doubling, by the year 2015, the number of residents who walk and bike to work. This latter change alone would save 9,000 global acres of Footprint each year.

The list below includes some of the many programs contained in the Countywide Plan that can help reduce the transportation component of Marin's Ecological Footprint.

Programs to Reduce Transportation Footprint

1) Promoting Small Scale Employment such as live/work spaces and Satellite Work Centers can reduce the total travel necessary for a worker (CD-3.a; CD-3.b).

2) An effort to Allow Mixed Use In Commercial Districts moves residents closer to their places of business, reducing commute distance and Footprint (DES-2.c).

3) Programs to Encourage Bicycling ,Support Bike Stations and Consider Attended Parking can substitute a zero Footprint mode of commuting for a fossil fuel-intensive one (TR-2.a; TR-2.c).

4) Increasing Bus Service and Providing Reduced-Cost Transit Passes can help to shift transport patterns away from private cars and towards buses. A trip driven in a car has more than four times the Footprint of the same trip in a bus (TR-3.a; TR-3.c).

5) When driving is a necessity, the County can Support Green Fuels and Encourage Zero, Partial Emission, and Low-Emission Vehicle Use to reduce the driving Footprint (TR-4.c; TR-4.d).

Powering Marin

Energy use within buildings is responsible for nearly one quarter of Marin County's total Footprint. Much of this comes from the use of electricity.

Marin has set a target of reducing total electricity consumption 20% by 2015. Part of this reduction can be accomplished by traditional conservation measures, such as adjusting the thermostat up during the summer and down in the winter.

Increasing efficiency can also reduce energy consumption dramatically, often without decreasing comfort or quality of life. Compact fluorescent light bulbs (CFLs), for example, provide the same amount of light as incandescent bulbs with only one quarter the electricity consumption.

In addition to the quantity of electricity used, the way electricity is generated can dramatically change the total Footprint of electricity consumption. Coal plants produce electricity with the highest Footprint, followed by natural gas. Renewable sources of electricity such as solar, wind, small-scale hydroelectric, or geothermal have nearly zero energy Footprint.

Electricity Use

- Marin can decrease its energy Footprint through conservation and efficiency as well as by using renewable sources of electricity.
- Reducing total energy consumption 20% by 2015 would save 400,000 global acres in that year alone.
- 15% of Marin County's electricity comes from renewable sources - the rest is generated by fossil fuel and nuclear plants.
- Electricity from coal plants has a Footprint of 3.4 global acres per megawatt hour.
- Natural gas electricity has a Footprint one quarter of that from coal.
- Meeting just Marin's targets for renewable energy in 2015 would save 590,000 global acres of Footprint.

The Countywide Plan has targets that aim to increase the percentage of Marin's electricity generated by renewable sources to 25% by the year 2010, and to 40% by 2015.

Programs to Reduce Electricity Footprint

1) Programs to Adopt Energy Efficiency Standards for New and Remodeled Buildings and Require Green Building Practices will decrease electricity use in buildings (EN-1.b; EN-3.a; EN-3.b).
2) Because pumping and treating water for Marin County is very energy intensive, programs that Support and Integrate Water Conservation Efforts and Minimize the Demand for Water in New Development can also result in large savings in electricity (PFS-2.a; PFS-2.b).
3) The growth of renewable energy resources will be promoted by Marin's programs to Provide Incentives for Alternative Energy Production and Use Renewable Energy in County Facilities (EN-2.e; EN-2.f).
4) The Countywide Plan requires Marin County to Establish a Permanent Sustainable Energy Planning Process, a commitment that will help to ensure that energy savings from other programs are realized and carried forward into the future (EN-1.a).

Trash and Recycling

- In 2002, Marin County generated 410,000 tons of waste.
- Marin County has one of the highest rates of waste diversion in all of California (71%).
- One ton of virgin paper has a Footprint as high as 4.4 global acres.
- A ton of recycled paper can have a Footprint as low as 0.9 global acres.
- Mining aluminum requires a particularly large amount of energy. Recycling one ton of aluminum can save 9.1 global acres of Footprint.
- A very conservative estimate suggests that the 57,000 tons of food thrown away in Marin each year has a Footprint of 68,000 global acres.

Dealing with Waste

Marin County's waste places demands on ecosystems in many different ways. Most visibly, disposing of solid waste has a Footprint associated with the physical area occupied by landfills. This area could otherwise be available for grazing, farming, or other forms of ecological productivity.

The trucks and roads needed to transport solid waste, along with the material and energy resources required to process the waste stream, have a total Footprint many times larger than the Footprint area occupied by the landfills. Decreasing the amount of waste created by individuals and businesses in Marin can reduce the magnitude of all these Footprint components.

Beyond the resources required to dispose of physical waste, waste itself represents products that are not serving human needs, but that still require ecological resources to produce. Reducing consumption by eliminating unnecessary packaging, buying durable products, reusing them where possible, and recycling them at the end of their useful life will generate Footprint savings all along the production chain, in addition to reducing the Footprint of waste processing and disposal.

Recycling in particular has an important role to play in reducing Footprint. Recycled products such as paper and cans can have a dramatically lower Footprint than these same products made from virgin materials. With one of the highest diversion rates in California, Marin has already recognized the importance of recycling, and the County has developed programs and set targets to further extend this success.

Programs to Reduce Waste Footprint

1) The program to Divert Construction Waste will require building projects to recycle or reuse a minimum of 50% of leftover or unused materials (EN-3.c).
2) An effort to Reduce Wood Waste and Encourage Reuse of Urban Lumber will specifically target the forest Footprint of Marin's buildings (DES-1.d).
3) With a program to Promote Alternative Materials and Conservation, Marin will specifically reduce the demand for mineral resources by working to optimize recycling of construction and demolition waste (MIN-1.l).
4) Marin will approach recycling most broadly through an overall commitment to Reduce Waste at Landfill by recycling, resource recovery, and composting (PFS-4.c).

Protecting the Land

Sustainability isn't only about reducing consumption and the demand it places on ecological resources. It is also about the balance between demand and supply. Managing the supply of ecological resources, through preservation and restoration, is an important part of balancing our ecological budget.

While the Ecological Footprint reflects demand on nature's resources, biocapacity is a measure of supply, nature's ability to regenerate these resources. Open space and ecosystems such as cropland, pasture, forest and fisheries differ in their ability to produce useful resources. This is taken into account in measuring their biocapacity.

An acre of cropland, for example, has a biocapacity more than twice that of the average biologically productive acre worldwide. An acre of pasture, by comparison, has a biocapacity one half that of the world average acre.

Biocapacity

- Only about 22% of Earth's total surface area is highly productive. The rest is mostly low-productivity ocean, ice caps, and deserts.
- There are 4.5 global acres of biocapacity available per person on Earth. The average per person Footprint is 5.4 global acres.
- 48% of the land area of Marin County is already in open space preserves.
- One acre of cropland, the most productive type of land, has a biocapacity of 2.2 global acres (acres with world average productivity).
- Land degradation can decrease its future biocapacity. Sustainable farming practices help ensure that cropland biocapacity does not decline over time.

Marin's biocapacity resides in its open space preserves and in its extensive agricultural lands. By the year 2015, Marin County hopes to preserve an additional 24,000 acres of land as open space, and place an additional 33,000 acres of agricultural land in easements. Biocapacity can also be found in smaller spaces, such as the urban gardens or parks noted in the Countywide Plan.

In addition to protecting land in through easements, open space, and zoning, Marin can also preserve its biocapacity by slowing activities that negatively impact ecosystem productivity. This might include measures to mitigate mining impacts and ensure adequate buffer areas.

Programs to Protect Biocapacity

1) As one of the most visible parts of Marin's ecological capacity, the commitment to Acquire and Protect Lands Pursuant to the Open Space District's Mission Statement will continue to ensure that Marin's land conservation strategy remains an example to other counties in the Bay Area (OS-2.c).
2) Protecting agricultural areas through programs to Preserve Agricultural Lands and Uses and Maintain Agriculture in the Inland Rural Corridor will help maintain Marin's agricultural biocapacity in the future (AG-1.l; CD-1.d).
3) Biocapacity isn't only found in large tracts of farm land and open spaces. Marin can also Encourage Community Gardens and Encourage Small-Scale Green Spaces to increase local biocapacity (AG-3.a; DES-3.c).
4) Programs to Preclude Mining at Ring Mountain and Mitigate Impacts associated with mining operations can help preserve the integrity of biological capacity in mining areas (MIN-1.b; MIN-1.g).

How Much Can We Save?

Marin's Countywide Plan includes many different types of programs and targets. Not all of them can be evaluated in terms of potential Footprint savings, either because they address issues, such as human health, which are not within the research domain addressed by the Footprint, or because the data required for an accurate Footprint analysis is not yet available.

For many of the programs and targets, however, Ecological Footprint analysis clearly reveals the potential power of collective and individual choice to reduce pressure on ecosystems. Meeting just the three specified targets below would reduce Marin County's Footprint by nearly 1 million global acres each year from 2015 forward.

How does this compare with the total Footprint of Marin County residents? At 27 global acres per person, the total Footprint of Marin residents is 6.7 million global acres. The potential savings approach 15% of this total Footprint.

While this reduction will not shrink the average Marin Footprint to that of Italy, it will bring it below that of the average resident of the United States. This is no small feat, considering the relatively high incomes and quality of life enjoyed by Marin County residents.

A wider perspective can help reveal the full significance of a 15% Footprint savings. Globally, human demand on nature exceeds biological capacity by just over 20%. If all high-income countries could achieve the same degree of Footprint reductions that would result from meeting just these three targets in Marin's Countywide Plan, humanity would be well on its way to eliminating global overshoot, and solving its current ecological dilemma.

1) Conserving Energy
   Marin has set a non-binding target of decreasing total electricity consumption within the county by 20% by 2015. Achieving this target would save Marin County 400,000 global acres of Footprint each year. This is an area of Footprint equivalent to more than the entire physical size of the county of Marin.

2) Shifting to Renewables
   Even if electricity use begins to decline, switching from fossil fuel to renewably generated sources of electricity would result in additional Footprint savings. Marin hopes to increase its share of renewably generated electricity to 40% by the year 2015. This shift to renewables would save an additional 470,000 global acres each year from the year 2015 onward.

3) Decreasing Transportation Impacts
   Transportation, the other major contributor to the energy Footprint, is also targeted by the Countywide Plan. Programs in the plan will increase the number of bicycle lanes and promote clustered development and live/work opportunities, all of which can allow an individual to walk or bike to work, or even avoid commuting entirely, with nearly zero Footprint. Marin's target of doubling the number of commuters who walk or bike to work would save 9, 000 global acres of Footprint each year.

APPENDIX 1-S

NOISE TECHNICAL BACKGROUND REPORT, APRIL 2002, UPDATED OCTOBER 2005

MARIN COUNTYWIDE PLAN

Noise
Technical Background Report

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I. INTRODUCTION

State law requires a Noise Element as part of all city and county General Plans. Noise Elements are required to identify noise problems in the community and work towards their resolution. The Marin County Noise Element was first adopted as part of the countywide plan in 1975. Since that time, the Noise Element has been revised once, as a part of the 1994 Countywide Plan update. As part of the update for the 1994 Noise Element, a comprehensive set of noise measurements was conducted throughout the county to provide information on the noise environment in the county at that time. The previous Noise Element update included current and projected future noise levels for major noise sources, including Highway 101 and major county roads, the heliport adjacent to Richardson Bay and the airport at Gnoss Field. The Noise Element also contained objectives, policies, and programs for controlling noise for existing and future development. As part of the 2001 Countywide Plan Update, the noise measurements conducted in1987 have been repeated to assess the magnitude of changes in noise levels throughout the county. When the traffic analysis for existing and future conditions is completed, the noise contours for the county will be updated accordingly, as will any changes in the noise generated by Gnoss Field activity and the Richardson Bay heliport. Additionally, since adoption of the 1994 Countywide Plan, several new noise issues have been identified in the county, specifically, noise generated by the San Rafael Rock Quarry on Point San Pedro Road and jet aircraft overflights. This background report describes the current noise environment in the County of Marin and reviews existing Countywide Plan goals and policies to stimulate discussion as to whether changes should be made to county policies to reflect current issues.

II. REGULATORY FRAMEWORK

Government Code Section 65302(f) requires:

A noise element shall identify and appraise noise problems in the community. The noise element shall recognize the guidelines established by the Office of Noise Control in the State Department of Health Services and shall analyze and quantify, to the extent practicable, as determined by the legislative body, current and projected noise levels for all of the following sources:

- Highways and freeways.
- Primary arterials and major local streets.
- Passenger and freight on-line railroad operations and ground rapid transit systems.
- Commercial, general aviation, heliport, helistop, and military airport operations, aircraft overflights, jet engine test stands, and all other ground facilities and maintenance functions related to airport operation.
- Local industrial plants, including, but not limited to, railroad classification yards.
- Other ground stationary sources identified by local agencies as contributing to the community noise environment.

Noise contours shall be shown for all of these sources and stated in terms of community noise equivalent level (CNEL) or day/night average level (L_{dn}). The noise contours shall be prepared on the basis of noise monitoring or following generally accepted noise modeling techniques for the various sources identified in paragraphs (1) to (6), inclusive.

The noise contours shall be used as a guide for establishing a pattern of land uses in the land use element that minimizes the exposure of community residents to excessive noise.

The noise element shall include implementation measures and possible solutions that address existing and foreseeable noise problems, if any. The adopted noise element shall serve as a guideline for compliance with the state's noise insulation standards.

III. MEASUREMENT AND EFFECTS OF NOISE

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its pitch or its loudness. Pitch is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. Loudness is the amplitude of sound waves combined with the reception characteristics of the ear. Loudness may be compared with the height of an ocean wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A decibel (dB) is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of ten decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its level. Each ten decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the A-weighted sound level or dBA. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same

TABLE I
DEFINITIONS OF ACOUSTICAL TERMS

TERM	DEFINITIONS
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
Frequency, HZ	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level, dB	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless reported otherwise.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Day/Night Noise Level, L_{dn}	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

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TABLE 2
TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

At a Given Distance From Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Impression
	140		
Civil Defense Siren (100')	130		
Jet Takeoff (200')	120		Pain Threshold
	110	Rock Music Concert	
Diesel Pile Driver (100')	100		Very Loud
	90	Boiler Room	
Freight Cars (50')		Printing Press Plant	
Pneumatic Drill (50')	80		
Freeway (100')		In Kitchen With Garbage	
Vacuum Cleaner (10')	70	Disposal Running	Moderately Loud
	60	Data Processing Center	
Light Traffic (100')	50	Department Store	
Large Transformer (200')			
	40	Private Business Office	Quiet
Soft Whisper (5')	30	Quiet Bedroom	
	20	Recording Studio	
	10		Threshold of Hearing
	0		

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acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus one dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus one to two dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The Community Noise Equivalent Level, CNEL, is a measure of the cumulative noise exposure in a community, with a five dB penalty added to evening (7:00 pm - 10:00 pm) and a ten dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The Day/Night Average Sound Level, L_{dn}, is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

A. EFFECTS OF NOISE

1. Hearing Loss

- Wile physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise, but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

- The Occupational Safety and Health Administration (OSHA) has a noise exposure standard which is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 dBA averaged over eight hours. If the noise is above 90 dBA, the allowable exposure time is correspondingly shorter.

2. Sleep and Speech Interference

- The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noise of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12 to 17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn} with open windows and

65-70 dBA L_{dn} if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to have their windows closed, those facing major roadways and freeways typically need special glass windows.

3. Annoyance

- Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 55 dBA L_{dn}. At an L_{dn} of about 60 dBA, approximately 2 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 12 percent of the population. There is, therefore, an increase of about one percent per dBA between an L_{dn} of 60-70 dBA. Between an L_{dn} of 70-80 dBA, each decibel increase increases by about 2 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the L_{dn} is 60 dBA, approximately ten percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about two percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a three percent increase in the percentage of the population highly annoyed.

IV. COUNTY NOISE EXPOSURE

By far, the most pervasive and significant noise source in Marin County is traffic noise. Highway 101 is a major noise source, but county roads also generate high levels of noise particularly close to the thoroughfares. In 1987 a noise survey was undertaken to quantify noise measurements at six locations. This study was repeated in 2001 and 2005. The following discussion describes the similarities and differences in the noise environments experienced over the last 18 years.

A. TRAFFIC NOISE

In July 2001 and July 2005, a noise monitoring survey was conducted at ten sites representative of noise sensitive locations throughout Marin County. The locations of these sites are shown in Exhibit 1. These locations consisted of sites along highways, freeways, primary arterials, and major local streets; the principal sources of noise in the county. Five of these measurements were conducted at the approximate locations of the six sites measured at in 1987. Four site locations were added based on recommendations of county staff. The other site (LT2) was in the vicinity of the 1987 location but in order to locate the noise meter in a secure location it had to be placed closer to Highway 101. The noise survey sites were selected to obtain noise measurements which reflect a range of land use, topographical, and traffic noise source conditions. These locations are listed in Table 3.

Noise contours depicting the existing noise exposure along the major roads in Marin County are shown in Exhibit 2.

In general, the highest noise levels were measured either in the late morning hours (7AM to 11AM) or the early evening hours (4PM to 6PM); during typical commute times. Table 4 lists the measured L_{dn} for all sites.

1. Changes in the Traffic Noise Environment of Marin County Since 1987

By comparing noise level data collected in 1987 with the data collected from revisiting the sites in 2001 and 2005, it can be seen that noise levels have not increased significantly throughout the county. Hourly noise pattern trends have also remained similar over the past 14 years (Exhibit 3); however, noise levels in 2001 appear to start increasing earlier in the morning than in 1987. This could possibly be due to more early morning traffic and/or shift in commute trends.

EXHIBIT 1: LOCATIONS OF LONG TERM NOISE MEASURMENTS

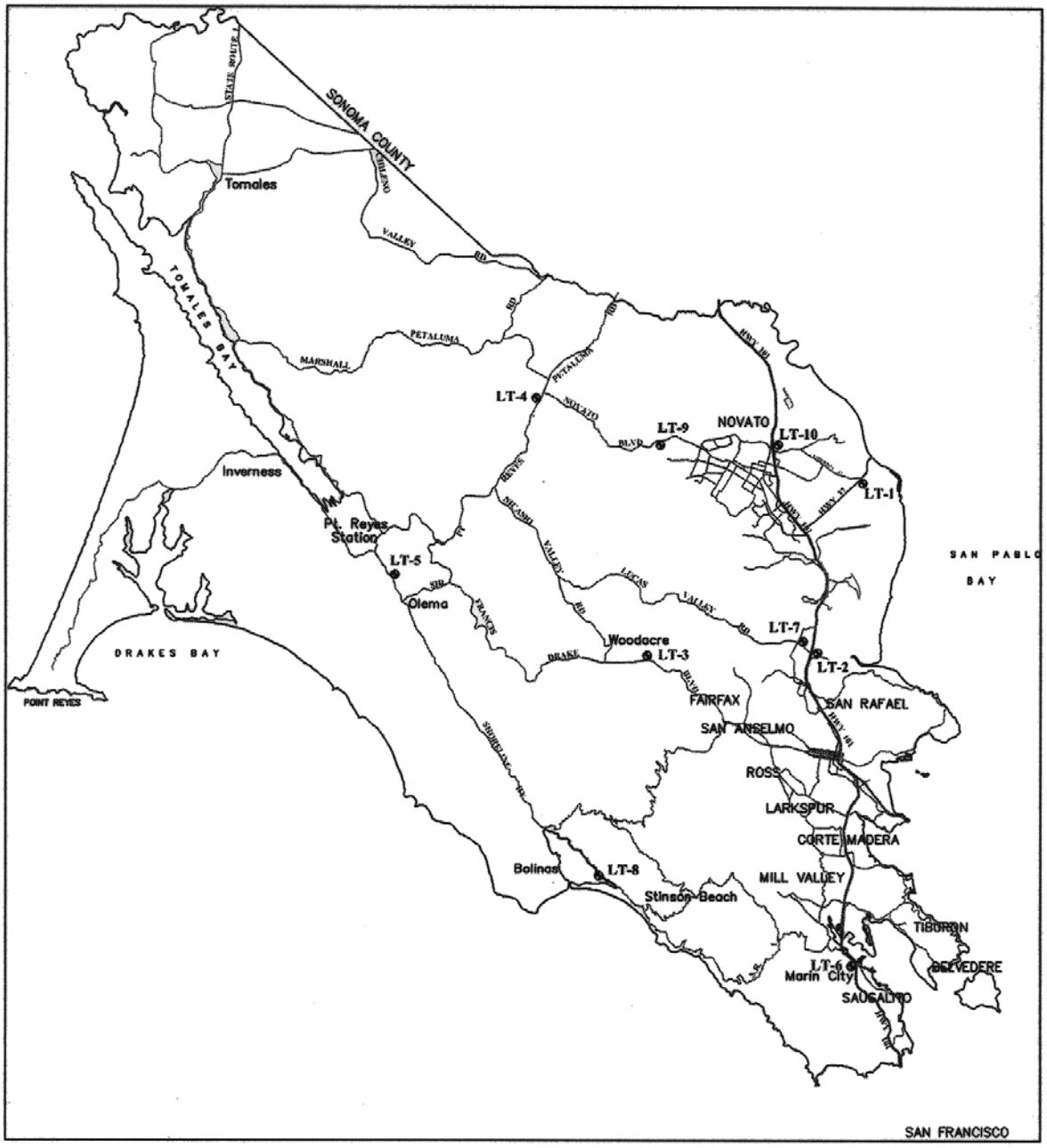

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TABLE 3
NOISE SURVEY LOCATION DESCRIPTIONS

Site Locations	Present Land Use	Topography	Noise Source
*LT-1: Hwy 37 at Atherton Rd.	Industrial, Commercial	Flat / Surrounded by Hills	Hwy 37 Railroad
*LT2: St. Vincent's Rd.	Agricultural, Residential, Institutional	Flat / Hill to the North	Hwy 101
*LT3: Sir Francis Drake Blvd. Near Woodacre	Residential, Commercial	Valley	Sir Francis Drake Blvd.
*LT4: Petaluma Point Reyes Road. South of Novato Blvd.	Industrial, Commercial	Valley	Pt. Reyes / Petaluma Rd.
*LT5: Hwy 1 South of Point Reyes Station	Residential, Commercial	Flat / Hills	Hwy 1
*LT6: Flea Market(87) / Shopping Center(01) Parking Lot off Hwy 101 in South Marin Co.	Commercial	Flat	Hwy 101
LT7: Lucas Valley Rd.	Residential, Commercial	Valley	Lucas Valley Rd.
LT8: Hwy 1 North of Stinson Beach	Residential, Commercial	Inlet	Hwy 1
LT9: Novato Blvd. Near Stafford Lake	Recreational, Residential	Hills	Novato Blvd.
LT10: Hwy 101 at Atherton Ave. Exit	Residential, Commercial, Recreational	Flat	Hwy 101 Frontage Rd.

* Indicates a site measured at in 1987

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SOURCE: ILLINGWORTH AND RODKIN, INC.

EXHIBIT 2: EXISTING NOISE CONTOURS

Legend

- County Boundary
- City Boundary
- Highways and Major Roads

Streams

- Perennial
- Intermittent

Water Bodies

- Lakes
- Lagoons

Noise Contours

- 60 LDN
- 65 LDN

N

1 inch equals 22,000 feet

0 1 2 4 6 8 Miles

THIS MAP WAS DEVELOPED FOR GENERAL PLAN PURPOSES.
THE COUNTY OF MARIN IS NOT RESPONSIBLE OR LIABLE FOR USE OF THIS MAP BEYOND ITS INTENDED PURPOSE.

April 2, 2002

File: H:\AdvPlan\CWP_Mapping\GIS\noise\Noise_b.mxd

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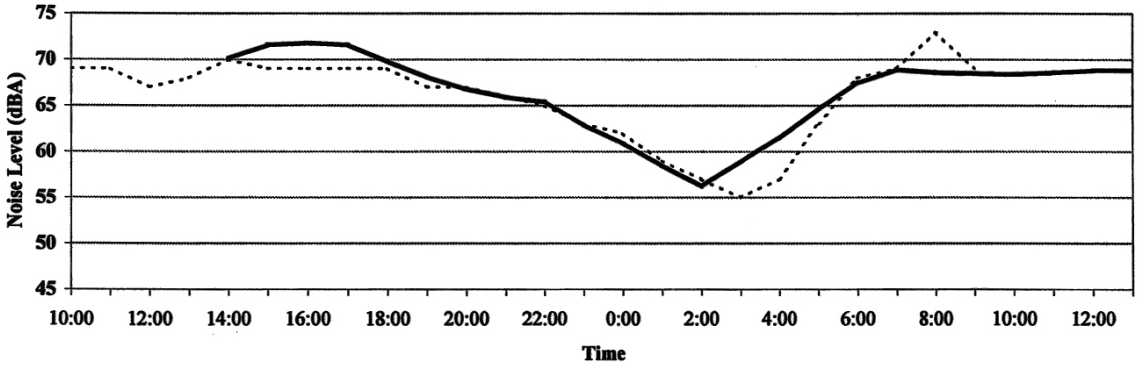
TABLE 4
ROADWAY NOISE COMPARISON, 1987 AND 2001

Site Locations	Ldn Measured in 1987	Ldn Measured in 2001	Ldn Measured in 2005
*LT-1: Hwy 37 at Atherton Rd.	71	71	73
*LT2: St. Vincent's Rd.	56	62*	63
*LT3: Sir Francis Drake Blvd. Near Woodacre	71	71 (August) 72 (December)	73
*LT4: Petaluma Point Reyes Road. South of Novato Blvd.	67	67	68
*LT5: Hwy 1 South of Point Reyes Station	62	65	62
*LT6: Flea Market (87) / Shopping Center(01) Parking Lot off Hwy 101 in South Marin Co.	75	76	76
LT7: Lucas Valley Rd.	Site not measured in 1987	70	72
LT8: Hwy 1 North of Stinson Beach	Site not measured in 1987	60	61
LT9: Novato Blvd. Near Stafford Lake	Site not measured in 1987	64	65
LT10: Hwy 101 at Atherton Ave. Exit	Site not measured in 1987	70	69

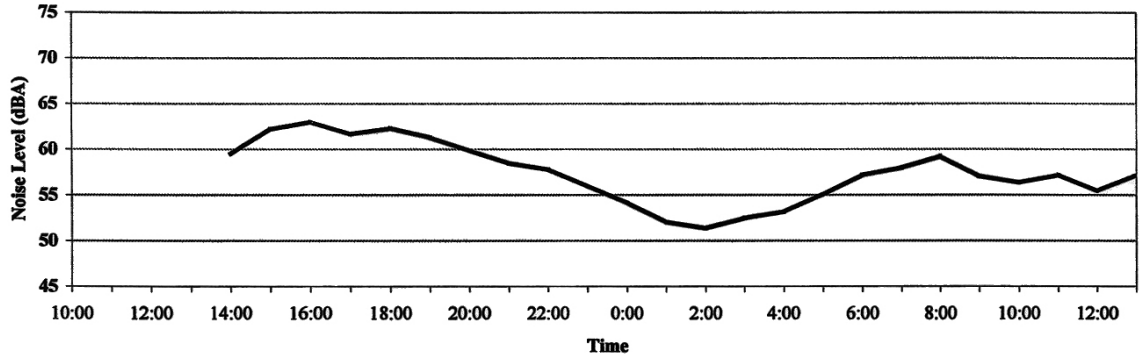
* The exact location of measurement LT2 in 1987 could not be repeated in 2001.

EXHIBIT 3: NOISE LEVEL TREND FROM MEASURED 24-HOUR NOISE DATA

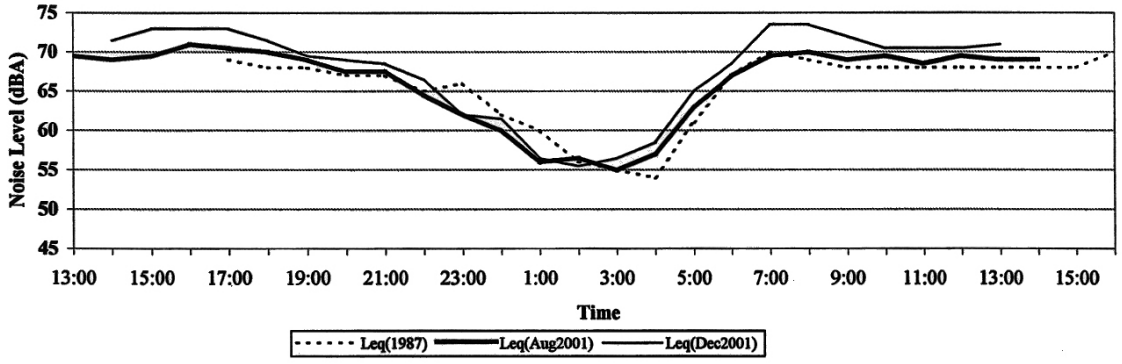
Location LT-1 - Atherton Avenue Exit off Hwy 37. Weekday Noise Levels Measured in 1987 and 2001. 1987 Ldn - 71, 2001 Ldn - 71.



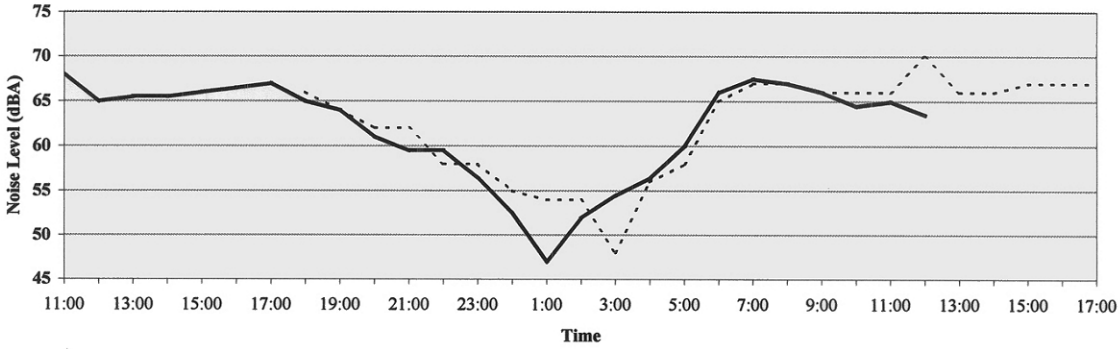
Location LT-2 - St. Vincents Drive off Hwy 101. Weekday Noise Levels Measured in 2001. Ldn - 62.



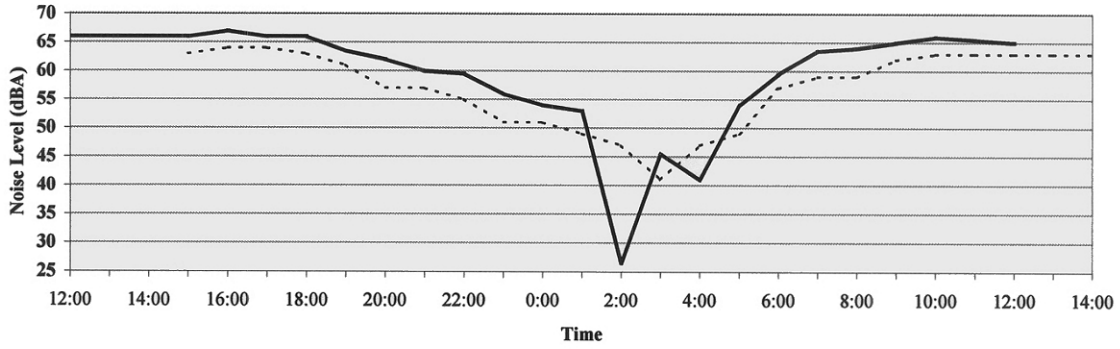
Location LT-3 - Sir Francis Drake Blvd., Woodacre. Weekday Noise Levels Measured in 1987, August 2001, and December 2001. 1987 Ldn - 71, August 2001 Ldn - 71, December 2001 Ldn - 72.



Location LT-4 - Petaluma Point Reyes Road. Weekday Noise Levels Measured in 1987 and 2001. 1987 Ldn - 67, 2001 Ldn - 67.



Location LT-5 - Hwy 1, South of Point Reyes Station. Weekday Noise Levels Measured in 1987 and 2001. 1987 Ldn - 62, 2001 Ldn - 65.



Location LT-6 - Flea Market / Shopping Center Parking Lot off Hwy 101. Weekday Noise Levels Measured in 1987 and 2001. 1987 Ldn - 75, 2001 Ldn - 76 .

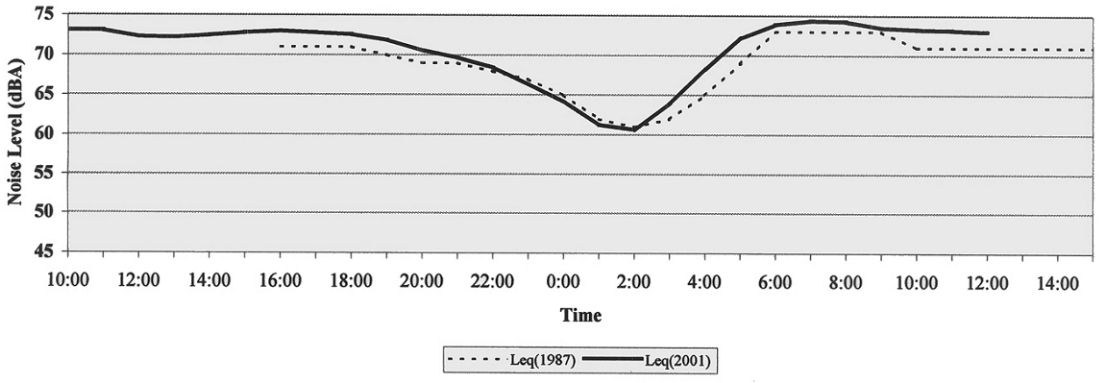
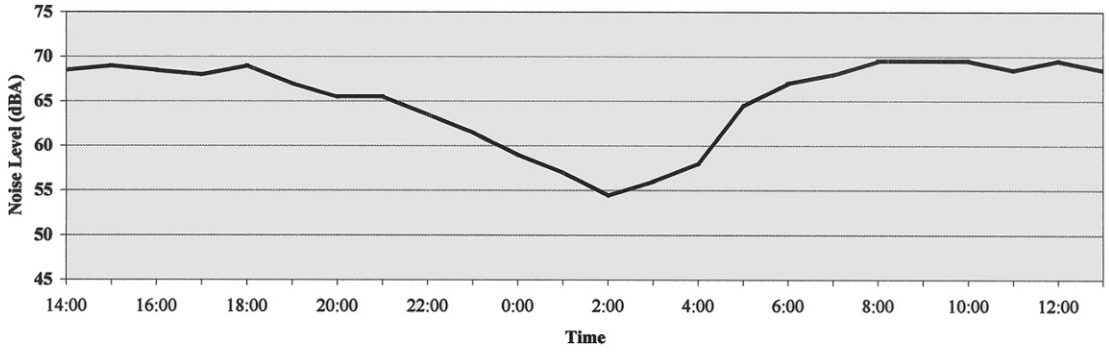
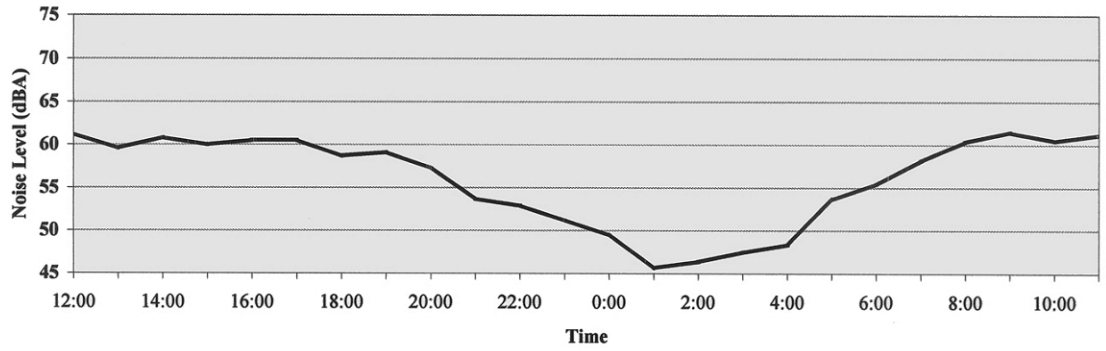


EXHIBIT 3: NOISE LEVEL TREND FROM MEASURED 24-HOUR NOISE DATA (cont'd.)

Location LT-7 - Lucas Valley Rd. West of Highway 101. Weekday Noise Levels Measured in 2001. Ldn - 70.



Location LT-8 - Highway 1 North of Stinson Beach. Weekday Noise Levels Measured in 2001. Ldn - 60.



Location LT-9 - Novato Blvd. Near Stafford Lake Bike Entrance. Weekday Noise Levels Measured in 2001. Ldn - 64 .

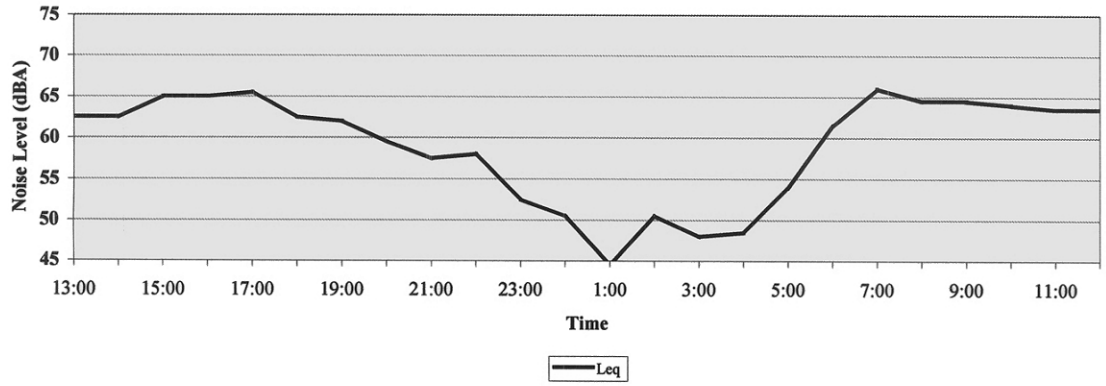
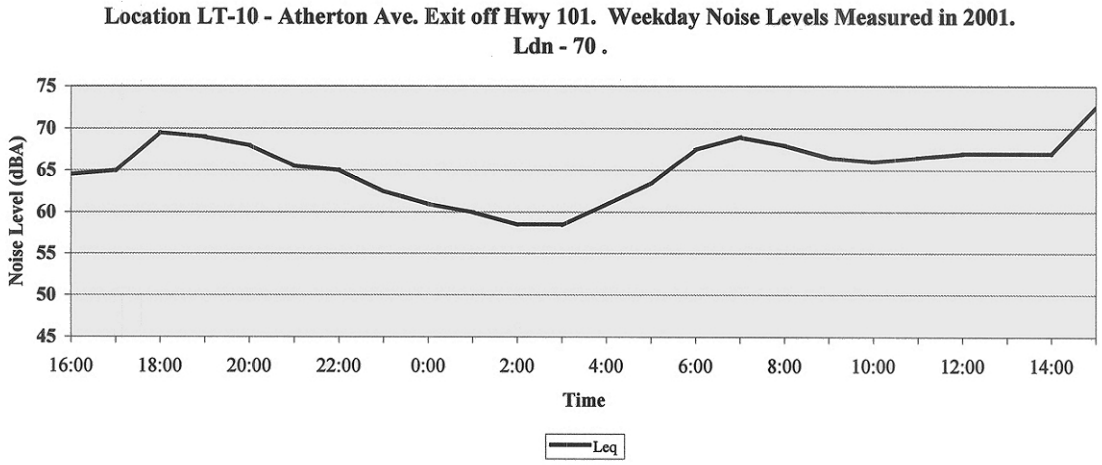


EXHIBIT 3: NOISE LEVEL TREND FROM MEASURED 24-HOUR NOISE DATA (cont'd.)



Since the noise monitoring survey for this background report was completed in the summer it was decided to repeat one measurement in the winter when school was in session.

The additional noise measurement was made at the same site as LT-3; approximately 45 feet from the center line of Sir Francis Drake Blvd just east of the town of Woodacre. The 24-hour measurement was made over December 17-18, 2001, (Monday to Tuesday), while Marin County schools were in session. The results of this noise measurement compared to measurements made in the same location in 1987 and August 2001 are shown in Exhibit 3. In general, hourly noise levels for the December measurement were slightly higher than previous measurements. The resulting Ldn was 72dBA, compared to 71dBA measured in August and 1987. When repeating measurements, it is normal to have a variance of up to 2 dB. The 1 dB change measured at LT-3 is indistinguishable to the human ear and is insignificant.

The results of the noise monitoring survey, supplemented by traffic noise modeling, were used to prepare the existing traffic noise exposure contours in Exhibit 2. The contours give a visual representation of the current traffic noise exposure along the major streets and highways in the county. The noise contours can be used to evaluate proposed land uses for compatibility with Program N-1.1b "Noise Guidelines for New Projects Exposed to Transportation-Generated Noise." If a residential development is, for example, proposed within the 60 L_{dn} noise contour shown on the noise contour map, then the general plan requires an acoustical analysis for this project showing how indoor and outdoor noise exposure will be controlled. The noise levels contained in the Noise Element Policies are the county's goals and the noise contour map is helpful for implementing the goals.

B. COMMERCIAL AIRCRAFT OVERFLIGHTS

Commercial aircraft overflight noise has become an issue of concern in Marin County. The California Division of Aeronautics is in charge of enforcing airport noise regulations for all airports within the State of California. Airports are not to expose residences to a community noise equivalent level (CNEL) of greater than 65 dB. The 65 dB CNEL noise contour for Oakland International and San Francisco

International Airports are not near Marin County. Nonetheless, aircraft overflight noise has been the subject of increased public awareness. Recently the County has undertaken efforts to dialogue with the Federal Aviation Administration to exam this problem. As a result of these efforts, it has been determined that there are flight paths over Marin County from both Oakland International Airport and San Francisco International Airport. Additionally, at the request of the County, San Francisco International Airport has conducted noise measurements at locations in Tiburon, Bolinas and Pt. Reyes to quantify aircraft overflight noise levels. These studies have shown that noise generated by individual jets reaches maximum overflight noise levels of 45 to 70 dBA at these locations. The aircraft-generated CNEL ranged from 27 to 39 dB in Pt. Reyes/Bolinas and from 19 to 44 dB in Tiburon. While these are not high noise levels, in the quieter areas of the County remote from traffic noise, the sound of aircraft overflights does stand out.

The noise generated by commercial aircraft in Marin County does not exceed any standards for health or land use compatibility. As far as can be ascertained from the literature, the noise generated by commercial aircraft overflights does not pose a threat to wildlife, although this issue has not been evaluated in Marin County.

C. STATIONARY SOURCES

The San Rafael Rock Quarry is an example of a significant stationary noise source in Marin County. The quarry has recently been the subject of complaints from the neighbors living in the vicinity. Noise measurements have indicated that the day/night average noise level at the closest residential development is about 49 dBA. This level is significantly below the level generally recommended as compatible with residential development but is an example of how even relatively low noise levels can generate adverse community response. In addition to the noise generated at the quarry site itself, the trucks to and from the quarry generate a significant amount of noise along San Pedro Road. The L_{dn} outside the closest residences to San Pedro Road reaches 70 dBA. Truck volumes routinely reach 58 to 65 trucks per hour during quarry operating hours. Major truck activity to and from the quarry is confined to the hours of 6:00 AM to 3:00 PM.

D. OTHER SOURCES

In addition to the noise sources described above, there are other noise sources with more localized impact. These include Gnoss Field, Richardson Bay Heliport, and even more localized sources, such as dog kennels. The noise generated by Gnoss Field and the Richardson Bay Heliport was described in the 1991 Noise Element and has not changed noticeably since then.

V. COUNTYWIDE PLAN NOISE ELEMENT POLICY REVIEW

The existing Noise Element goals and policies detail the procedures to be followed to develop land uses that are compatible with the onsite noise environment, and set forth criteria for evaluating impacts of new projects on existing land uses. Table 5 provides a review of the policies and programs from the current Noise Element.

Areas where additional policy guidance in the Noise Element will be valuable are as follows:

- Consider developing a quantitative noise ordinance that would apply to existing noise sources in the County. It would be used to resolve disputes among neighbors and control noise intrusion from one property to another. There are pros and cons associated with having a quantitative noise ordinance and the development of any ordinance should include a public input process to arrive at the most appropriate ways to deal with noise disputes.

- Policy guidance would be useful for the control of aircraft overflight noise. The County is currently involved in negotiations with the FAA, defining the extent of overflight noise problems, and evaluating procedures that could minimize aircraft flyover noise. The Noise Element should reflect the County's position and contain information quantifying the extent of the aircraft overflight noise problem. One of the problems with dealing with aircraft overflights is that the noise generated by the aircraft is under control of the Federal Government. At best, the County can influence the decision-makers on flight paths and altitudes, but it cannot set a noise limit for aircraft overflights. Any policies pertaining to aircraft noise contained in the Noise Element of the Countywide Plan should be consistent with the policies currently under consideration by the Board of Supervisors for dealing with aircraft noise.

- Consider setting aside areas of the County as designated "quiet" areas where protection of existing quiet will be paramount and develop guidelines for enforcement. As far as can be determined from a review of other General Plan Noise Elements, this type of policy has not been implemented in California. Some effort would be required to identify the areas to be protected. The idea would be to provide areas where the only sounds heard are the natural sounds of the environment.

- Develop noise exposure information for alternative uses of the Northwestern Pacific Railway line to assist in the decision making process. A detailed noise assessment should be prepared for nay Commuter Rail project on the Northwestern Pacific Railroad right-of-way. Appropriate mitigation measures must be included in the ultimate transitway design. The analysis should address the County's noise standards and the Federal Transit Administration (FTA) guidelines.

TABLE 5
EVALUATION OF EXISTING COUNTYWIDE PLAN NOISE POLICIES AND PROGRAMS

NOISE	COMMENTS
Policy N-1.1 Use Noise Level Guidelines-New Development. The County shall use noise level guidelines contained in this element to direct the siting, design, and insulation of new commercial and residential development.	Needs Refinement -- The County should consider designating "Quiet Areas" and setting goals for these areas accordingly. Applicable
Program N-1.1a Use the CEQA Process and Discretionary Review to Minimize Exposure to Excessive Noise Levels. Both CEQA and discretionary review of new development shall	Still Applicable

NOISE	COMMENTS
ensure that new development is protected from excessive noise levels. Potential noise impacts and mitigation measures shall be evaluated through discretionary review procedures such as environmental view, master plans, design review, and use permits.	
Program N-1.1b Noise Guidelines for New Projects Exposed to Transportation-Generated Noise Table N-2, "Land Use Compatibility for Community Noise Environments" and the noise contours shown in Appendix N-1 shall be used as a guide for determining the appropriate type of new development and its relation to ambient noise level. An acoustical analysis shall be performed for new residential development in areas with greater than 60 dBA outdoor L_{dn} to determine the appropriate mitigation measures for meeting an exterior noise level of 60 dBA, measured at the property line, and an interior noise level of 45 dBA. The threshold for performing an acoustical analysis shall be 65 dBA existing outdoor Ldn for office and retail commercial development and 70 dBA existing outdoor L_{dn} for industrial commercial development. The acoustic analysis shall determine ambient noise level conditions and mitigation measures necessary to minimize the exposure of residents and/or workers to excessive levels of noise.	Still Applicable
Program N-1.1c Noise Guidelines for New Projects Exposed to Stationary Source Noise Generators. Table N-3 shall be used as a guide for establishing allowable noise levels produced by stationary noise generators. An acoustical analysis shall be performed for new residential projects and other noise-sensitive uses proposed near stationary source noise generators in order to determine the appropriate mitigation measures for conforming to the standards in Table N-3. Effective mitigation measures shall be incorporated into the new development to reduce exposure to noise at or below the standards shown in Table N-3.	Still Applicable
Program N-1.1d Noise Guidelines in the Gnoss Field Environs. The County Community Development Agency will review new development proposals within two miles (referral area) of Gnoss Field for consistency with the noise criteria set forth in the adopted Airport Land Use Plan.	Still Applicable

NOISE	COMMENTS
Policy N-2.1 Use Noise Level Guidelines – Existing Development. The County shall use noise level guidelines contained in this element to protect existing land use from noise generated by new development.	Needs Refinement --This policy could be fleshed out to include the designation of "quiet" areas if the County so desires.
Program N-2.1a Use the CEQA Process and Discretionary Review to Protect Existing Land Uses from Significant Noise Impacts Due to New Development. Both CEQA and discretionary review of new development shall determine the noise impacts of new development. Potential noise impacts and mitigation measures shall be evaluated through environmental review, master plans, design review, use permits, and other discretionary permits in cases of significant increases in noise levels.	Still Applicable
Program N-2.1b Noise Guidelines to Protect Existing Land Uses from Transportation-Generated Noise Due to New Development. Table N-2 shall be used as a guide to establish allowable noise levels. Where the existing noise level is rated "Normally Acceptable", if new development raises the L_{dn} by more than 5 dBA but the noise level still remains in the "Normally Acceptable" category, it is considered a significant impact. In areas where the existing noise level is "Normally Acceptable", if new development raises the L_{dn} by more than 3 dBA and the noise level exceeds the "Normally Acceptable" standard, it is considered a significant impact. In areas that already exceed the "Normally Acceptable" noise level, if new development raises the L_{dn} by more than 3 dBA, it is considered a significant impact. When a significant impact occurs, mitigation measures shall be required.	Still Applicable
Program N-2.1c Noise Guidelines to Protect Existing Land Uses from Stationary-Source Noise Generated by New Development. Table N-3 shall be used as a guide to establish allowable noise levels. New noise-generating development proposed near existing residential or other noise-sensitive land uses shall have an acoustical analysis performed to determine the appropriate mitigation necessary to conform to the standards in Table N-3. Effective mitigation measures shall be incorporated into the new development to reduce exposure to noise levels at or below the standards shown in Table N-3. Table N-2 shall be used to determine allowable noise levels for commercial, industrial, agricultural or other less noise-sensitive land uses exposed to stationary source noise generated by new development.	Still Applicable

NOISE	COMMENTS
Policy N-2.2 Minimize Noise Impacts From Possible Future Transitway. If a transitway is developed along the Northwestern Pacific right-of-way, the noise impacts of transit vehicles on existing development should be minimized.	Still Applicable
Program N-2.2a Quantify Noise Levels Form Possible Future Transitway. When sufficient information exists to quantify noise levels generated by vehicles traveling along the Northwestern Pacific right-of-way, the noise contours should be incorporated into this Element.	Still Applicable
Program N-2.2b Develop Mitigation Measures to Minimize Impacts of Possible Future Transitway. Based on information generated through implementation of Program N-2.2a, mitigation measures shall be develop to ensure that existing developed areas are not subject to excessive noise levels from the proposed transitway.	Still Applicable
Policy N-2.3 Oppose Sound Walls Along Highway 101. The County of Marin opposes sound walls as a means of noise mitigation along Highway 101.	Applicable? – If the County chooses to keep this policy, site planning, building construction, and distance from the highway are the tools that can be used to mitigate noise for new developments. Without sound walls, development must generally be kept much farther from the road to achieve acceptable outdoor noise levels.
Program N-2.3a Coordination with Caltrans. The County will work with the California Department of Transportation to ensure that adequate studies are prepared and alternative noise mitigation measures are considered. The County will also request that Caltrans consult with local officials and with residents outside the noise impact boundary defined by Caltrans.	Still Applicable
Policy N-2.4 Minimize Impacts from Excessive Noise Levels Due to Construction Activity. During all phases of construction, measures should be taken to minimize the exposure of neighboring properties to excessive noise levels from construction-related activity.	Still Applicable

NOISE	COMMENTS
Program N-2.4a Limit Construction Hours. The Planning Department reserves the right to set hours for construction-related activities involving the use of machinery, power tools, or hammering. The type of construction, site location, and noise-sensitivity of nearby land uses will determine the hours of construction. The conditions of approval will specify hours for staging and type of construction activities. Special consideration shall be given to homeowners who perform their own work.	Still Applicable
Policy N-2.5 Minimize Noise Impacts from Temporary Land Uses. The permit review process for land uses of a temporary nature, such as fairs or exhibits, should include mitigation measures to minimize their noise impacts on surrounding areas. The L_{dn} from the temporary use should be in conformance with the noise level guidelines for nearby land uses.	Still Applicable
Policy N-2.6 Coordinate With Other Public Agencies. The County shall work with other public agencies to address both existing and potential noise impacts resulting from public agency activities. The County shall cooperate with other public agencies in determining the appropriate mitigation measures necessary to meet County noise guidelines.	Still Applicable

VI. FINDINGS

The following summarizes the noise issues in Marin County:

- The primary source of noise in Marin County has been and continues to be vehicular traffic. Highest noise levels are received along the highways and major streets in the county.
- Noise levels have not increased significantly in the last 14 years, although there has been a trend for increased noise levels during the early morning hours due to the change in commute patterns.
- There is currently a heightened sensitivity to aircraft flyover noise in Marin County and this is an issue that is receiving and will require more attention.
- Noise will continue to be an important factor in the planning process as pressure increases to develop properties exposed to high noise levels and/or noisy activities closer to noise sensitive receptors.

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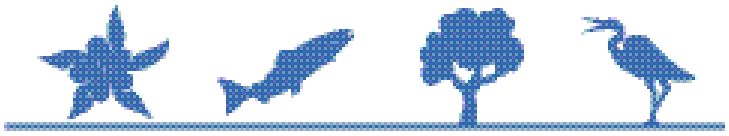
APPENDIX 1-T

PARKS AND RECREATION TECHNICAL BACKGROUND REPORT, JANUARY 2005

MARIN COUNTYWIDE PLAN



Parks and Recreation
Technical Background Report

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January 2005

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EXISTING CONDITIONS

A. Existing Park and Recreation Facilities

The description and analysis of existing parks and recreation facilities in Marin is complicated by a number of factors, including: the multiplicity of agencies providing parks and recreation; the presence of extensive Federal, State and open space; the wide range of size, function and level of development that exists among County and local parks; and the effect of unique jurisdictional and topographic conditions on the level of service provided within each incorporated and unincorporated community.

1. Park Classification and Standards

Where possible, the following discussion is arranged according to the classification described below and summarized in Table 1. The standards quoted are taken from *Planning and Design Criteria* (de Chiara and Koppelmann, 1982) and are generally based on standards published by the National Parks and Recreation Association. These are thought to be the most appropriate of the standards commonly used.

> *County and regional parks:* Serving a population of 30,000 and usually incorporating natural areas, trails, water features, picnic areas, and recreation facilities;
>
> *Community parks:* Ideally serving a population of 10,000 to 30,000 within a 3-mile radius. Usually containing specialized facilities such as swimming pools, tennis courts, community centers and sports field complexes;
>
> *Neighborhood parks:* Ideally serving one or more neighborhoods with a population of 2,000 - 5,000 and within a radius of 1/2 mile and with a minimum size range between 5 and 20 acres; and,
>
> *Mini-parks and tot-lots*: Very small parks, play spaces and sitting areas serving neighborhoods and individual developments.

Mini-parks, neighborhood, and community parks may be provided by cities, community service districts or homeowners' associations, while community parks are usually provided by the cities or by the County. A typical standard for total acreage in these parks averages approximately ten acres per thousand persons as noted by the National Recreation and Park Association. However, the Quimby Act uses the range of three-to-five acres per thousand residents for the purpose of park land dedications or in lieu fees associated with development. The park and recreation system is also augmented by school parks, which may provide hard surface courts, sports fields, and recreation/meeting rooms, and by private facilities.

Table 1. Park and Recreation Facility Size and Service Area Standards

	Service Area Population		Acres/1,000 Persons	Acres/Facility	
	Minimum	Maximum	Minimum	Minimum	Maximum
Parks					
Regional/County	50,000	100,000	20.0	250	
Community	10,000	50,000	2.5	20	100
Neighborhood	2,000	10,000	2.5	5	20
Mini-Parks		500	2,500.0		
School Parks					
Elementary	8,000		2.5	20	
Junior High	20,000	30,000		35	
High	local need			50	
Facilities					
Softball Diamonds	3,000				
Baseball Diamonds	6,000				
Basketball Courts	500				
Tennis Courts	2,000				
Recreation Center	25,000				
Cultural Center	None				
Swimming Pool	10,000				
Golf Course	25,000				

Source: Urban Planning and Design Standards, De Chiara and Koppelmann, 1982.

The first Marin County Parks and Recreation Facilities Inventory was prepared in 1977 by the County Parks and Recreation and Planning Departments, with the assistance of volunteers and local Parks and Recreation officials. Existing public parks and recreation facilities and many private facilities were identified by type, size and ownership and were recorded and mapped for six planning areas: Novato, Las Gallinas/San Rafael, Upper Ross Valley, Lower Ross Valley, the Richardson Bay Communities, and West Marin.

The inventory was updated in 1985 and 1990 to reflect changes since 1977. The inventory was also computerized to ease maintenance and reorganized according to the County's three standard geographic divisions: the City-Centered Corridor with its six planning areas, the Inland Rural Corridor, and the Coastal Corridor. With these improvements, a thorough and well-organized inventory should have continuing value in the following respects:

- as a source of public information which is easy to update;
- as a planning tool to assist County and local agencies in analyzing the supply of parks and recreation facilities in the County and each planning area relative to appropriate standards and thus to assist in

setting planning, acquisition, and development priorities.

Because open space does not serve the County's needs for many types of active recreation outlets, lands in the open space category are not included in the inventory. These lands will be discussed in the Parks and Recreation Section of the Socioeconomic Element only as their presence affects the policy choices available to the County and other local park and recreation providers.

Table 2. Comparison of Facilities Recommended for Development and Acquisition in the 1965 Park and Recreation Master Plan with Completed Facilities in 2004

Recommended Facilities, 1965	Status in 2004
1. **Major Regional Parks**	
Deer Park	Marin County
Phoenix Lake	Marin Municipal Water District
Nicasio Reservoir	Marin Municipal Water District
Stafford Lake County Park	Marin County
Stafford Lake - Watershed	North Marin Water District
Laguna Chileno	Private ownership, not a park
2. **Shoreline Areas* - Boating**	
Muir Beach and Overlook	Golden Gate National Recreation Area
Bolinas Lagoon	Marin County Open Space District
Agate Beach, Expansion	Marin County (no expansion)
Tomasini Point	State ownership
Miller Park	Marin County
Hog Island Boating Park	Marin County (Miller Park)
Toms Point Beach Park	Audubon Canyon Ranch and private ownership
Estero Americano Park	Private ownership, not a park
Paradise Beach Park	Marin County (expanded)
Keil Cove - Bluff Point	Private ownership, not a park
China Camp - Rat Rock Park	State ownership
Manzanita Marina Green	Private ownership, not a park
Corte Madera Marina	Private ownership, not a park
Gallinas Creek Marina	May be included in McInnis Park
Black Point Marina	Private ownership (with County Launch)
3. **Golfing - Driving Ranges**	
Rodeo Lagoon	Golden Gate National Recreation Area (undeveloped)

Recommended Facilities, 1965	Status in 2004
Corte Madera	Golden Gate Bridge District - various plans
Lucas Valley	Developed as residential
Nicasio Valley	Private ownership - rangeland
West Marin (San Geronimo)	Private ownership, not a park
Chileno Valley	Private ownership - rangeland
4. **Historic, Geologic and Botanic Areas**	
Tiburon Uplands	Marin County (expanded)
Elephant Rocks (Dillon Beach)	Private ownership, not a park
Estero Fossil Site	Point Reyes National Seashore
Olompali Adobe at Burdell Mountain	State ownership
5. **Wildlife and Stream Reserves**	
Marin Islands	State, Federal, County, and land trust ownership
Bolinas Lagoon Refuge	Audubon Canyon Ranch & Marin County
Upper and Lower Tomales Bay	State and private ownership
Tidelands	Private ownership, not a park
Papermill Creek	Private ownership, not a park
Nicasio and Halleck Creeks	Private ownership, not a park
Walker, Salmon and Chileno Creek	State and private ownership
San Antonio Creek	Private ownership, not a park

Note: In the Coastal Recreation Corridor, most of the undeveloped land west of Tomales Bay is owned by the Point Reyes National Seashore, and land east of Tomales Bay is owned by the Golden Gate National Recreation Area. The Point Reyes National Seashore manages most of the Golden Gate Recreation Area land.

a. County-Owned Parks

Marin County is abundant with Federal and state parks, open space, and watershed lands; however, these lands are generally protected for environmental purposes and are not available for active recreation. In contrast, County-owned parks, which provide a variety of recreational opportunities, total only 458.6 acres, which is well below the standard of 20 acres per thousand residents shown in Table 1.

The parks and facilities owned and operated by the County and listed in Table 3 vary widely in type and size. They include: specialized facilities (boat launches and the Civic Center facilities); a community park (Deer Park); a neighborhood park (Bolinas); beaches (Agate Beach, as well as beaches at McNear's and Paradise Parks); and the nature preserve at the Tiburon Uplands. Although McNear's Beach and Paradise County Parks serve a countywide function and are thus classified as regional in the Facilities Inventory, only Stafford Lake and McInnis Parks meet the size and service area criteria for a true regional park. The total of 589 acres in these two parks represent a small portion of the 4,430 acres needed to meet the countywide regional parks standard. County regional park acreage meets the

standard only in central Marin, in the Las Gallinas planning area where McInnis Park is located. While the standard may be unrealistic in light of Marin's extensive open space, it helps underscore a demonstrated need for additional countywide parks for active recreation.

Significant changes in recreational interests have occurred since 1965, including most notably the growth of interest in hiking, running, horseback riding, and biking. Because of the variety of facilities needed, no clear emphasis has emerged to suggest future park and recreation activity in the county. In terms of specialized types of recreation facilities, the County emphasized boating in the 1965 Plan. Golf courses were also emphasized but, with the exception of the Mill Valley course, the former nine-hole Gallinas course, and the planned course at McInnis Park, these facilities have been developed privately.

Table 3. County-Operated Park and Recreation Facilities, 2004

Planning Area	Facility Name	Facility Type	Acres
1. Novato	Black Point	Boat Launch	2.0
	Stafford Lake	Regional Park	139.0
	Novato Multi-Use Path	Multi-use Path	5.6
2. Las Gallinas	Lagoon Park	Community Park	10.0
	McInnis Park[1]	Regional Park	75.0
	Adrian-Rosal[2]	Mini-Park	0.7
	Castro Park[2]	Neighborhood Park	1.5
	Pueblo Park[2]	Mini-Park	2.0
	Candy's Park[2]	Mini-Park	0.1
	Mission Pass Multi-Use Path	Multi-use Path	0.5
3. San Rafael	McNear's Beach	Regional Park	55.0
4. Upper Ross	Deer Park	Community Park	30.0
	Creekside Park	Community Park	25.7
	Creekside Multi-Use Path	Multi-use Path	2.8
6. Richardson Bay	Paradise Beach	Regional Park	19.0
	Tiburon Uplands	Nature Preserve	24.0
	Mill Valley/Sausalito Multi-Use Path	Multi-use Path	20.7
7. West Marin	Agate Beach	Beach & Marine Study Area	7.0
	Bolinas Park	Neighborhood Park	1.0
	Miller Park	Boat Launch	6.0
	Whitehouse Pool	Fishing Access	22.0
	Upton Beach	County Beach	4.0

Planning Area	Facility Name	Facility Type	Acres
	Chicken Ranch Beach	Community Beach	3.0
	Village Green	Community Park	2.0
County Total			458.6

[1] McInnis Park is composed of 75 acres of developable park area and 283 acres of wetland.
[2] Funded by CSA #18 (Las Gallinas Valley)
[3] Funded by CSA #33 (Stinson Beach)

b. Local Parks

In a 1990 inventory of local parks, several planning areas appear to be deficient in neighborhood park space, according to the typical neighborhood and community park distinctions and standards given in Table 1. These standards are suitable for planning purposes and are based on minimum size, acres per thousand persons, service area radius, facilities, and functions served. However, Marin exhibits several features that make application of standard park planning measures somewhat misleading. Due to the small size and geographic isolation of many neighborhoods and communities, mini-parks may serve as neighborhood parks while parks of less than five acres may offer facilities typical of community parks. For this reason, the classification of local parks in this technical report is therefore based upon the judgment of recreation directors of city and district parks.

Table 4 shows that both the Las Gallinas and Lower Ross Valley planning areas are deficient in aggregate mini-, neighborhood, and community park space, when the normal Quimby Act standard of three acres per thousand residents is applied. The county aggregate falls more than 350 acres below the upper Quimby standard of five acres per thousand. The latter standard approximates the de Chiara and Koppelmann standard for neighborhood and community parks of 2.5 acres of each type per thousand residents.

In addition, it should be noted that local deficiencies throughout the planning areas may be greater than the aggregate figures suggest. This is because distribution of parks is often uneven due to the small size and relative isolation of individual communities, the topographic isolation of some neighborhoods, or the nature of city and service district boundaries. A further concern is that projected growth, especially in the Las Gallinas and Novato planning areas, which are already the most severely deficient in local park acreage, will require substantial additional neighborhood and/or community park space to achieve and maintain the standard provision.

Table 4. Park Acreage by Planning Area (Excluding Schools) Compared with Quimby Act Standards

Planning Area	Local Park Acreage	Required at 3 per 1000	Surplus or Deficit	Required at 5 per 1000	Surplus or Deficit
Novato	216.40	163.55	52.85	272.58	(56.18)
Las Gallinas*	61.00	76.69	(15.69)	127.82	(66.82)
San Rafael Basin	126.90	104.47	22.43	174.12	(47.22)
Upper Ross Valley	82.80	72.59	10.21	120.98	(38.18)
Lower Ross Valley	70.80	88.94	(18.14)	148.23	(77.43)
Richardson Bay	132.00	130.84	1.16	218.06	(86.06)
West Marin	26.00	53.22	(27.22)	88.71	(62.71)
Total Marin County	715.90	690.30	25.60	1,150.50	(434.60)

* Excluding McInnis Park, which is defined as a countywide regional park.
Source: Marin County Parks and Recreation Facilities Inventory, updated April 1990; U.S. Census, 1990.

Table 5 summarizes park acreage for each city/town by facility type, updated for 2004. An expanded listing of park acreages by city or town is contained in Appendix A.

Table 5. Park Acreage by City/Town and Facility Type (Excluding Schools and County-operated Parks and Facilities)

City/Town	Mini Park	Neighborhood Park	Community Park	Regional Park	Total
Belvedere	0.20	4.80	0.00	0.00	**5.00**
Corte Madera	1.35	20.00	30.20	0.00	**51.55**
Fairfax	0.10	18.50	4.70	0.00	**23.30**
Larkspur	3.90	19.50	93.00	0.00	**116.40**
Mill Valley	2.40	27.70	90.60	44.3	**165.00**
Novato	19.14	132.34	190.20	6.14	**347.82**
Ross	0.00	6.00	29.40	0.00	**35.40**
San Anselmo	0.00	61.80	13.00	0.00	**74.80**
San Rafael	4.22	137.96	302.00	0.00	**444.18**
Sausalito	5.35	47.60	15.50	0.00	**68.45**
Tiburon	2.80	62.40	6.40	0.00	**71.60**

City/Town	Mini Park	Neighborhood Park	Community Park	Regional Park	Total
West Marin	0.00	5.30	82.10	0.00	**87.40**
Total Marin County	39.46	543.90	857.10	50.44	**1490.90**

PARK AND RECREATION ISSUES AND ALTERNATIVES

Examination of Marin's park and recreation needs in the context of the inventory and agency policies raises a number of policy, fiscal, and implementation issues. Despite the extensive open space in the county, there is a significant need for developed park and recreation opportunities. The central issues concerning the County's role in helping to meet these needs are: 1) determining the financial feasibility of expanded park and recreation provisions; and 2) selecting the appropriate types of parks, facilities and programs.

In helping to meet park and recreation needs, the County may choose one or more of the roles described in the following pages:

- Acting as a coordinator of the activities and policies of regional and local park and recreation agencies;
- Providing a central information source to local agencies and residents;
- Providing continued and expanded countywide parks and facilities for active recreation.

A. Coordination and Information

In light of the number of providers of recreation, the County could provide a valuable coordinating function. Preparation of the Parks and Recreation Section of the Socioeconomic Element is the first step towards providing such policy coordination. Continued monitoring and updating should be provided to ensure that parks and recreation agencies at all levels augment the system, and to ensure coverage of areas where deficiencies exist.

1. Parks and Recreation Policy Coordination

Policy coordination with the County will assist cities in determining:

- How to interpret Quimby Act standards, using the higher five acres per thousand standard in sub-areas where unserved or underserved pockets exist;
- When to require in-lieu fees rather than dedication; and
- When supplementary assistance from the County may be appropriate to support acquisition and development of parks.

a. Centralized Database Preparation and Maintenance

Completion and maintenance of an adequate database is the key to providing coordination and centralized information. Ideally, all park and recreational needs and resources in Marin should be

identified in a manner that permits periodic review and application of criteria for establishing priority needs.

b. Improvement and Maintenance of the Facilities Inventory

- Thorough updating, augmenting, and automating the Parks and Recreation Facilities Inventory, the County has made significant progress towards establishing a maintainable database.
- The inventory will be of primary assistance to local agencies in planning for parks and recreation. In addition, the County could also provide information on parks, facilities and programs to the public. Offering such a public information service on an ongoing basis would be a costly undertaking. An annual publication, summarizing the inventory and providing local contacts for detailed information, might be more appropriate.

c. Recommendations for Updating the Parks and Recreation Needs Analysis

Preparation and conduct of a new comprehensive needs survey is a key recommendation of this Parks and Recreation Section. A methodology is needed to supplement the consistent long-term staff knowledge and observation on which the County was able to rely in the past and which is increasingly hard to guarantee. Ideally, an entirely new and systematic survey should be designed and regularly repeated to achieve and maintain an accurate and useful picture of needs.

The requirements of the Quimby Act provide an important reason why the County should undertake this monitoring and coordinating function.

2. Development of Quimby Act and Education Code Criteria

a. Quimby Act

Close coordination between the County and cities is essential for ensuring consistency in parkland dedication requirements and in-lieu fees.

Many cities, such as San Rafael, have collected park and recreation data and developed park and recreation plans for the city that include surrounding unincorporated areas as well as the area within the city boundaries. They can thus ensure that provision of parks, whether through dedication or use of in-lieu fees, in developments slated for annexation to the city will both meet city standards and be appropriately located so as to achieve even distribution. The effectiveness of such planning could be enhanced with overall monitoring by the County.

b. Education Code Sections 17485-17500

Under the terms and conditions of the Education Code, an opportunity exists to preserve most surplus school sites, if a determination is made that the school facilities provide a valuable neighborhood or district-wide recreational need. This determination would be made by the local community and park and recreation agency, on a case-by-case basis.

B. Park And Recreation Provision By The County

In addition to providing information and policy coordination, the County may expand its role as a provider of parks and recreation. The earlier discussion of park and recreation needs has indicated a demand for more parks with facilities for active recreation. The County has the option to satisfy these needs directly, or through funding assistance and recommendations for policy changes, to see that they are met by other agencies.

Numerous other options for active recreation activities not currently provided in the county should be examined individually in terms of need and interest, location, and feasibility. Proposals for certain types of developed recreation are expected to be controversial. However, increased active recreation opportunities, ranging from managed facilities for mountain bike riding to archery, are desirable to relieve pressure on natural parks and open spaces from inappropriate use. While a majority of Marin residents desire and respect natural areas, many residents would like more developed facilities. Such facilities will lessen unauthorized use of areas adjacent to existing parks and will serve as potential revenue generators.

C. Options For Funding Acquisition and Operation of Parks and Recreation Facilities

Even in Marin County, with its relatively well-developed tax base, municipal austerity programs have had a profound effect on the ability to acquire, develop, maintain and improve public parks and recreation facilities. Implementation of policies for expanding parks and recreation resources despite fiscal constraints will require creativity and ingenuity. The following section identifies both traditional and non-traditional approaches to obtaining and maintaining parkland and recreation resources.

1. Public Acquisition of Parklands

a. In-Fee Purchase

Traditionally, park and recreation agencies relied primarily on purchase of land for public parks in fee. The funding source was most often a budget allocation from the general fund, supplemented by bond issues for large and important purchases. City and County budgets now have little room for parks, even if a convincing case were made for a major expansion program. Although Marin County residents have shown a willingness to support bond issues for open space acquisition, it should not be assumed that bond money will be available for park purposes, or at least for all the expanded park acquisition, development and operations that appear to be needed.

The fact that very little new park land has been added to the 1977 inventory reflects the Proposition 13 curtailment of jurisdictions' ability to fund improvements, programs and maintenance from normal revenue sources. The effects of Proposition 13 only began to be felt after 1978. Moreover, local governments have also been affected by recessions and curtailment of some outside funding sources since 1978. Voters have also been unwilling to approve bond issues for acquisition or construction of new recreation facilities.

However, funds for purchase may be available from other sources. A thorough exploration of available approaches should be undertaken regularly. Funding sources include: Community Development Block

grant funds (for projects which serve low- and moderate-income areas), State Park Bonds and private grants. Substantial grants are likely to be available only from the State funds. However, competition among jurisdictions and among projects is intense. Whenever possible, the County and other recreation agencies should seek ways to combine funding and acquisition sources, supplementing dedications, donations and easements with publicly or grant-funded acquisitions.

b. Negotiated Purchase

The major advantage of purchase, as opposed to condemnation, is that it is possible to reduce the initial cost through installment purchases or options to purchase. Under each of these alternatives, the price of acquisition is established but payment may be deferred, at least in part, until revenues from user fees or other sources are generated. The price paid to purchase land on an installment contract or deed of trust is normally higher than that paid in cash.

Purchases can be funded by bond issue, County funds, State or Federal program assistance, or private (foundation) sources. Proposition 13 also limits the local jurisdictions' ability to provide maintenance and operational funds, even if a bond issue is passed. These maintenance and operations funds must be provided from the existing 1% limit on assessed value.

c. Gifts

Gifts of land for open space or park purposes can sometimes be obtained by offering tax incentives to donors. In cases where the donor wishes to remain living on the land, life estates can be developed. Although gifts are not expected to comprise a large source of parkland acquisition, this potential source could be stimulated by publicizing the tax advantages to major owners with an interest in open space, parks and recreation.

d. Eminent Domain

The use of eminent domain to acquire land for most open space uses is well established. The power to condemn land for the purpose of creating parks is less common and is politically undesirable. Ordinarily, eminent domain is used to acquire property only a few years before the desired use is to be developed. Eminent domain cannot be used to acquire land on an installment basis.

e. Use of the Development Process

As indicated above in the discussion of the Quimby Act, cities and counties are permitted to require that private developers dedicate land and/or pay in lieu fees for the purpose of park development. Standards set in each subdivision ordinance must show that existing parkland provision is below three acres per thousand or, in exceptional communities, five acres per thousand. Dedications or fees must serve the proposed development but parts may also be used by other adjacent residential areas.

Where parkland is in particularly short supply, cities may consider offering density bonuses or other incentives in return for excess dedications or fees. As with other uses of bonuses and incentives, available infrastructure and environmental conditions must be capable of supporting the additional units.

In some instances, it may be preferable to acquire park land rather than open space when lands in a subdivision are offered for dedication by developers. Under these circumstances, County Community Development Agency and park planners should review the lands proposed for dedication to determine if they are suitable for park purposes.

Cities should examine their subdivision ordinances to ensure that they provide sufficient flexibility with regard to the in-lieu fee option. It is often desirable to require payment of fees, in order to avoid acquiring land which is poorly located or otherwise unsuitable for park use. The fees can be used for purchase of a more suitable and easily developable site in the general vicinity.

Where a nexus can be found, developers may also be required to provide recreation easements as a condition of approval of a proposed project. Such easements should include all coastal access permits identified in the Local Coastal Program.

2. Less Than Fee Acquisition of Parkland

a. Zoning

In some cases, passive, visual open space may be desirable for improving the setting of a park or protecting a unique or otherwise valued resource for which access is not required. In such cases, local agencies may be able to avoid acquisition costs through the use of zoning.

However, while zoning can insure orderly, attractive, environmentally-sensitive development, it cannot prevent development. More permanent protection can be achieved through specific plans that require clustered development and preservation of a portion or portions of the site of a project in open space and/or public access easements.

b. Agreements

As an alternative to zoning, agreements, worked out to the mutual satisfaction of both parties, may offer the simplest and most cost-effective method of meeting preservation objectives.

An example of such an agreement is a recreational easement for playing fields and tennis courts at the Hidden Valley School in Sleepy Hollow, acquired by the County from the Ross Valley School District. The agreement stipulates that the area subject to the easement will be used in perpetuity for recreation except during school hours. The remainder of the property may be leased or sold by the school district.

c. Use and/or Acquisition of School Sites and Facilities

This key approach invokes Education Code Sections 17485-17500 to augment the local inventory of park facilities by preserving surplus school sites for recreational use. See Section III.A.2.b for additional discussion.

d. Special Districts

The types of special districts that provide parks and recreation services are explained below:

CSA: A Community Service Area (CSA) is formed and governed by the County Board of Supervisors in a specific geographic area for a specific purpose or purposes. There are a number of CSA's throughout the County that were formed for the purpose maintaining park areas while others were established for the purpose of acquiring open space. A similar body could be used for the purpose of acquiring park land.

CSD: A Community Service District (CSD) is a separate government agency under State law that has its own elected governing board and serves multiple purposes. Marinwood CSD is an example of a comprehensive CSD which provides recreation, fire protection and police services, and open space.

Several of the special districts in unincorporated Marin County provide parks and recreation services and one, the Strawberry Recreation and Parks District, was established exclusively for this purpose. Such districts are now difficult to establish due to the effect of fiscal and economic constraints on voter preferences. However, the County could play an important indirect role in augmenting recreation opportunities by helping the proponents of new districts plan and promote their establishment.

3. Development, Maintenance and Program Funding

Funding limitations affect the ability of the County and other service agencies to acquire additional park space. Limited funding also restricts the ability of these agencies to develop new facilities and programs within existing parks and to operate and maintain existing facilities. Thus, apparent opportunities for no-cost or low-cost acquisition, such as excess school properties, become significant issues because of the additional burden they may represent in terms of development, operation and maintenance.

a. User Fees

User fees are a means of financing improvements, maintenance and programs. However, some county residents cannot afford private recreation or public facilities and programs for which user fees are charged. Some communities appear to have found a greater acceptance of charges for the use of recreation facilities and participation in recreation programs. Belvedere reports that its programs are 100% funded by fees; however, Belvedere is a relatively high income city.

Some communities may consider offering reduced rates for large families, packages of several programs, or use of several facilities for a period of time. Cities and special districts should also maintain regular cooperative arrangements, fee structures, and prepare joint information brochures to ensure the maximum service population for each facility and program. Many agencies are finding that their ability to finance needed programs is restricted by too small a market, which results from jurisdictional boundaries and sometimes overlapping services.

b. Public/Private Partnerships

In order to finance capital-intensive facilities, the County should consider partnerships with the private sector. When private funds are used to develop a major facility on County-leased land, the County receives minimum annual rent and a percentage of the gross. This financial arrangement has been used successfully for facilities such as the McInnis Golf Center, which also includes a restaurant and other revenue-producing amenities. Revenues generated from these facilities should be used to finance other

park capital improvements and cover a substantial part of the maintenance and operation cost of the County park system. Public/private partnerships offer an innovative approach to funding major projects under the revenue constraints of Proposition 4. Projects financed in the above mentioned manner are subject to possessory interest tax, which exempts the project from the Proposition 4 limits on excess revenue uses.

APPENDIX A: Parks and Recreation Facilities by City

Appendix A shows the distribution of parks and recreation facilities by city and does not include County operated parks and recreation facilities, which are shown in Table 3.

Parks and Recreation Facilities – City of Belvedere

Facility Type	Facility Name	Acres
Mini Park	Beach Rd. and San Rafael traffic circles	0.20
Neighborhood Park	Belvedere Park	1.00
	Belvedere Way Park	0.03
	Centennial Park	0.16
	Community Park	1.60
	Oak Park	0.01
	Thomas S. Price Memorial Park	2.00
Community Park	N/A	0.00
Regional Park	N/A	0.00
	TOTAL ACRES	5.00

Parks and Recreation Facilities – Town of Corte Madera

Facility Type	Facility Name	Acres
Mini Park	Granada Park	1.10
	Skunk Hollow Neighborhood Park	0.25
Neighborhood Park	Neil Cummings School Park	10.00
	San Clemente School	10.00
Community Park	Grenada Park Tennis Courts	1.00
	Higgins Landing/Boat Ramp	0.50
	Menke Park	1.00
	San Clemente Park	5.00
	Town Park includes, Main Recreation Hall	22.70
Regional Park	N/A	0.00
	TOTAL ACRES	51.55

Parks and Recreation Facilities - Town of Fairfax

Facility Type	Facility Name	Acres
Mini Park	Fairfax Tennis Courts	0.10
Neighborhood Park	Deer Park School Site	0.00
	Doc Edgar Park at Cascade and Hickory	1.00
	Manor School	10.00
	White Hill School	7.50
Community Park	Central Ballfield	0.00
	Fairfax Town Park	4.70
	Lawrence Park at Claus Circle	0.00
	Pavilion	0.00
	Women's Club	0.00
Regional Park	N/A	0.00
	TOTAL ACRES	23.30

Parks and Recreation Facilities - City of Larkspur

Facility Type	Facility Name	Acres
Mini Park	Bon Air Landing	0.80
	Hamilton Park	0.30
	Heatherwood Park	0.80
	Neighborhood Park	2.00
Neighborhood Park	Dolliver Park	2.50
	Hall Middle School	10.00
	L/CM School District Office	0.00
	Remilland Park	7.00
Community Park	Piper Park	22.00
	Redwood High School	63.00
	Tubb Lake/Miwok Park (Undev)	8.00
Regional Park	N/A	0.00
	TOTAL ACRES	116.40

Parks and Recreation Facilities - City of Mill Valley

Facility Type	Facility Name	Acres
Mini Park	Freeman Park	0.70
	Molino Park	0.90
	Scott Highlands Park	0.80
Neighborhood Park	Alto & Edna Maguire Schools	11.00
	Blithedale Park	1.30
	Boyle Park	7.70
	Homestead School	2.00
	Old Mill School	2.50
	Park School	2.00
	Sycamore Park	1.20
Community Park	Cascade Park (Three Wells)	7.40
	Community Recreation Center	0.00
	Earnsliffe Canyon Park	1.20
	Edgewood Botanic Garden	0.70
	Hauke Park	2.50
	Kathleen Norris Memorial Park	1.30
	Mill Valley Middle School	20.00
	Miller Grove	1.40
	Old Mill Park	5.50
	Recreation House	0.00
	Strawberry School	10.00
	Tamalpais High School	27.00
	Tamalpais Valley School	12.00
	Warner Canyon Park	1.60
Regional Park	Bayfront Park	7.00
	Municipal Golf Course	37.30
	TOTAL ACRES	165.00

Parks and Recreation Facilities - City of Novato

Facility Type	Facility Name	Acres
Mini Park	Bahia Mini Parks	1.00
	Caribe Park	0.20
	Charles W Thigpen Tennis and Sport	2.50
	Fairway - Alameda	1.34
	Firehouse Park	1.00
	Hillside Park	1.00
	Hudson Park	0.30
	Joyce Street Tot Lot	0.25
	Lee Gerner Park	2.00
	Montego Park	0.50
	Olive Tot Lot	0.25
	Olive/McClelland	0.80
	Pacheco Valle	2.40
	Pansy Tong Lo Tot Lot	0.75
	Park Novato	1.30
	Partridge Knolls Tot Lot	0.50
	Pell Park - undeveloped	0.90
	Robinhood Park	0.30
	Spyglass Park	1.00
	Stafford Grove Park	0.25
	Terry Circle - undeveloped	0.60
Neighborhood Park	Bel Marin Community Center	0.30
	Hamilton School	18.00
	Joseph Hoog Community Park	9.94
	Loma Verde School	12.00
	Lu Sutton School	10.00
	Lynwood School	8.70
	Marin Highlands Park	4.00
	Marion Recreation Area	2.75
	Olive School	13.00
	Pacheco Valley/Creekside	4.70
	Pioneer Park	8.75
	Pleasant Valley School	12.00
	Rancho School/Arroyo Avichi Ballfield	1.20

Parks and Recreation Facilities - City of Novato (cont.)

Facility Type	Facility Name	Acres
Neighborhood Park (cont.)	San Marin	4.60
	San Ramon School	10.80
	Slade Park	3.10
	South Hamilton Park	4.00
	Sport Court Island (skate park)	4.50
Community Park	Equestrian Center - O'Hair Park	2.00
	Hamilton Ampitheater Park	4.00
	Hill Recreation Area	13.00
	Lynwood Hill Park	13.30
	Novato High School	37.70
	San Jose Middle School	17.60
	San Marin HS	37.60
	Scottsdale Pond & Marsh	40.00
	Sinola Middle School	25.00
Regional Park	Miwok Park and Museum of the American Indian	6.14
	TOTAL ACRES	347.82

Parks and Recreation Facilities - Town of Ross

Facility Type	Facility Name	Acres
Mini Park	N/A	0.00
Neighborhood Park	Ross School	6.00
Community Park	Natalie Coffin Green Park	25.00
	Ross Commons Town Park	4.40
Regional Park	N/A	0.00
	TOTAL ACRES	35.40

Parks and Recreation Facilities - Town of San Anselmo

Facility Type	Facility Name	Acres
Mini Park	N/A	0.00
Neighborhood Park	Brookside Annex	13.00
	Brookside Elementary	6.50
	Faudi Park (open space)	15.00
	Landsdale Station Park	2.00
	Memorial Park	9.00
	Red Hill School	9.00
	Robson Harrington Park	2.50
	Wade Thomas School	4.80
Community Park	Creek Park	2.00
	Sir Francis Drake High School	11.00
Regional Park	N/A	0.00
	TOTAL ACRES	74.80

Parks and Recreation Facilities - City of San Rafael

Facility Type	Facility Name	Acres
Mini Park	Arbor Park	0.18
	Bayside Mini Park	0.10
	Freitas Parkway Mini Parks	0.40
	Hartzell Park	0.44
	Ranchitos Park	3.00
	Schoen Park	0.10
Neighborhood Park	Bahia Vista Annex	0.00
	Bernard Hoffman Park	3.80
	Bret Harte Park	0.50
	Dixie School	11.50
	Don Timoteo School	10.00
	Freitas Park	0.40
	Gallinas School	12.00
	Hillview	0.20
	Laurel Dell Primary School	0.00
	Lucas Valley Community Center	2.00
	Lucas Valley School	10.00

Parks and Recreation Facilities - City of San Rafael (cont.)

Facility Type	Facility Name	Acres
Neighborhood Park (cont.)	Mac Phail School (park is privately owned)	0.00
	Mary E. Silveira School	10.00
	Miller Creek School	17.00
	Munson Park	0.40
	Old Gallinas School	7.80
	Oleander Park	2.00
	Peacock Gap Park	7.00
	Riviera Park	0.26
	Santa Margarita School	11.00
	Santa Margarita Valley Park	5.00
	Sun Valley Park	2.10
	Vallecito School	25.00
Community Park	Albert Park	11.50
	Bahia Vista School	5.10
	Beach Park	0.40
	Boyd Park	42.00
	Coleman School	4.00
	Davidson Middle School	14.00
	Falkirk Community Cultural Center	11.00
	Gerstle Park	6.00
	Glenwood School	24.60
	Las Gallinas	0.10
	Marinwood Park	25.00
	Pickleweed Park	17.00
	San Pedro School	8.50
	San Rafael Community Center	1.50
	San Rafael High School	35.00
	Shoreline Park	27.50
	Short School Children's Center	1.00
	Sun Valley School	5.00
	Terra Linda Community Center	3.40
	Terra Linda High School	30.20
	Victor Jones	29.20
Regional Park	N/A	0.00
	TOTAL ACRES	444.18

Parks and Recreation Facilities - City of Sausalito

Facility Type	Facility Name	Acres
Mini Park	Bolinar Plaza	0.10
	Cazneau Playground	0.10
	Civic Center Park	0.50
	Cloudview Park	0.50
	Gabrielson Park	0.60
	Harrison Playground	0.10
	Langendorf Playground	0.40
	Municipal Fishing Pier	0.30
	North View Park	0.50
	Plaza Vina Del Mar	0.20
	Schoonmaker Beach	0.75
	Southview Park	0.60
	Swedes Beach (Valley Street) Beach	0.10
	Tiffany Beach	0.10
	Tiffany Park	0.20
	Turney Street Boat Ramp	0.20
	Yee Tok Chee Park	0.10
Neighborhood Park	Bayside Park (undeveloped)	1.80
	Bayside School	17.00
	Cypress Ridge	13.00
	Marinship Park	2.80
	Martin Luther King Jr. Academy	13.00
Community Park	Dunphy Park	2.00
	MLK Athletic Fields	13.00
	Sausalito Recreation Center	0.50
Regional Park	N/A	0.00
	TOTAL ACRES	68.45

Parks and Recreation Facilities - Town of Tiburon

Facility Type	Facility Name	Acres
Mini Park	Bel Air Park	0.20
	Belveron Mini Park	2.10
	Cypress Hollow	0.50
Neighborhood Park	Bel Aire School	10.20
	Belveron Mini Park	1.00
	Del Mar School	10.00
	Downtown Shoreline Park	8.90
	Middle Ridge Park	18.00
	Point Tiburon Shoreline Park	0.60
	Reed School	11.70
	Zelinsky Park	2.00
Community Park	Point Tiburon Tennis Courts	1.50
	Richardson Bay Linear Park	4.90
Regional Park	N/A	0.00
	TOTAL ACRES	71.60

Parks and Recreation Facilities - West Marin

Facility Type	Facility Name	Acres
Mini Park	N/A	0.00
Neighborhood Park	Bolinas School	3.50
	Stinson School	1.80
Community Park	Inverness School	4.50
	Lagunitas/San Geronimo Schools	20.00
	Nicasio School	7.60
	Tomales Elementary	21.00
	Tomales High School	20.00
	West Marin Elementary	9.00
Regional Park	N/A	0.00
	TOTAL ACRES	87.40

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APPENDIX 1-U

REPORT ON GREENHOUSE GAS EMISSIONS FOR MARIN COUNTY, JUNE 2003

MARIN COUNTYWIDE PLAN

Report on
Greenhouse Gas Emissions for Marin County

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Report on Greenhouse Gas Emissions for Marin County

Background

Mounting scientific and economic information suggests that global climate change is a result of escalating greenhouse gas emissions and that immediate action to reduce these emissions should be taken to reduce its negative environmental, social and economic impacts.

The Intergovernmental Panel on Climate Change (IPCC), an international scientific body assembled by the United Nations Environment Program and the World Meteorological Organization, determined that "the balance of evidence suggests a discernible human influence on global climate."

In 1997, twenty-five hundred United States economists, including eight Nobel laureates, published a statement stating that economic research supports the following conclusions:

- Global climate change carries with it significant environmental, economic, social, and geopolitical risks.
- Preventive steps are economically justified.
- There are many potential policies to reduce greenhouse-gas emissions for which the total benefits outweigh the total costs.
- For the United States in particular. . . there are policy options that would slow climate change without harming American living standards.
- These measures may in fact improve U.S. productivity in the longer run.

Global climate change will seriously affect local communities. Cities and counties in urban and suburban areas may experience damage to infrastructure, property, and natural resources as well as public health problems from prolonged heat waves, migrating disease patterns and an increase in asthma cases due to air pollution. As a coastal community, Marin will feel the impacts of rising sea levels profoundly.

Addressing climate change at a local level can have a significant impact, and, in the absence of federal action, is quite critical. Many local government policies – such as building codes, the arrangement of roads and neighborhoods, the provision of public transit, and waste management practices – seriously affect the amount of greenhouse gases released by a community. Each of these decisions affects the emissions not only now, but in the decades that the building or landfill is in existence. Therefore, and because of the potentially serious local impacts, city and county governments should act as quickly as possible to reduce greenhouse gas emissions.

Addressing climate change locally has numerous additional benefits. Actions that reduce greenhouse gases (GHGs) save money by reducing electricity and fuel use, savings that accrue to its citizens, businesses and institutions. Decreased energy costs, coupled with the growth of new technologies and services, such as renewable energy and energy efficiency, will be a boon to Marin's local economy.

County of Marin: Cities for Climate Protection Campaign Partner

In May of 1999, the Marin County Board of Supervisors unanimously approved a set of environmental sustainability recommendations. The Board of Supervisors committed the County to undertake actions such as: public environmental education, improving County operations, and using sustainability as the foundation for the Countywide Plan Update that began in 2000.

During Earth Week 2002, the Board signed a resolution to join the Cities for Climate Protection Campaign (CCP). This campaign is administered under the International Council for Local Environmental Initiatives (ICLEI) and attempts to reduce international greenhouse emissions through actions by local governments.

CCP calls on municipalities to proceed through five milestones to reduce their contribution to climate change:

1) Analyze greenhouse gas emission levels: determine current greenhouse gas (GHG) emissions and forecast the growth in emissions that will occur without preventative action.
2) Set a reduction target: the target is the specific reduction that Marin aims to achieve by a designated year; e.g. 20% GHG reduction by 2020.
3) Develop a local action plan: this plan is a description of policies, programs, and measures that Marin will implement in order to meet its target.
4) Implement the local action plan: follow through on the proposed actions.
5) Monitor progress and report results: determine the success of the plan.

The County has now finished its first analysis of greenhouse gas emissions levels and is currently working on developing an emissions reduction target.

Milestone 1: Results of Emissions Analysis

An inventory of 1990 greenhouse gas emissions shows levels to be approximately at 2,860 megatons of eCO_2 (or 2.8 million tons). Overall, Marin has experienced an 8% increase in greenhouse gas emissions from 1990 to 2000. Unincorporated areas of Marin account for approximately 21% of greenhouse gas emissions in the County.

Year	1990	2000
Countywide (tons)		
Unincorporated	617,562	639,741
Incorporated	2,237,162	2,473,825
Total	2,634,003	3,113,565
Percentage growth	+ 15%	
Internal (tons)		
Total	16,945	18,451
Percentage growth	+ 8%	

Milestone 2: Establishing an Emissions target

Adopting a target and a timetable for its achievement is essential to foster not only political will but also to create a framework that guides planning and implementation of greenhouse gas-reducing measures. Two targets will be set, one for internal County government and one that is Countywide. Internal County government emissions will be significantly easier to effect because government operations that generate the majority of CO_2 emissions, such as vehicle fleets, building energy use and waste generation, can be directly influenced by internal policies and procedures. Countywide targets will be pursued by means of the Countywide Plan, energy and water conservation programs, and improvements in the efficiencies and alternatives to our current modes of transportation; because of the nature of these measures, the lead times to reduce CO_2 can be considerably longer. The targets should be realistic and feasible, yet progressive. Initial investigation into targets for Marin suggests that what is appropriate given current growth patterns, availability of necessary technology to reduce emissions, and other pertinent trends is: 15% – 20% for County government, and 15% Countywide.

The targets should take into consideration the following:

1) Measures that have already been implemented to reduce emissions.
   Internal: The County has taken many steps to reduce energy and water use and waste generation, where possible. Actions such as purchasing hybrids, retrofitting facilities for energy efficiency, lighting retrofits, providing commuter alternatives for employees and switching incandescent traffic signals to light emitting diodes (LEDs) have all helped the County reduce internal operation emissions by at least 4% over baseline levels.

   Countywide: Recycling programs, energy rebate programs, the Green Business Program, renewable energy purchases and alternative fuel vehicles have all contributed to reducing overall greenhouse gas emissions.

2) Measures that will reduce emissions, as mandated by federal and state legislation.
   Internal and Countywide: Legislation such as Senate Bill 58 and Assembly Bill 1493 will result in reduces emissions without action on the part of Marin County. SB 58 establishes a renewable portfolio standard (RPS) for California, which would require the utilities to increase their renewable power procurement by at least 1% each year, with the goal that 20% of the electricity sold to California customers come from renewable resources by 2015. AB 1493, the first of its kind in the nation, is a bill directing the California Air Resources Board (CARB) to adopt Corporate Average Fuel Economy (CAFE) standards for cars and light-duty trucks beginning with the model year 2009.

3) Additional County-level measures that can be feasibly and economically implemented.
   Internal & Countywide: Potential measures that the County can engage in that will lead to meaningful decreases in CO_2 emissions include investing in renewable energy, increasing the number of alternative fuels and alternative fuel vehicles, and additional energy and water conservation measures.

4) The Ecological Imperative
   When developing a short-term target, it is important to keep the longer-term effects of global climate change in mind. The "Ecological Imperative" refers to the broader view of how much

greenhouse gas emissions need to be reduced in order to mitigate a global climate change crisis. One study suggests that by the end of the century a 60% reduction in global emissions is required to stabilize at current CO_2 levels. Other studies suggest that the actual number is closer to 75-85% reduction just to maintain current levels of 370 parts per million (ppm). IPCC has demonstrated that if we reduce emissions by some large percentage during the next 100 years, it will still take 100-300 years to stabilize at the new level (somewhere between current levels of 370 ppm to 550 ppm). Temperatures would continue to rise for another 300 years or more. Sea level will still be rising for the next 3000 years – even if we stabilize our emissions.[1]

Target Breakdown

Below are tables that categorically separate the components of the greenhouse gas reductions target. For measures where there is not yet a method for assessing the CO_2-reducing potential, they are listed at "to be determined" (TBD).

Internal County Government

TARGET YEAR	TARGET BREAKDOWN	PERCENTAGES
BY 2020	**What Has Already Been Achieved**	**Estimated CO_2 Reduction to date**
1.A	Lighting/energy retrofits	2.4%
1.B	LED traffic signals	0.6%
1.C	Solar Installation (100 KW)	0.5%
1.D	Alternative fuel vehicles	0.1%
1.E	Recycling Programs	2%
1.F	Purchasing preferences for recycling	TBD
1.G	Employee Commuter Incentives	4%
	SUBTOTAL	**9.6%**
BY 2020	**What Can Be Achieved Through Mandates**	**Potential CO_2 Reduction**
2.A	CAFE standards	1.5%–3%
2.B	RPS	1.5%–3%
	SUBTOTAL	**3%–6%**
BY 2020	**Policy-Driven**	**Potential CO_2 Reduction**
3.A	Green power purchases	5%
3.B	Add'l renewable energy investments	7%
3.C	Add'l alternative fuels	3%
	SUBTOTAL	**15%**
BY 2020	**Suggested Target**	**15–20%**
BY 2100	**The Ecological Imperative**	**60%**

[1] IPCC. Climate Change 2001: Synthesis Report. Third Assessment Report.

Unincorporated County

TARGET YEAR	TARGET BREAKDOWN	PERCENTAGES
BY 2020	**What Has Already Been Achieved**	**Estimated CO_2 Reduction to date**
1.A	Green Business Program	TBD
1.B	Rebate Program	0.5%
1.C	Energy Efficiency Ordinance	TBD
1.D	Alternative fuel vehicles	TBD
1.E	Recycling Programs	4%
1.F	Construction & Demolition Ordinance	TBD
1.G	Green Building Program	TBD
1.H	Solar Installations	0.5%
	SUBTOTAL	**5%**
BY 2020	**What Can be Achieved Through Mandates**	**Potential CO_2 Reduction**
2.A	CAFÉ standards	1–3%
2.B	RPS	3%–5%
	SUBTOTAL	**4.5%–8%**
BY 2020	**Policy-Driven**	**Potential CO_2 Reduction**
3.A	Green power purchases	TBD
3.B	Add'l renewable energy investments	5%
3.C	Add'l alternative fuels	5%
3.D	Countywide Plan policies/programs	5%
	SUBTOTAL	**15%**
BY 2020	**Suggested Target**	**15%**
BY 2100	**The Ecological Imperative**	**60%**

Examples of other targets:

In California:
- San Jose: 20%
- Los Angeles: 20%
- Chula Vista: 20%
- Oakland: 15%
- Berkeley: 15%

In other states:
- Fort Collins, CO: 30%
- Miami-Dade County, FL: 20%
- Portland, OR: 20%
- Austin, TX: 10-20%
- Overland Park, KS: stabilize

Process

This report summarizes the first milestone in the Cities for Climate Protection Campaign (CCP). The intent is to determine the current levels of GHG throughout the county. Although the Marin County government has jurisdiction over only unincorporated county areas, data limitations made it impossible to exclude incorporated areas; the data represents the entire county. This calculation method has the

benefit of encouraging the County to provide positive leadership to other municipalities. However, when setting emission reduction targets, it should be realized that the County has influence over only a limited portion of the total countywide emissions.

The greenhouse gases analyzed in this study include carbon dioxide, methane, nitrous oxide, and various hydrofluorocarbons.[2] The levels of the emissions are reported in equivalent carbon dioxide (eCO_2) units. Converting all emissions to carbon dioxide units allows for comparison between greenhouse gases of varying strengths; for instance, methane is twenty-one times more powerful than carbon dioxide in its capacity to trap heat, therefore 1 ton of methane is equal to 21 tons of carbon dioxide.

The County gathered information on greenhouse gas emissions in three years – 1990, 1995, and 2000 – to understand trends in the County's greenhouse gas emissions. These trend lines, along with indicators, will be used to forecast greenhouse gas emissions in 2020, in the absence of ameliorative measures.

Greenhouse gas emissions were calculated for the following categories:

- Energy use: residential, commercial, industrial
- Transportation
- Waste
- Agriculture

The calculations were computed using CCP software, which translates data on a community's energy use and solid waste into the corresponding levels of greenhouse gas emissions. The process of the computation is explained below. Data sources are listed in Appendix B.

Indicators

Indicators are basic statistics on a particular jurisdiction such as population, number of households and number of commercial employees. Where specialized data does not exist, indicators are used to forecast greenhouse gas emissions because indicators can be expected to reasonably approximate a population's emissions patterns over time.

Coefficients

Coefficients are standardized values that reflect the quantity of eCO_2 emissions associated with the use of a particular unit of fuel or the decomposition of a unit of waste. Coefficients for electricity generation are based on California's fuel mix; other California-specific coefficients include livestock sources of methane.

2 These are HFC-23, HFC-125, HFC-134a, HFC-152a, CF4, C2F6, and SF6.

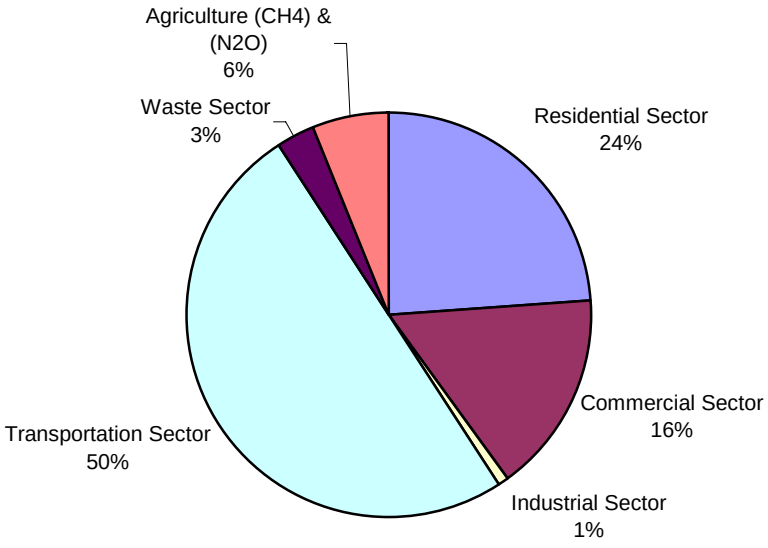
Total Energy Use

Countywide emissions for all sectors are summarized in the following table:

SECTOR	1990	2000
Transportation Sector	1,542,175	1,649,116
Residential Sector	724,835	797,499
Commercial Sector	469,933	562,434
Agriculture	197,376	183,462
Industrial Sector	36,609	15,145
Waste Sector	-116,204	-94,091
Totals	2,854,742	3,113,565

By percentage, the transportation sector is the largest contributor to GHG emissions, followed by residential and commercial energy use.

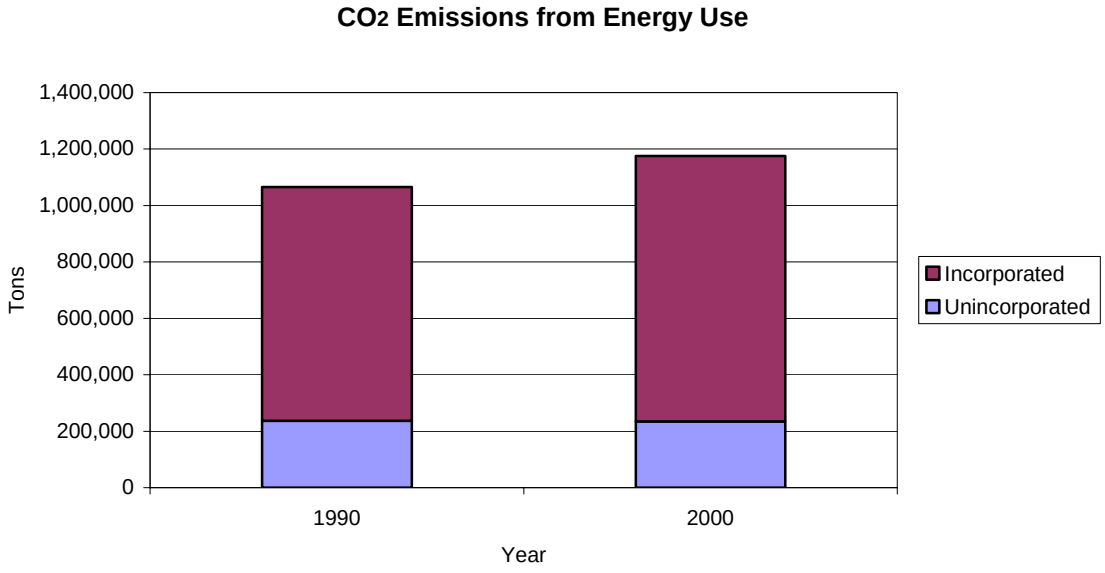
Countywide Emissions Analysis



Building Energy Use

Stationary energy use by buildings in all sectors (residential, commercial and industrial) accounts for 44% of the total GHG emissions in Marin. In California, these emissions are largely the result of combusting natural gas for electricity and heat in the residential and business sector.

The County has experienced an overall increase in energy use from 1990 through 2000 of 10%, from 1.23 Megatons of eCO_2 to 1.38 Megatons of eCO_2. In 2000, unincorporated Marin is responsible for approximately 17% of emissions from stationary energy sources.



Inputs

The greenhouse gas emissions resulting from energy use were calculated from the amounts of electricity and natural gas used by residents and businesses in the County.

- Inputs for all sectors: electricity (kilowatt-hours) and natural gas (therms).
- Residential energy use indicators: population, number of households.
- Commercial energy use indicators: area of commercial floor space, number of employees, and number of commercial establishments.
- Industrial energy use indicators: area of industrial floor space, number of employees, and number of industrial establishments.

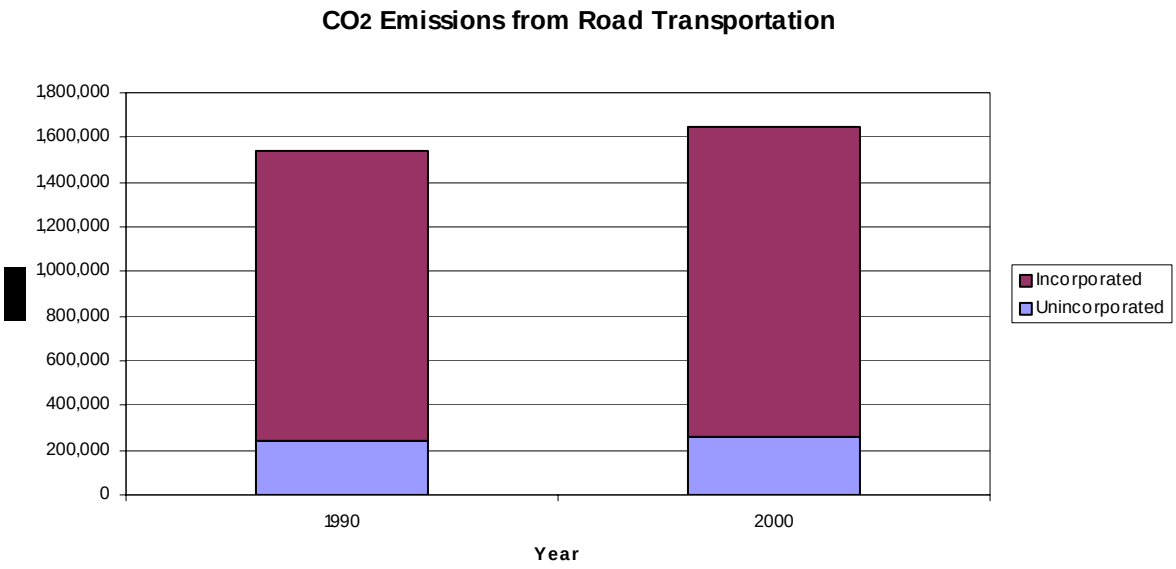
Qualifications

To obtain values for unincorporated Marin, total energy use was divided by the number of households in Marin, which provided an energy use per household figure. This number was then multiplied by the number of households in unincorporated Marin.

This information does not include self-generated energy, such as individual diesel generators, heating oil, and propane.

Transportation

Transportation is responsible for 53% of total greenhouse gas emissions. There was an overall increase in transportation emissions of 6% from 1990 to 2000. As of 2000, transportation within the unincorporated areas of Marin accounts for approximately 15% of total Countywide emissions, based on Caltrans vehicle studies.



Inputs

Transportation sources of greenhouse gases were separated into two fuel types: gasoline and diesel. Emissions were calculated using annual vehicle miles traveled (VMT) by personal vehicles, commercial trucks, buses, and "other" vehicles, the fuel efficiency of each type of vehicle, and therefore, the number of gallons of fuel used to power each vehicle type.

Other inputs include annual vehicle miles traveled (VMT) in Marin, statewide breakdown of VMT by vehicle and fuel type, and statewide fuel economy for each vehicle and fuel type.

Qualifications

Overall vehicle miles traveled are Marin specific values. To divide these miles by vehicle and fuel type requires use of state averages, which can introduce some error. In addition, these state averages only included gasoline and diesel fuel types; it was assumed that alternative fuel vehicles, such as those powered by biodiesel or compressed natural gas, do not comprise a significant portion of Marin's traffic.

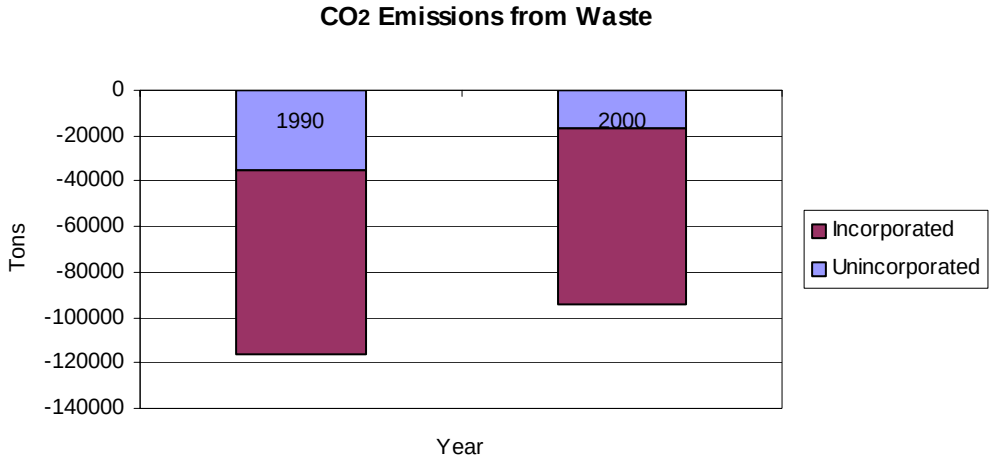
Fuel efficiency values are state averages and may not accurately represent the average fuel efficiencies of Marin vehicles. Informal observations suggest that while there is a disproportionately high number of sport-utility vehicles (SUVs) driven in Marin than in California as a whole, which have problematically low fuel economies, there may also be fewer pickup trucks as there is less industry, no off-road trails, and the area is built-out.

Waste

In 2000, waste was -4% of Marin's GHG emissions, which means it serves as a sink (net loss) of eCO_2.

The methodology for quantifying GHG releases from the landfill was developed by the EPA. The intent was to measure not the amount of greenhouse gases emitted in a given year from waste piled in landfills, but the amount eventually to be emitted as a result of the waste sent to landfill in a given year. Although this is a sight deviation from the other sections which measure the greenhouse gases actually released, it is a more accurate representation of the atmospheric pollution occurring due to a year's actions, and it allows the data to reflect actions such as waste reduction and recycling.

Under natural conditions, food, paper and other organic matter would decay and release CO_2. In a landfill, there are two conditions. First, the anaerobic conditions lead to decomposition, which produces methane, a GHG more potent than CO_2. Some of this gas perpetually remains under the liner of the landfill. Most methane is recovered and then flared, which converts the methane back into CO_2 as it combusts. Depending on the balance between the characteristics of the waste stream, the methane that is trapped, the flaring and the release of methane from the landfill, waste deposition can act as a sink for GHG.



Inputs

Tons of waste sent to landfill include the following categories: paper; food; plant; wood, furniture, and textiles; and other. Data from residential and commercial sectors were combined. Methane emission

coefficients were included due to the landfill's collection and burning of methane, which converts methane to CO_2.

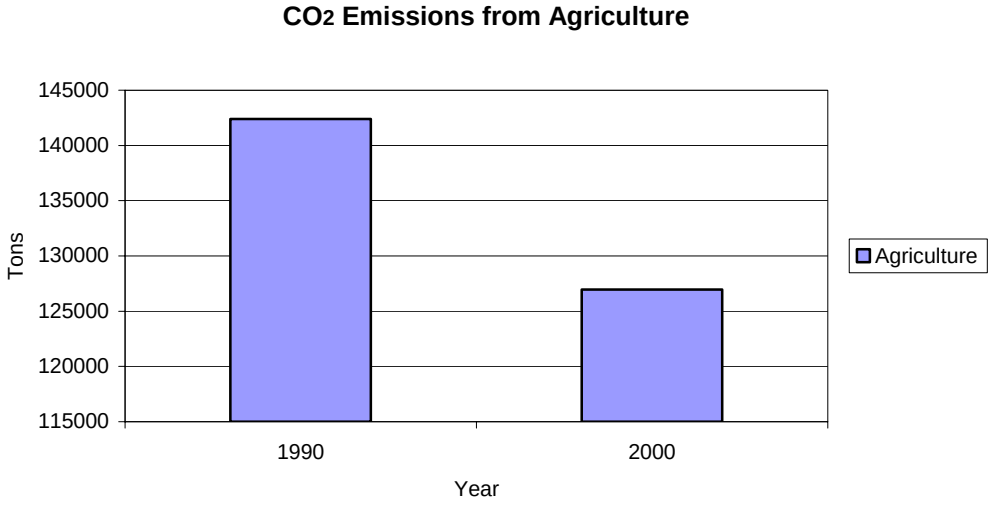
Qualifications

Actual data on the methane emission coefficient was unavailable and estimated to be 90% based on conversations with landfill personnel. The national average is 75%; therefore it is assumed that local landfills have higher than average efficiencies of methane collection due to stricter California waste regulations.

Information on waste was not available for this report; it was estimated by projecting upwards from 1995. This estimation method assumes a constant rate of change in waste amounts and would not record a sudden population jump or sudden increase in recycling (although we doubt that this occurred). The Solid Waste Characterization Database (www.ciwmb.ca.gov) shows the estimated composition of waste typically disposed by single family and multifamily residences within California. Total tonnage for each jurisdiction is computed using regional per capita disposal rates obtained in the 1999 Statewide Waste Characterization Study. This is average data and may not reflect actual composition for Marin's specific jurisdiction.

Agriculture

Agricultural practices are responsible for greenhouse gas emissions through the methane produced by livestock and through soil and cropping practices such as fertilizer applications and crop residue burning. This report focuses on livestock-related emissions. Farm animals contribute to methane emissions both through the production and release of methane during digestion and through the release of methane as their manure decompose. Nitrogen compounds, such as N_2O, are also released through manure decomposition, though this is a much smaller source of livestock-related greenhouse gases. Methane and N_2O released by livestock are considered human-caused greenhouse gases for two reasons: people control the animal population to provide human food and other services, and the high concentrations in which the animals are kept causes their manure to produce more gases as it decays than it would under unmanaged conditions.



An 8% decrease in emissions from agricultural sources occurred from 1990 to 2000. This is probably due to a shrinking number of ranchers in the area. Agricultural emissions account for approximately 6% of the County's total emissions in 2000. In terms of agriculture's contribution to unincorporated Marin's emissions, most agriculture occurs within these boundaries; therefore methane constitutes approximately 27% of total emissions in unincorporated Marin.

Inputs

Direct emissions from livestock: number of livestock by livestock type, typical methane released per livestock head per year.

Emissions from manure decomposition (methane): number of livestock by livestock type, typical animal mass, weight of solids released per animal mass, portion of farms using different manure management systems (e.g., deep pit, pasture, and anaerobic lagoon), conversion rate of solids to methane for each manure management system.

Emissions from manure decomposition (N2O): number of livestock by livestock type, typical animal mass, Kjeldahl nitrogen released daily in manure (per animal mass), portion of farms using different manure management systems (e.g., deep pit, pasture, and anaerobic lagoon), conversion constant representing the amount of nitrogen in managed manure that volatizes to non-greenhouse gases, conversion rate of remaining nitrogen to N2O for each manure management system.

Qualifications

The assumption is made that all agriculture emissions are found in the unincorporated areas of Marin. Only the livestock contributions to greenhouse gases were calculated. Other agriculture-related emissions from soil and crop management, such as fertilizer applications or crop reside burning, were not calculated due to lack of data. Their contribution is expected to be much lower than that of livestock. Those crops whose residues are commonly burned, such as rice, are grown in very small

quantities, if at all, in Marin County. Livestock-based products account for the vast majority of Marin County agriculture both in value and acreage, due primarily to the nature of West Marin's rugged topography, soil limitations, and scarcity of water.

It was also assumed that the manure management method currently employed was also used in 1987, 1992, and 1997. If manure management methods have changed, some error may be present.

Internal County Greenhouse Gas Analysis

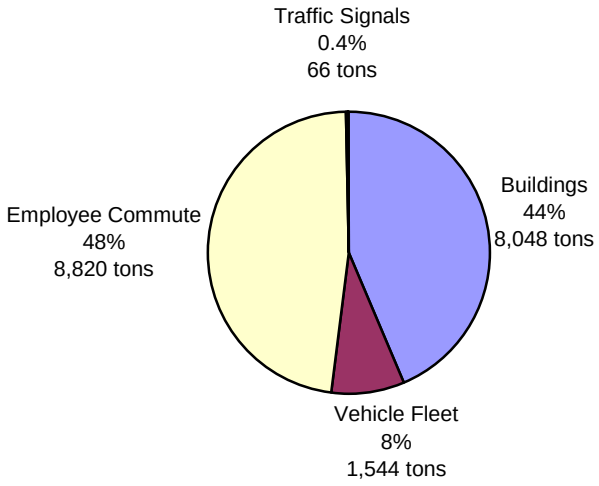
Overview

An inventory was taken of greenhouse gas emissions that result from the County's daily operations. Energy usage was analyzed in the following categories: employee commuting, County facilities, County fleet, traffic signals and waste.

As the graph shows, employee commuting and buildings account for the majority of GHG emissions, followed by County-maintained vehicles, while traffic signals and waste is minor.

Internal emissions are estimated to be 18,450 tons of equivalent CO_2 (eCO_2) for 2000. The following graph illustrates the tons of eCO_2 emitted in 2000.

Total Emissions from Internal Operations



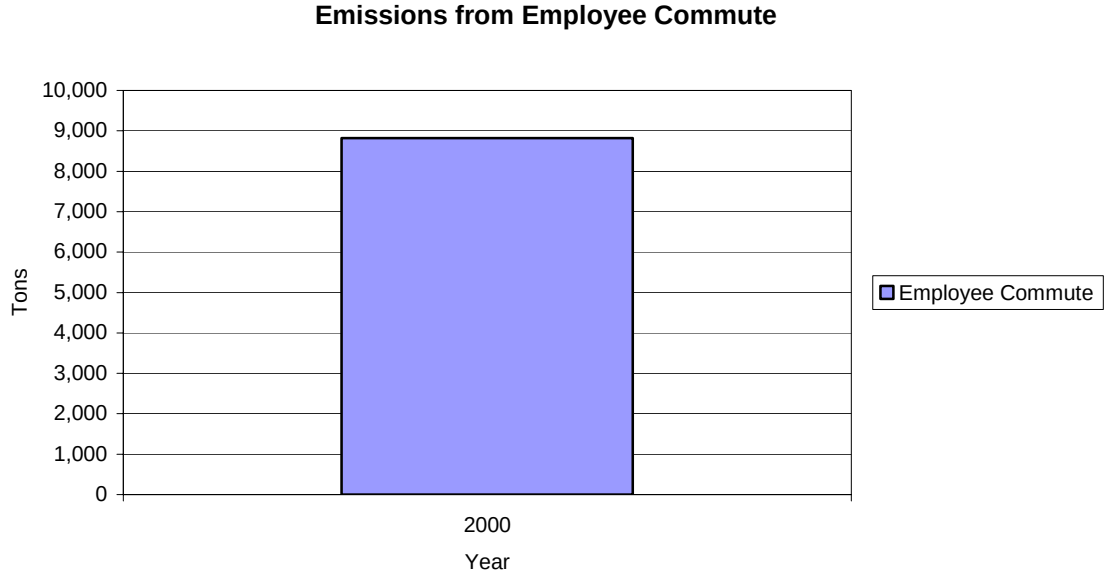
Qualifications

The data for all 1990 categories are approximations based on indicators involving county growth; sufficient data was not available for a complete analysis. The use of 1990 in the following report is only meant as a means of obtaining a broader picture of changes in emissions at the County.

Employee Commute

Employee commuting accounts for 48% of total internal emissions. A survey conducted by the Department of Public Works of 450 out of 2,554 employees shows that a daily average of 84% of our employees drove alone. The survey also states that approximately 49% of County employees live in Marin County and 31% live in Sonoma County, collectively totaling 80%. The remaining 20% live in Contra Costa, Solano, Alameda, San Francisco, and Napa Counties, as well as several other counties outside of the Bay Area, such as Butte and Santa Cruz Counties.

Notably, the County has experienced an almost 10% decrease in employee commute emissions (approximately 1,000 tons), which can be attributed to the success of the County's Employee Commute Alternatives Program, which provides incentives for using public transit, riding bicycles and carpooling.



Qualifications

Transportation data was gathered from surveys conducted by Department of Public Works Transportation Services Division. The survey was able to obtain a relatively high response rate of 17%, though the survey was done during inclement weather, which might skew commuting patterns slightly more towards travel in single-occupancy vehicles.

Buildings

Building energy consumption accounts for 44% of internal emissions. While overall energy use has grown between 1990 and 2000, the Marin Civic Center building, which accounts for over half (54%) of all County facilities' electricity use, performed lighting, heating and cooling retrofits that decrease the annual consumption in that building alone by 26% below 1990 levels. This is equivalent to a 490-ton reduction in CO_2 emissions. However, the increase in square footage of County facility space has lead to an overall increase in energy consumption, as shown in the graph below.

Qualifications

Data for specific County buildings was not available for any facilities in 1990. The approximate levels of electricity and gas usage for 1990 were recorded in a report by Rich Wallace, in the Marin County Maintenance Division.

Vehicle Fleet

The County's vehicle fleet contributes 8% to internal emissions. There was an approximate 36% increase in carbon emissions from County vehicles from 1990 to 2000. While fuel efficiency generally improved over the past decade, the number of vehicles in the County fleet increased from 394 to 491.

Qualifications

For 1990, data was obtained from the 1990 – 1991 Proposed Budget Books, which aggregates gasoline and diesel costs and usage and does not breakdown data by vehicle category.

Traffic Signals

Carbon emissions resulting from traffic signals is 0.5% of total emissions with a 27% decrease in energy consumption from 1990 to 2000. Significant energy savings having been achieved through retrofits of red incandescent bulbs to light-emitting diodes (LEDs). Since 2000, the majority of remaining incandescent bulbs, both green and yellow, have been switched to LEDs.

Qualifications

In order to obtain the estimate for 1990, the assumption was made that energy consumption by traffic signals is relatively the same from 1990 to 1998, as there were no significant improvements or changes to the lamps until LEDs were introduced. Data for 1990 is approximated as 1998 traffic signals data; two additional traffic signals were installed between 1990 and 1998, which are reflected in the calculations.

Waste

Analysis of the County's waste stream shows that, overall, it is a slight greenhouse gas (GHG) sink, at -0.1%, which means that it is absorbing more GHGs than it is emitting. The difference in emissions from 1990 and 2000 is approximately 80%. This is a result of recycling programs, which did not exist in 1990. Recycling programs divert the majority of the County's waste from the landfill.

Qualifications

The data characterizing the County's waste stream (i.e., percentage of waste coming from paper, plants, wood and other) were obtained from the California Integrated Waste Management's Solid Waste Characterization Study, under the category of public administration. A characterization of waste streams for public administrations does not exist for 1990, so data from the closest year (1995) was used.

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Appendix A

RESOLUTION NO. 2002 – 46

A RESOLUTION OF THE MARIN COUNTY BOARD OF SUPERVISORS to participate in the Cities for Climate Protection Campaign to reduce both greenhouse gas and air pollution emissions throughout the community.

WHEREAS, a scientific consensus has developed that Carbon Dioxide and other greenhouse gases released into the atmosphere have a profound effect on the Earth's climate; and

WHEREAS, scientific evidence including the Third Assessment Report from the International Panel on Climate Change and the U.S. Global Change Research Program's First National Assessment indicate that global warming has begun, with the 1990's the hottest decade in recorded history and January 2002 the hottest on record; and

WHEREAS, rising sea levels due to melting glaciers and expansion due to temperature rise is a primary effect of global warming; and

WHEREAS, rising sea level inundate wetlands and other low-lying lands, erode beaches, intensify flooding, and increase the salinity of rivers, bays, and groundwater tables; and

WHEREAS, scientists predict that North America will experience the El Nino effect in 2002-2003 which may exasperate floods, hurricanes, and record-high temperatures; and

WHEREAS, local governments absorb human and financial costs of the damage caused by such effects; and

WHEREAS, energy consumption, specifically the burning of fossil fuels, accounts for more than 80% of U.S. greenhouse gas emissions; and

WHEREAS, local governments greatly influence the community's energy usage by exercising key powers over land use, transportation, construction, waste management, and energy supply and management; and

WHEREAS, more than 160 countries pledged under the United Nations Framework Convention on Climate Change to reduce their green-house gas emissions; and

WHEREAS, the Cities for Climate Protection Campaign, sponsored by the International Council for Local Environmental Initiatives (ICLEI), has invited the County of Marin, California, to become a partner in the Campaign;

NOW, THEREFORE, BE IT RESOLVED by the Marin County Board of Supervisors that the County of Marin commits to participate in the Cities for Climate Protection Campaign and, as a participant, pledges to:

1. Take a leadership role in promoting public awareness about the causes and impacts of climate change.

2. Undertake the Cities for Climate Protection program's 4 milestones to reduce both greenhouse gas and air pollution emissions throughout the community, specifically:

- conduct a greenhouse gas emissions inventory and forecast to determine the source and quantity of greenhouse gas emissions in the jurisdiction;
- establish a greenhouse gas emissions reduction target;
- develop an action plan with both existing and future actions which when implemented will meet the local greenhouse gas reduction target; and
- implement the action plan and monitor progress.

PASSED AND ADOPTED at a regular meeting of the Board of Supervisors of the County of Marin, State of California, on the 23rd day of April, 2002, by the following vote to-wit:

AYES: Supervisors:

NOES: Supervisors:

ABSENT: Supervisors:

_____

CYNTHIA MURRAY, PRESIDENT
MARIN COUNTY BOARD OF SUPERVISORS

Attest:

_____

Mark J. Riesenfeld, AICP
Clerk of the Board

Appendix B – Countywide Analysis Data Sources and Specifics

Energy Use

Information on electricity and natural gas consumption for Marin County was provided by the California Energy Commission (CEC) divided into certain industry categories (residential, commercial, TCU, industrial, farm, and unclassified).

Indicator values for residential energy use (population and number of households) for 1990 and 2000 were determined from the U.S. Census.

Of the commercial and industrial energy use indicators, the number of employees and establishments for each category were taken from the County Business Patterns, provided by the U.S. Census. The numbers are recorded annually, in mid-March of each year. Employment data was divided by the Standard Industry Classification (SIC) prior to its replacement in 1998 by the North American Industry Classification System (NAICS). These codes were used to align employment statistics as closely as possible with the energy consumption categories provided by the CEC. Slight inaccuracies may originate in converting from SIC categories to NAICS or in matching employment categories to energy consumption categories. Farm employment was found from the California Employment Development Department, Labor Market Information Division, Industry Employment and Labor Force, Annual Average, "Total Farm" line (series 000120).

Transportation

To calculate the greenhouse gases resulting from transportation required accessing the annual vehicle miles traveled by category of vehicle and the average fuel efficiency for each category. Annual vehicle miles traveled (AVMT) for Marin County were found in the California Department of Transportation (Caltrans), Division of Transportation System Information, Office of Travel Forecasting & Analysis, Highway Inventory & Performance Branch database (HPMS Database) at http://www.dot.ca.gov/hq/tsip. This includes a breakdown of VMT by municipality.

The percentage of the statewide AVMT traveled by different vehicle types (car, small truck, etc.) and fuel types (gasoline and diesel) is found in California Department of Transportation (Caltrans) California Motor Vehicle Stock, Travel, and Fuel Forecast (MVSTAFF) reports from November 1991 (1990 data) and November 2001 (2000 data). This document also reports statewide fleet fuel economy for each vehicle type and fuel type. The use of statewide numbers to apportion the County's AVMT into vehicle and fuel types may introduce errors to the analysis.

Waste

In the waste sector, greenhouse gases reflect the gases that will eventually be released by the decomposition of the waste sent to landfill in a given year. The California Integrated Waste Management Board (CIWMB) Solid Waste Characterization Database provided the data. Since this varies significantly by the waste composition, the gas amounts are calculated from the tons of waste in

four categories: paper; food; plant; wood, furniture, and textiles; and other. The waste composition data categories of the CIWMB were divided as accurately as possible into these five categories.

Waste tonnage data was provided for the residential and commercial sectors. These sectors were totaled to find the total waste for a year. In the residential sector, CIWMB data was available for 1990 and 1999. Residential tonnages for 2000 were estimated by assuming a constant rate of change between 1990 and 1999 and assuming this rate continued to 2000. Commercial tonnages were available for 1990 and 1999; data for 2000 was extrapolated using the rate of change between 1995 and 1999.

According to the CIWMB website, business waste tonnage and composition is estimated by the business makeup of the county and typical business waste compositions for particular SIC codes, estimated by sorting garbage samples of individual businesses in southern California. Residential tonnages and waste composition is computed using regional per capita disposal rates obtained in the 1999 Statewide Waste Characterization Study. More information on the CIWMB's approximation methods is available at http://www.ciwmb.ca.gov/.

Agriculture

Agriculture-related greenhouse gas emissions were computed by summing the methane directly emitted by animals, the methane produced during manure decomposition, and the N2O produced during manure decomposition. The calculations follow the process prescribed by the United States Environmental Protection Agency (U.S. EPA) Emission Inventory Improvement Program (EIIP) handbook, volume 8, October 1999, Chapters 6 and 7. Equations, conversion factors, and national averages used for typical animal mass and other similar values were found in this report. Livestock populations were taken from the Census of Agriculture produced by the National Agriculture Statistics Service (NASS) and the U.S. Department of Agriculture in 1987, 1992, and 1997. These years' data were applied to the emissions totals for 1990, 1995, and 2000, respectively.

Where livestock population data was not sufficiently detailed, it was supplemented through conversation with Stephanie Larson, Livestock Range Advisor, Marin County Agriculture Extension Office, University of California, Davis. This issue was especially important for cattle populations. For example, the census provides the population counts for mature cows and the total cattle population, but not for the subpopulations of bulls and calves. Thus, a method for estimating these subpopulations was required.

To estimate bull populations, it was assumed that for every 100 cows, beef farms kept 4 bulls and cattle farms kept 1 bull. To estimate calf populations, every adult cow was assumed to have one calf. Of these, 20% become "replacement calves." For every 100 cattle, there are thus 20 replacement calves 0-12 months of age and 20 replacements 12-24 months of age (the 12-24 month replacements should actually be 20% of last year's population, but the census does not occur annually). The other 80% of the calves are typically sold when they're six months old. Thus, in addition to the 20 calves (per 100 adults) that are replacement calves 0-12 months old, there are 80 calves kept for one-half of the year, or approximately 40 additional calves 0-12 months old (per 100 adults). Thus, the population of replacement calves 0-12 months old was 60% of the adult cow population, while the population of replacement calves 12-24 months old was 20% of the adult cow population.

The appropriateness of this population estimation method was confirmed by observing that it yielded total cattle populations very close to the actual county total as counted by the census. For the three years considered, percentage error ranged from was 1.3%, 0.4%, and 8.9%. (Because calves are born in different seasons, it is reasonable to assume that at any given time, half of that year's calves will be present for counting.) When calculating emissions, however, this estimation method may slightly overestimate emissions because a calf kept until 6 months of age will produce less than half of the emissions of a calf kept from birth to age 1, because emissions increase with size. However, a more appropriate scalar for calf emissions could not be found.

In calculating the releases of nitrogen and methane as manure decomposes, for dairy cattle, the EPA calculation method only offers nitrogen and methane conversion values for "heifers," (female cattle that have not calved over 500 pounds). It gives no value for calves under 500 pounds. Nor did the subpopulation categories already calculated (determined by age) line up with these new categories (determined by weight). Therefore, it was assumed that all calves 12-24 months represented a heifer, while all calves 0-12 months of age (a figure that includes those 80 calves kept for one-half the year) represented one-half of a heifer. Other assumptions and more detailed information on data sources and methods can be found by contacting the Marin County Advanced Planning Department.

To calculate the amount of nitrogen and methane released from manure decomposition, assumptions had to be made about the proportion of farms using particular manure management techniques. Percentages of farms employing particular manure management practices, such as deep pit, pasture, and anaerobic lagoon, were estimated by Stephanie Larson, UC Davis, for cattle and sheep, by Michael Murphy, UC Davis, for horses, and by individual animal raisers for turkeys. Where not specified, values (e.g. typical animal mass, methane conversion rates) are national or state averages supplied by the U.S. EPA EIIP handbook. It was assumed that the manure management method currently employed was also used in 1987, 1992, and 1997. If manure management methods have changed, some error may be present. For beef farms, it was assumed that 100% of the manure was deposited on the range. For dairy farms, it was assumed that 70% of the manure was managed in anaerobic lagoons, 15% was managed in drylots, and 15% was deposited on the range.

To calculate the amount of manure released directly by livestock, the population of that animal was multiplied by the pounds of methane typically released annually by that animal.

To calculate the amount of methane released from manure decomposition, the number of livestock was multiplied by the typical animal mass, the typical weight of solids produced per animal mass and the amount of methane produced per unit of solids. The latter value was calculated using a weighted average of the different manure management methods used in the County and these methods' methane conversion rates.

To calculate the amount of N2O released from manure decomposition, the number of each type of livestock was multiplied by the typical animal mass for that type, the Kjeldahl N/year/animal mass, the percentage of manure managed (as opposed to being deposited on the range or paddock), and a conversion factor of 80% which represents the amount of elemental nitrogen that is not volatized to NH3 or NOx and thus remains to potentially become N2O. This calculation determines the amount of elemental nitrogen annually present in Marin County's managed manure. To calculate the amount of elemental nitrogen becomes N2O, the kg/year of unvolatized N was multiplied by a conversion

factor for each type of manure management system weighted by the percentage of manure managed in that system. Because fewer manure management conversion factors were provided, these calculations were less precise than those for methane, reducing the calculation's accuracy slightly.

Appendix C – Internal Operations Analysis Data Sources

Employee Commute

Information taken from the Employee Transportation Survey conducted under the FY 2002-03 Transportation Services Work Program.

Buildings

Data obtained from PG&E as well as the County's energy accounting software, Utility Manager 3.1. Buildings included in this analysis:

Airport
Juvenille Hall
10 & 20 N San Pedro
Health Center
IST, Bel Marin Keys
Garage/radio shop/maintenance
Nicasio Valley Corp Yard
Marin County Jail
Marin Parks and Recreation buildings
Marin Open Space
65 & 161 Mitchell Street, San Rafael
120 Redwood Drive, San Rafael
Flood Control # 1,3,4,7
Storage Tower Near Water Cargo
Reservoir Hill Radio
Civic Center Fountain
White Hills Pump
Housing Authority Facility
Marin City Fire Station, 850 Drake Ave.
Libraries: Novato (Ignacio, Novato Blvd); Corte Madera

Vehicle Fleet

Data obtained from Department of Public Works' fleet accounting software, Cascade.

Traffic Signals

Data obtained from PG&E as well as the County's energy accounting software, Utility Manager 3.1.

Waste

Data obtained from Michael Frost, Waste Specialist with the Department of Public Works.

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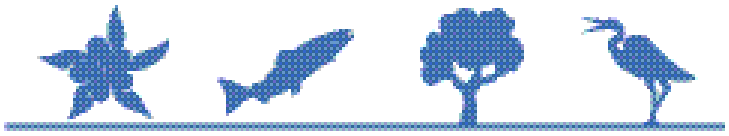
APPENDIX 1-V

TRAILS ELEMENT TECHNICAL BACKGROUND REPORT, JANUARY 2004

MARIN COUNTYWIDE PLAN



Trails Element
Technical Background Report

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Michele Rodriguez, Principal Planner, AICP
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Kristin Drumm, Planner
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January 2004

The Marin County Community Development Agency, Planning Division
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I. EXECUTIVE SUMMARY

Marin County residents have long demonstrated a respect for the natural environment and a desire to preserve that environment for the enjoyment of the public. The Marin Countywide Plan adopted in 1973 included a policy to develop a system of bicycle, hiking, and riding trails to connect open space, residential areas, and activity centers. The County adopted a Trails Element in 1984 which identified a network of 533.6 linear miles of trails in the County in a series of policy maps. In 1991, 464 linear miles of the trails network were open to the public, including 26 miles of paved pathways.

Acquisition of public rights-of-way for the trails network is a difficult issue and is addressed in this technical report. Trails are acquired for public use via: l) gifts of land and easements, 2) prescriptive rights of trail use, 3) purchase, and 4) dedication of trail easements and trails.

Requiring trails dedication prior to issuance of development permits will be more difficult for public agencies since the 1987 Supreme Court decision on Nollan v. California Coastal Commission. The court established that there must be a clear "nexus" between an exaction, such as a trail dedication requirement, and the impact that the development will have. The Nollan decision requires that dedication requirements for public access directly respond to the type of burden on access created by that development.

Funding for the purchase of trails easements could be generated from foundation sources, State recreation programs and new local taxes. The County Parks, Open Space, and Cultural Commission has appointed an Open Space/Trails Committee which works with the Open Space District staff to review upcoming development applications for potential trails easements. They also actively acquire trail rights through purchase or other means.

Trails development is the responsibility of the public entity accepting a dedicated easement. Often the entity is a public agency other than the County, such as Marin Municipal Water District, Golden Gate National Recreation Area or the State Parks System. Trails cost between $2.00 and $8.00 per linear foot to construct, not including the cost of parking, fencing, posting, and other needed amenities.

Although trails design and development are largely a function of the terrain underlying a trail easement, the new trails policies call for protecting the adjacent environment and the rights of adjacent property owners while accommodating a broad range of trail user needs. Specifically, the trails system as a whole should reflect a consideration of the abilities and interests of persons with various physical impairments and the elderly in that at least some trails should be accessible to the handicapped.

Trails maintenance responsibility lies with the public entity accepting a dedicated easement or the underlying property owner if the dedication has not been accepted. Trails sometimes require seasonal closures, repair of amenities such as benches and signs, drainage, the clearing of brush and surface repair. A number of volunteer organizations in the county assist in maintaining trails.

Public and private liability for injuries experienced while on the trail are addressed in several sections of the California Government Code, including Sections 815, 831.2, 831.4, 831.7 and 846. These sections of code set limits on public liability and lay out standards for both public and private immunity from liability so that trails may reasonably be enjoyed by the public.

II. INTRODUCTION

The public lands in Marin County attract visitors from all over the world. The County recognizes that public open spaces and trails in Marin fulfill an important open space need for both residents and visitors. The trails system connects environmentally important areas of the county, such as bayside, coastal and ridgetop areas, established recreational and open space areas, and even developed urban areas.

The voters of Marin County created the Open Space District in 1972 for the acquisition of open space (see the Environmental Quality Element for details). The 1973 Environmental Quality Element called for the development of a countywide trails system and major trails identified on the conservation map. By 1990, more than 150,000 acres of open space had been preserved in Marin by either local, State or Federal efforts. The trails network discussed in this element is intended to connect these valuable lands to each other and to adjacent communities.

III. RELATIONSHIP TO OTHER GENERAL PLAN ELEMENTS AND DOCUMENTS

The Natural Systems Element's Trails Section is related to other general plan elements and documents.

Built Environment Element

Transportation Section: Requires new development to provide trails or paths for bicyclists and pedestrians.

Community Based Policies and Maps Section: Coordinates open space and trails to connect with those designated in the Larkspur and San Rafael General Plans and the Bay Trail.

Natural Systems Element

Biological Resources Section: Discusses how trails interact with the natural environment and animal habitat.

Open Space Section: Discusses open space preservation. Policies should be consulted whenever a particular trail alignment is being considered.

Socioeconomic Element

Parks and Recreation Section: Provides an inventory of parkland. Policies should be consulted whenever a particular trail alignment is being considered. Generally, proposed trails are extensions of existing trails and provide access to already publicly owned open space.

Trails Maps: Used for planning and securing the trails system. The 23 maps have been included in the Natural Systems Element, Trails Section.

Built Environment Element, Transportation Section: See Table TR-1 for road and trails information.

Further references to trails of local significance may be found in city general plans and the community plans for unincorporated portions of the county. Many short trails of local significance may not appear on the Trails Maps but may appear in community plans. Trail policies for specific communities can be found in the San Geronimo Community Plan, the Tamalpais Area Community Plan, and the Inverness Ridge Communities Plan.

Table TR-1. Relationship of Trails Element to other Plans and Elements

Paths/Trails	Elements and Plan Documents
Class I: Bicycle Path (paved, off-roadway)	Marin County Unincorporated Bicycle and Pedestrian Master Plan (2001) Built Environment Element, Transportation Section (2004) Natural Systems Element, Trails Section (2004)
Class II: Bicycle Lane (striped roadway)	Marin County Unincorporated Bicycle and Pedestrian Master Plan (2001) Built Environment Element, Transportation Section (2004)
Class III: Bicycle Route (signed only)	Marin County Unincorporated Bicycle and Pedestrian Master Plan (2001) Built Environment Element, Tramsportation Section (2004)
Unpaved Trails	Natural Systems Element Trails, Section (2004)

IV. EXISTING CONDITIONS

A. PRESENT STATUS OF TRAILS IN MARIN

The trails in Marin are subject to policies governing the use of trails which are established by the various land management agencies in Marin County such as the Golden Gate National Recreation Area, State Parks, the Marin Municipal Water District and the Marin County Open Space District.

Generally, proposed trails are extensions of existing trails and provide access to existing publicly-owned open space and parks or provide connections between various parks and open space areas. Many of the trails in Marin County were originally constructed by the Marin County Fire Department and serve as fire protection access roads and fire breaks. These fire protection access roads, or fire roads, pass through public and private lands. In the past they were all maintained on an ongoing basis by the Fire Department. Some old logging and ranch roads are also important links in the overall trail network.

In cases where proposed trails pass through private property, property owners vary in their reactions toward the designated use of their land. Some view trails and trail dedications as a development amenity which adds value to a project. Others tolerate or discourage use of the trails and access roads. On private trails throughout the central and western parts of the County where grazing and other agricultural land uses predominate, a number of property owners allow individual or group use of their

trails on a permission basis. Various equestrian organizations stage annual long distance riding events which require permission from landowners.

B. TRAIL USERS

The following discussion will briefly describe the four predominant trail users of Marin County: hikers, equestrians, bicyclists, and disabled trail users. These types of trail users have been identified by the various land management agencies throughout Marin County which develop and implement trail use policies within their jurisdictions. The following passages do not establish County policy for trail use. They are descriptions of policies established by the land management agencies.

1. Hikers

Hikers represent a large and varied group of users ranging from a hiker or runner who covers from 10 to 20 miles in one day to the hiker who may venture into an open space area for a short stroll and return home within a matter of minutes. Much of the hiking is done by individuals or small groups and some is done in conjunction with organized groups like the Sierra Club, Bay Area Ridge Trail, and other organizations. With the exception of some overnight hiking and camping areas in the Point Reyes National Seashore and GGNRA, most of the hiking on County trails is day use.

2. Equestrians

Equestrian use of the trails in Marin County is quite extensive. Use may be on an individual basis or in organized group trail riding activities. Most equestrian activities take place outdoors, because of the county's mild climate and varied terrain.

Marin has a large number of active riding clubs and commercial equestrian facilities. Many experienced riders make long distance rides on the trails. It is anticipated that equestrian use of the trails will continue at this level for the foreseeable future.

3. Bicyclists

Multi-speed bicycles with narrow tires are popular for recreation and transportation purposes. Road bikes are light and work well on paved surfaces. Some long-distance riders may cover 50 to 100 miles in a day's ride. The Transportation Section details other factors concerning road bikes and their riders.

Mountain bikes, also known as all-terrain bikes or off-road bikes, have grown in popularity over the past several years. Because of their strong construction, low gearing, powerful brakes, and wide high-traction tires, mountain bikes can traverse both paved and unpaved surfaces and a wide variety of terrain. Many mountain bicyclists prefer an unpaved surface.

Mountain bicyclists are major users on unpaved trails throughout the county. During the latter half of the 1980s, most public agencies in Marin prohibited mountain bicycling on narrow, single-track trails. Most public agencies in Marin allow mountain bike users on fire roads.

Shared use and the avoidance of hazards on trails requires sensitivity on the part of three user groups: mountain bicyclists, hikers, and equestrians.

4. Disabled Trail Users

Disabled trail users may require special design accommodations for sight, hearing and mobility impairments. Disabled trail users may choose walking, horseback riding, or mountain bicycling as their mode of trail transportation, though a significant portion of this group is reliant upon wheelchairs or walking aids.

This user group appreciates opportunities to join in trail experiences with disabled and non-disabled friends and family members. Mobility-impaired trail users, like other individuals, vary with regard to the level of challenge they seek in their trail experiences, though they are much more sensitive to steep gradients, narrow trails, and rough or unstable surfaces than others. Such physical conditions, commonly found in public open spaces, may often preclude the use of public trails by the mobility impaired.

The number of elderly residents in Marin is increasing and, as a consequence, the number of disabled trail users in also expected to increase.

C. TYPES OF TRAILS

Marin County land management agencies have identified the following three types of trails:

Single-track trails: unpaved trails that vary in width and are too narrow for service vehicles. Gradients on these trails are usually varied with some obstructions and line of sight is usually less than 100 feet.

Double-track trails or fire roads: unpaved trails that are wide enough to accommodate fire protection and service vehicles. Many of these trails were originally constructed as fire protection roads.

Class I bicycle paths; paved routes on a right-of-way, which are completely separate from a street and may include an unpaved section for pedestrians and joggers. An example of this type of path is the Tiburon bike path.

D. USES FOR TRAIL TYPES

Each land management agency in Marin County governing use of park and open space lands develops policies regarding uses for trail types within its jurisdiction. Each agency develops policies based upon the physical characteristics of the trails in its jurisdiction, such as slope, width, clearance, line-of-sight, susceptibility to erosion. The agencies also develop safety requirements for trail users. The primary goal of the land management agencies is to provide varied and quality outdoor experiences for a range of trail users and to develop policies which are reflective of environmental and safety constraints, community needs, and the needs of recognized user groups. The County encourages land management agencies to work with representatives of hiking, equestrian, and bicycling groups and with organizations representing persons with disabilities when developing criteria for designating trails for the recognized user groups. Classifications presented in this element are descriptive only and reflect the policies currently in place on most park and open space lands in Marin County. These classifications

are not intended for use by land management agencies in the future when they formulate trail policies for newly acquired trails. Policy documents for the various land management agencies are listed in the bibliography of this element.

1. Hiking-only Trails

Hiking-only trails provide opportunities to enjoy the intimacy, interpretive experience, and aesthetic qualities in open space areas without distractions from other users. This type of trail can be quite narrow with various obstructions, and it may traverse steep gradients. If a footprint appears alone on the maps, it indicates a hiking-only trail.

In general, hiking trails are located within a 10 foot wide right-of-way. The physical improvements of the hiking trail may vary somewhat; however, a minimum tread width of two to three feet is normally required. On some steep slopes, the tread width may diminish to 12 to 18 inches, but only for short distances. Grades along a hiking trail may vary, although steep grades are tiring for hikers and may create erosion problems. Grades of 10% or less are desirable, but 15%-20% is considered generally acceptable for short distances. Some trails with grades in excess of 20% exist in the County.

Exceptions to the criteria for hiking-only trails include:

> Trails that were constructed specifically for hiking that do not have steep gradients and may be paved, such as the trail in Muir Woods; and,
>
> Other trails designated as hiking-only by the governing land management agency such as the Marin Municipal Water District.

These trails are not appropriate for equestrian or bicycle use, due to concerns about quality of experience, safety, susceptibility to erosion and physical constraints such as steep gradients, narrow tread, overhead clearance, and obstructions.

2. Equestrian/Hiking Trails

These trails provide a leisurely horseback riding or hiking experience without distraction from other types of users. Such trails normally include substantial overhead clearance.

Equestrian/hiking trails are unpaved and located within a 10 to 20 foot right-of-way. The developed width of the trail can vary from three to six feet. Gradients for equestrian/hiking trails are similar to those for hiking trails. Publications listed in the technical report detail the physical requirements of these trails.

Exceptions to the criteria for equestrian/hiking trails include:

> Trails that were specifically constructed for equestrian/hiking use-only, but may be wide enough to accommodate other users; and,
>
> Other trails designated as equestrian/hiking-only by the governing land management agency.

Trails in this category are often narrow with steep or winding tread. They are not appropriate for bicycle use because of potential safety problems and diminished quality of experience.

3. Combined Use Trails

These trails provide an opportunity for joint use by mountain bicyclists, hikers, and equestrians. Shared use requires cooperation and sensitivity on the part of all users. This type of trail is indicated by a hoof print and circle symbol on a trail map.

Combined use trails offer substantial overhead clearance and a tread width (generally 6 to 12 feet) sufficient to safely accommodate multiple trail users. For the most part, these trails do not exceed moderately steep gradients. These trails often serve as fire protection roads, although some of trails are specifically designed for combined use.

Exceptions to the criteria for combined use trails include:

Trails that were constructed specifically for all three types of users but may not be wide enough for fire protection vehicles.

Trails that are designated as appropriate for hikers, equestrians, and bicyclists by the governing land management agency.

Trails that may be designated for specific user group combinations.

4. Paved Paths

Paved paths are multi-use trails. Equestrian use is generally not compatible with this type of trail, unless an unpaved area of sufficient width is provided along the side of the road. Plans and projects for paved countywide bike paths are reviewed by the Bikeways Committee, staffed by the County Department of Public Works.

Eight feet is the minimum paved width of the Class I type paved path. Typically the path has a paved surface eight to ten feet wide and jogging or hiking areas along the shoulders. Where more than modest use is anticipated, a 10-foot paved section should be constructed. In addition to the paved section, the trail should include an unpaved 18 inch pedestrian/jogging path on either side. An ideal improved section of 13 feet can be accommodated within a 20 foot right-of-way on level surfaces. However, an additional right-of-way width may be necessary when slopes, buffers, or other improvements are taken into consideration.

The Marin County Bicycle and Pedestrian Master Plan was adopted in June 2000 which replaced the 1975 Bicycle Plan for Marin. It includes recommendations regarding safety improvements and alignments of paved bike paths and bicycle routes along roadways, referred to as either Class I, II, or III bicycle paths. Recommendations regarding Class I bicycle paths are also included in the Trails Element because Class I paths are open to pedestrians as well as bicyclists. The Trails Element also indicates where bicycles may be used on unpaved routes. The circle symbol appearing alone on a trail map indicates a Class I type of multi-use path.

5. Trail Access For Persons With Disabilities

Many trails lend themselves to use by persons with disabilities. Multi-purpose pathways which accommodate pedestrians and bicycle riders are ideal for barrier-free access and should be planned accordingly. In most cases, existing gradients and curb cuts designed for cyclists offer satisfactory wheelchair access. Barriers placed at entrances to pathways for prohibiting entry by motorized vehicles must be designed to accommodate wheelchairs, unless such use would be unsafe or cause severe management problems or environmental impact.

In accordance with State and Federal ADA accessibility policies for recreational facilities, the county's trails should be designed whenever possible in consideration of the abilities and interests of a diverse population, including persons with disabilities and the elderly. A sensitively designed trail must have a continuous "path of travel," meaning no breaks or interruptions in the route such as streams, impassable barriers or gates.

The trail should have a solid, slip resistant surface, and a continuous, unobstructed route of no more than 5% in slope. The cross-slope (side-to-side grade) should be no more than 2% to prevent tipping over and falls. Other important features include: safe, level, and accessible parking; accessible drinking fountains, toilets, phones; and trail information at the trailhead.

The County needs a map showing accessible trails and describing their characteristics. Currently, the County does not have a good map of accessible trails, although some portions of existing trails may already be accessible. Consideration should be given to produce this type of map.

E. PROPOSED TRAILS TO CONNECT THE BAY AREA

1. The Bay Area Ridge Trail

The San Francisco Bay Area Ridge Trail is a regional trail project proposed by the Bay Area Ridge Trail Council (BARTC), a private non-profit organization of individuals, park partners, recreational and community groups. The proposed 450-500 mile Ridge Trail will ultimately follow the ridges and hills that circle the Bay through nine Bay Area counties. The trail will connect over 75 parks and public open spaces, including those owned and managed by Federal, State, regional, and local jurisdictions, as well as private land trusts such as the Ridge Trail Council.

The Ridge Trail will provide recreational opportunities and dramatic vistas for hikers, equestrians and bicyclists. Many segments of the trail are now complete. The target date for completion of 300 miles is 2005, and 400 miles is expected to be completed by 2010.

To the greatest extent possible, the Ridge Trail has used existing County trails and rights-of-way. When trail connections necessitate use of private lands, private landowners have been approached to discuss voluntary dedication of public easement or land. In Marin County, the Ridge Trail goes through existing public lands or along alignments indicated on the Trails Plan maps adopted by the County in 1984.

2. San Francisco Bay Trail

The Association of Bay Area Governments (ABAG) was directed by the State Legislature to prepare and adopt a plan and implementation program for a continuous recreational hiking and bicycle trail around the perimeter of the San Francisco and San Pablo Bays.

Under the authority of SB 100 (Lockyer), the plan must include a specific route which relates to existing park and recreational facilities and links existing and proposed public transportation facilities. The Environmental Impact Report for the Bay Trail was certified in June, 1989, and the final plan was adopted in July, 1989.

In Marin County, the Bay Trail follows some alignments already in public use, like Paradise Drive in Tiburon and Point San Pedro Road in San Rafael. However, a portion of the trail between the Marin Civic Center and Route 37 in Novato uses the Northwestern Pacific Railroad right-of-way.

ABAG expects to complete most of the Bay Trail by 2013.

3. State Coastal Trail

The California Coastal Conservancy has revised Plans for a multiuse Coastal Trail running the length of Marin County and the State. Preliminary plans have been completed and should be incorporated into the County trail Plan maps as well as the local Coastal Plan. Efforts in the past by the Coastal Commission, Coastal Conservancy and other resource agencies have provided some secured right of way for this trail. In addition remnants of the old California Riding and Hiking trail also should be secured by the Conservancy if they are pertinent to implementing this trail. The nonprofit Coastwalk's efforts have contributed to the reintroduction of this trail which is of Statewide significance.

V. TRAILS ACQUISITIONS

The Marin County Trails Committee has identified over 200 miles of trails proposed for Marin County. These trails may be significant as recreational resources or may serve as important links for existing recreational facilities.

Trails are acquired for public use via: 1) gifts of land and easements, 2) prescriptive rights of trail use, 3) purchase, and 4) dedication of trail easements and trails.

A. GIFTS OF LAND AND EASEMENT

The acceptance of gifts of trails and trail rights-of-way is a viable means of preserving trails for public use. Individual owners may find it to their advantage to offer a gift of a trail that is currently being used by the public. The advantages may include, but not be limited to: income tax benefits for the donor, elimination of maintenance of the trail by the original owner, added security on the trail by increased or new patrolling by the accepting public agency, shift of legal liability to the accepting public agency, as well as the opportunity for philanthropy to benefit the community.

Gifts of trails and trail rights-of-way to a responsible agency, like the Open Space District, are viable means of preserving trails for public use. Along with the philanthropic reward, property owners donating trail to a public agency may realize benefits, including: income tax benefits; relinquishment of legal liability and maintenance responsibilities; and trail security provided by the accepting agency.

B. DEDICATION OF TRAIL EASEMENTS AND TRAILS

County and city subdivision ordinances have legal authority to require easement dedications. The Supreme Court decision, Nollan v. California Coastal Commission, requires a direct nexus between the requirement of an exaction (i.e. an easement) and the impact of a development. The Nollan decision requires that dedication requirements for public access directly correspond with the type of burden on access created by development.

During the development permitting process, the County Community Development Agency and/or Open Space District may request dedication of a public easement for a trail. In many cases, the benefits gained through dedication offer sufficient incentive to encourage voluntary dedication.

Once the easement is secured through negotiation, the developer makes a formal offering of the easement. The easement is recorded on an addendum to the final map and in a separate written legal description. The property owner retains ownership and title to the land. The public is simply allowed use of the land for a trail. An easement offered for dedication is intended to run with the land in perpetuity.

Possible County responses to the offer of dedication are:

> Consent to recordation of the easement. In this case, an easement is recorded as a legal description with the County Recorder. The easement does not disappear unless someone petitions to vacate it.
>
> Rejection of the dedication. In this case, the easement is reserved as a legitimate right of the public, yet is not accepted by a public entity for trail development, maintenance, and liability. The offer of dedication may be subject to acceptance at a later date.
>
> Acceptance of the dedication. In this case, responsibility for trail development, maintenance, and liability is accepted by a receiving entity. The receiving entity may be a jurisdiction, service district, or non-profit organization such as The Nature Conservancy. The assignment of the receiving entity should be made at the time of dedication.

Although dedication of trails and trail easements has been an important method of preserving trails within Marin County, public purchase of land has provided most trails.

C. PRESECRIPTIVE RIGHTS OF TRAILS USE

Trail preservation by prescriptive right is a method that has been utilized in the past and could be effectively utilized in the future. This method has been used successfully in local communities such as Tiburon. The law provides that, in certain cases, when public access across private property has been

unimpeded by the land owners for a period of five or more years, the public may have gained a permanent right of access to this trail without express consent of the owner.

D. PURCHASE

Purchase of trail easements and trails is desirable in cases where, because of timing or other reasons, other methods are not practical. The Marin County Open Space District and Bay Area Ridge Trail Council actively pursue fee purchase of trail rights.

VI. ACQUISITION ISSUES

Since the acquisition of trails through the use of dedications may be limited in the future by the Nollan decision, the facts of this case and its ramifications for future planning are presented below.

A. NOLLAN V. CALIFORNIA COASTAL COMMISSION

The State has broad powers to regulate land for the health, safety, and general welfare of its populace. In so regulating, the State must establish that the regulation: l) advances a legitimate State interest; 2) furthers the State interest which it was designed to serve; and 3) allows for a reasonable, beneficial use of the land.

James and Marilyn Nollan contested a requirement to permit public access across the sand beach between their seawall and the high tide line in order to obtain a permit to enlarge their beachfront home. The Nollans contended that the required donation of a public right-of-way constituted a taking of private property for public use without just compensation, a governmental act forbidden by the Constitution. The Coastal Commission asserted that the proposed structure reduced visual access to the beach from the coastal highway. The right-of-way requirement was a mitigation measure, a substitution of physical access for the loss of visual access.

California courts have held that the dedication of real property as a condition to the receipt of a development permit is a valid exercise of governmental authority where the dedication has been reasonably related to lessening the adverse impacts of development. In Nollan v. California Coastal Commission, the Supreme Court reaffirmed the broad scope of governmental authority to regulate land use, but articulated a much stricter requirement for a nexus between the impact of that development and the dedication required to alleviate that impact.

Assuming the legitimacy of the State's interest and the retention of economic viability of the property with the dedication requirement, the Court ruled in favor of the Nollans. The court found that the condition placed on development failed to further the State interest advanced as justification for the condition. It dismissed the substitution of physical access for visual access as merely a play on words. The requirement of a direct relationship, a "nexus" between the land use regulation and the State interest, was underscored. The Court affirmed the validity of dedications, which specifically address the burden created by a particular project.

The Nollan decision requires that dedication requirements for public access directly respond to a type of burden on access created by that development. In his article "Property Rights in the Supreme Court", Joseph Sax says that had the Coastal Commission "predicated its regulation on a showing of long standing public use, and some evidence that development was deterring that use, a regulation or exaction designed to mitigate that effect would likely have been upheld" (Sax, 1987).

In Marin County, "prescriptive rights" may be argued as a basis for requiring dedications on popular trails, which have been used over the years by the public. On those properties where the public has long enjoyed a path across the land, development which impedes that path of travel may be required to dedicate an easement as a remedy for the impact of the development.

In the future, dedications will need to be carefully established in order to meet the rigorous scrutiny of the Nollan decision. However, this decision should not deter the pursuit of dedications. "Even a valid governmental purpose and public benefit may not be enough to obtain a dedication unless the County or other public entity is willing to purchase the easement. It is clear that the U. S. Supreme Court will inspect an exaction more closely to ensure that certain individuals alone are not forced to bear public burdens which, in fairness and justice, should be borne by the public as a whole" (Armstrong v. U. S. (1960) 354 U. S. 40, 49, and Nollan v. Coastal Commission).

B. FUNDING FOR TRAILS ACQUISITIONS

Since the Nollan decision tightened the rules under which dedications may be required as a condition of development, the County should explore funding possibilities for the acquisition of trails. Such possibilities include the utilization of State Bond Funds and Foundation grants to help finance these purchases.

C. COORDINATION OF TRAIL ACQUISITIONS

An 11-member Open Space and Trails Committee oversees trails planning for Marin County. This standing committee of the County Parks, Open Space and Cultural Commission meets monthly. The committee reviews upcoming development projects with the purpose of obtaining trails dedications, planning trails that connect publicly-owned lands, and making recommendations for development and implementation of the Trails Element policies.

The Planning Department and Open Space District are responsible for comprehensive trails planning. The county prepares the Trails Element and Trails Section Map Series. The Open Space District implements the Element and manages the trails. District staff and the Trails Committee review development permits for potential acquisition of trails designated in the Map Series.

Trails of local significance may not necessarily be represented in the Trails Element Map Series. These trails are often short, but offer local trail users with a multipurpose alternative to paved public roads. When proposed development threatens to remove these shorter trails, the County encourages local groups to preserve the trails.

VII. TRAILS DEVELOPMENT

A. RESPONSIBILITY

The responsibility for trails development lies with the property owner or the public entity accepting a dedicated easement.

B. COST

The cost of developing a trail is dependent upon several factors; trail type, slope, soil condition, the method of trail construction, materials used, etc. A 1988 survey of the Golden Gate National Recreation Area, Open Space District, California State Parks, the Marin Conservation Corps, and Trail Center to obtain information on trail construction currently the construction cost for a four-foot wide hiking trial constructed with a backhoe tractor by a skilled crew to be $2.00 to $2.50 per linear foot. Use of a hand crew, such as the Marin Conservation Corps, cost between $4.00 and $8.00 per linear foot. Some agencies have trailmaking machines, which lowers the cost of construction to less than $2.00 per linear foot.

C. TRAIL ACCESSIBILITY

Access to trails involves several factors, including parking, maps and literature, and continued access of trails for historic users.

Some trails, primarily those of greatest countywide significance, are developed with parking facilities and/or other amenities at trailheads. Trails used primarily by neighborhoods tend to have little or no parking. Availability of parking may be affected by the desires of local community, policies of the County or cities, or objectives of the land agency managing the trail. In areas where the popularity of public lands and trails causes parking congestion and neighborhood difficulties, local jurisdictions may institute parking restrictions. These restrictions reduce the local problem, but limit the ability of the wider public to reach public trails. For this reason, the County must be vigilant in preventing open space and trails from becoming private amenities at public expense.

Individuals can learn about the availability of public trails by obtaining literature and maps prepared by the managing agencies. Other maps and information can be found in guidebooks prepared by private sources. Trails that do not meet agency standards or are not legally open to the public may intentionally be excluded from these maps although they are regularly used by the public.

Some trails used by the public begin or continue onto private lands, which are subject to closure at the discretion of the landowner. Closure of privately owned trails long used by the public can create strong feelings of animosity between landowners and the historic trail users. In many cases, public land agencies may take action to guarantee public access to historic trails, including a request for trail easements dedicated during the development process, negotiation for the purchase of a trail easement, or pursuit of a prescriptive rights court case.

In some cases, historic trails on private land may be frequently used by particular user groups before the trail is acquired by a public agency. Depending on the agency's trail use policies, historic users may be precluded from further use of the trail when policies prohibit such use. Although the trail may become legally public where it was once private, a user group may view application of such trail use policies as an infringement upon its historic right of use. For this reason, the County encourages trails designation and design to give full consideration to the historic users of a newly acquired trail.

VIII. TRAILS MAINTENANCE

A . RESPONSIBILITY

The maintenance of trails requires seasonal closures when appropriate, user group management, repair of amenities like benches and signs, trail drainage, brush clearing, and surface repair. The responsibility for trail maintenance rests with the property owner or the public entity accepting an easement dedication.

B. RESOURCES

Maintenance work may be contracted out on a private basis or secured through a volunteer organizational effort. Organizations which may participate in trail construction and maintenance include the Marin Conservation Corps, the Tamalpais Conservation Club, the Sierra Club, equestrian groups, cycling groups, Boy Scouts and Girl Scouts, or neighborhood and community groups.

IX. LIABILITY

The existing trails policy refers to preserving "trails for public use with due consideration of liability exposure of property owners adjacent to the trail." This reference oversimplifies the true complexity of the liability issue which, in practice, defied such a simplistic approach. The following section discusses briefly the liability protection both public entities and private individuals have under primarily California law.

A. CALIFORNIA LAW

A number of statutes have been enacted by the legislature to address the various conditions under which liability may be established and those conditions under which liability is limited to both public entities and private individuals. However, the statutes are vague, and the subtle nuances of the case law require detailed review.

B. PUBLIC LIABILITY

California Government Code Section 815 established the immunity government has from being sued while carrying out public policy. However, the Federal Tort Claims Act provides the framework for bringing just such suits against the government.

California Government Code Section 835 holds public entities liable for dangerous conditions on their property if the conditions create a reasonably foreseeable risk of injury. The public entity must be negligent in either: 1) creating the condition; or, 2) taking action to correct the condition (once notice is given) to establish the basis for a lawsuit.

The legislative committee comment on the statute goes even further to state that: "Even if the elements stated in the statute are established, a public entity may avoid liability if it shows that it acted reasonably in the light of the practicability and cost of pursuing alternative courses of action available to it."

A defense such as "comparative negligence" or "assumption of risk," may also be used to avoid liability under this statute. Under such a defense, the government may claim that a plaintiff has acted negligently or to have knowingly and freely assumed a risk which resulted in injury.

There are three California Government Code sections which address the issue of public liability on lands used for recreational purposes:

1. California Government Code Section 831.2 states: "Neither a public entity nor a public employee is liable for an injury caused by a natural condition of any unimproved public property, including but not limited to any natural condition of any lake, stream, bay, river or beach."

   In his analysis of Section 831.2, Van Alstyne says, "The scope of immunity is not entirely clear; the act does not provide a precise standard for determining when, as the result of developmental activity, public property in its natural state ceases to be unimproved. However, it appears that some form of physical change in the condition of the property at the location of the injury, which justifies the conclusion that the public entity is responsible for reasonable risk management in that area, may be required to preclude application of the immunity" (Van Alstyne, 1985).

2. California Government Code 831.4 states:

   > A public entity, public employee, or grantor of a public easement to a public entity for any of the following purposes, is not liable for an injury caused by a condition of: (1) Any unpaved road which provides access to fishing, hunting, camping, hiking, riding, including animal and all types of vehicular riding, water sports, recreational or scenic areas and which is not a ... public street. (b) Any trail used for the above purposes. (c) Any paved trail, walkway, path, or sidewalk on an easement of way which has been granted to a public entity, which easement provides access to any unimproved property, so long as such public entity shall reasonably attempt to provide adequate warnings of the existence of any condition of

> the paved trail, walkway, path or sidewalk which constitutes a hazard to health or safety. Warnings required by this subdivision shall only be required where pathways are paved, and such requirement shall not be construed to be a standard of care for any paved pathway or road.

The legislative committee comment under Section 831.2 states that this section and Section 831.4 continue to extend an existing policy adopted by the Legislature in former Government Code Section 54002. "It is desirable to permit the members of the public to use public property in its natural condition and to provide trails for hikers and riders and roads for campers into the primitive regions of the State. But the burden and expense of defending claims for injuries would probably cause many public entities to close such areas to public use. In view of the limited funds available for the acquisition and improvement of property for recreational purposes, it is not unreasonable to expect persons who voluntarily use unimproved public property in its natural condition to assume the risk of injuries arising therefrom as a part of the price to be paid for benefits received."

3. California Government Code Section 831.7 sets limits on public liability to "any person who participates in hazardous recreational activity...who knew or reasonably should have known that the hazardous recreational activity created a substantial risk of injury to himself..." The definition of hazardous recreational activities includes animal riding and bicycle racing, activities which may occur along trails.

C. PRIVATE LIABILITY

Protection for the private property owner who dedicates an easement for the enjoyment of the public is afforded by California Civil Code Section 846. It states that an owner of any estate in real property owes no duty of care to keep the premises safe for entry or use by others for any recreational purpose, excepting willful or malicious failure to guard against or warn of dangerous conditions.

D. MARIN COUNTY EXPERIENCE

According to the County Counsel's office, no trails related cases have gone to court in the past few years. A number of bike-trail related cases have been brought against the County, resulting in substantial legal efforts and exposure.

E. REFERENCING LIABILITY WITHIN THE TRAIL ELEMENTS

The subject of liability will be omitted from the Trails Element for the following reasons:

1) As this report indicates, liability is a complex issue. Cursory summations for inclusion within a planning document belie this complexity and thus are not appropriate.

2) Omitting liability discussions from Plan Elements is common practice. One can easily imagine the liability issues attendant to the Transportation and Environmental Hazards elements, yet

the subject is not typically discussed in these State-mandated elements. Therefore, there should be consistency in the treatment of liability issues in such optional elements as the Trails Element.

3) The liability reference may in of itself be provocative and thus undermine the spirit and intent of the Trails Element.

GLOSSARY

Bicyclist	Includes bicyclists on Motocross (BMX), touring, and mountain bikes.
Class I Path	Off-roadway paved bicycle path.
Class II Path	Adjacent to roadway paved bicycle path.
Class III Path	Signed only paved bicycle path.
Disabled Trail User mobility impairments.	A person requiring special accommodations for sight, hearing and
Double-track trail	Unpaved trail, 8 to 10 feet wide.
Equestrian	Includes casual, group, competitive, and endurance riders and equestrian with disabilities.
Hiker	Includes runners, joggers, casual hikers, backpackers, interpretive hikers and hikers with disabilities.
Line-of-sight	The maximum visible distance between two trail users.
Path	Paved surface for bicycles, joggers and pedestrians.
Right-of-way	Corridor within which the trail is constructed.
Single-track trail	An unpaved trail two to six feet wide with gradients as high as 20% or more in some places.
Tread	Usable width of the trail.
Trail	An unpaved route.
Trailhead	Trail connection to paved roadways.

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