INITIAL STUDY
AND
MITIGATED NEGATIVE DECLARATION
OF ENVIRONMENTAL IMPACT

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT

May 23, 2011

Lead Agency:
SONOMA COUNTY WATER AGENCY
404 Aviation Boulevard
Santa Rosa, CA 95403

Prepared By:

David Cuneo
Senior Environmental Specialist
(707) 547-1935
Sonoma County Water Agency

POSTING AND REVIEW PERIOD: June 3, 2011 to July 18, 2011

TABLE OF CONTENTS

PROJECT TITLE 1
INTRODUCTION 1
PROJECT LOCATION 1
PROJECT BACKGROUND 1
PROJECT PURPOSE AND NEED 4
PROJECT DESCRIPTION 4
NOTICE OF PREPARATION AND SUMMARY OF COMMENTS 26
ENVIRONMENTAL SETTING 27
RIGHT-OF-WAY 33
LAND USE AND CONFORMANCE WITH GENERAL PLAN 33
ENVIRONMENTAL EVALUATION AND MITIGATION MONITORING 36
JURISDICTIONAL/PERMITTING AGENCIES 36
FINDING 36
SUMMARY OF ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED 36
ENVIRONMENTAL CHECKLIST 37
I. AESTHETICS 38
II. AGRICULTURAL AND FOREST RESOURCES 40
III. AIR QUALITY 42
IV. BIOLOGICAL RESOURCES 44
V. CULTURAL RESOURCES 48
VI. GEOLOGY AND SOILS 50
VII. GREENHOUSE GAS EMISSIONS 52
VIII. HAZARDS AND HAZARDOUS MATERIALS 53
IX. HYDROLOGY AND WATER QUALITY 56
X. LAND USE AND PLANNING 59
XI. MINERAL RESOURCES 60
XII. NOISE 61
XIII. POPULATION AND HOUSING 63
XIV. PUBLIC SERVICES 64
XV. RECREATION 65
XVI. TRANSPORTATION/TRAFFIC 66
XVII. UTILITIES AND SERVICE SYSTEMS 68
XVIII. MANDATORY FINDINGS OF SIGNIFICANCE 69
DETERMINATION 71
SUPPORTING INFORMATION SOURCES 72

FIGURES

FIGURE 1. PROJECT LOCATION 3
FIGURE 2. KEY TO DEMONSTRATION PROJECT AREA RIVER MILE FIGURES 8
FIGURE 3. EXISTING CONDITIONS FOR RIVER MILE 6.2 TO 6.5 9
FIGURE 4. PROPOSED ENHANCEMENT FOR RIVER MILE 6.2 TO 6.5 10
FIGURE 5. EXISTING CONDITIONS FOR RIVER MILE 6.5 TO 6.6 11
FIGURE 6. PROPOSED ENHANCEMENT FOR RIVER MILE 6.5 TO 6.6 12

FIGURE 7. EXISTING CONDITIONS FOR RIVER MILE 6.6 TO 6.9 13
FIGURE 8. PROPOSED ENHANCEMENT FOR RIVER MILE 6.6 TO 6.9 14
FIGURE 9. EXISTING CONDITIONS FOR RIVER MILE 6.9 TO 7.1 15
FIGURE 10. PROPOSED ENHANCEMENT FOR RIVER MILE 6.9 TO 7.1 16
FIGURE 11. EXISTING CONDITIONS FOR RIVER MILE 7.1 TO 7.3 17
FIGURE 12. PROPOSED ENHANCEMENT FOR RIVER MILE 7.1 TO 7.3 18
FIGURE 13. BANK STABILIZATION EXAMPLE GRAPHIC 19
FIGURE 14. DRY HIGH-BANK STABILIZATION EXAMPLE GRAPHIC 19
FIGURE 15. BACKWATER CHANNEL EXAMPLE GRAPHIC 20
FIGURE 16. BACKWATER POND EXAMPLE GRAPHIC 20
FIGURE 17. SIDE CHANNEL EXAMPLE GRAPHIC 21
FIGURE 18. LOG JAM EXAMPLE GRAPHIC 21
FIGURE 19. POOL ENHANCEMENT EXAMPLE GRAPHIC 22
FIGURE 20. RIFFLE CONSTRUCTION EXAMPLE GRAPHIC 22
FIGURE 21. PROPOSED HABITAT CHANGES 25
FIGURE 22. CNDDB OCCURRENCES 35

APPENDICES

A. Notice of Preparation and Comment Letters Received
B. Special Status Species Potentially Occurring Within the Dry Creek Habitat Enhancement Demonstration Project
   B-1. Special Status Plant Species Potentially Occurring Within the Dry Creek Habitat Enhancement Demonstration Project
   B-2. Special Status Wildlife and Fish Species Potentially Occurring Within the Dry Creek Habitat Enhancement Demonstration Project
C. Plant Species Observed Within the Dry Creek Habitat Enhancement Demonstration Project
D. Draft 60% Complete Design Report – Dry Creek Habitat Enhancement Demonstration Projects: River Miles 6.2 to 7.3
E. Dry Creek Habitat Enhancement Demonstration Project Draft Mitigation Monitoring Plan

PROJECT TITLE

This Initial Study and Mitigated Negative Declaration has been prepared by the Sonoma County Water Agency (Water Agency) for the **Dry Creek Habitat Enhancement Demonstration Project.**

INTRODUCTION

The Water Agency is the lead agency in accordance with the California Environmental Quality Act (CEQA) for the proposed project. An Initial Study is a preliminary analysis of a project's potential environmental impacts used to determine whether a Negative Declaration or an Environmental Impact Report will be prepared. This document is intended to provide a clear understanding of the environmental impacts associated with the construction and operation of the proposed project for decision-makers, responsible and trustee agencies under CEQA, and the public. If an Initial Study identifies potentially significant impacts but the project is modified or revised to clearly mitigate the impacts, a Mitigated Negative Declaration may be prepared. If an Initial Study concludes that a project may have a significant effect on the environment, an Environmental Impact Report should be prepared.

PROJECT LOCATION

The project site is within the Dry Creek channel and on private properties in an unincorporated area of Sonoma County, California (see Figure 1). The project sites are located in and along Dry Creek from approximately ½ mile upstream of Lambert Bridge to ½ mile downstream of Lambert Bridge.

PROJECT BACKGROUND

The Water Agency was created in 1949 by the California Legislature as a special district to provide flood protection and water supply services. The Sonoma County Board of Supervisors acts as the Water Agency's Board of Directors. The Water Agency's powers and duties, as authorized by the California Legislature, include the production and supply of surface water and groundwater for beneficial uses, control of flood waters, generation of electricity, providing recreational facilities (in connection with the Water Agency's facilities), and the treatment and disposal of wastewater.

From its outlet in Warm Springs Dam, Dry Creek meanders 14 miles to the Russian River. The creek is home to endangered coho salmon and threatened Chinook salmon and steelhead (including steelhead raised at the Don Clausen Fish Hatchery). The creek also serves as a conduit for water that is released from Lake Sonoma by the U.S. Army Corps of Engineers in the winter for flood control purposes and by the Water Agency in the summer for water supply.

The National Marine Fisheries Service (NMFS) issued the *Biological Opinion for Water Supply, Flood Control Operations, and Channel Maintenance conducted by the U.S. Army Corps of Engineers, the Sonoma County Water Agency, and the Mendocino County Russian River Flood Control and Water Conservation District in the Russian*

River Watershed (Russian River Biological Opinion) on September 24, 2008. NMFS' Russian River Biological Opinion is a culmination of more than a decade of consultation between the Water Agency, the U.S. Army Corps of Engineers (Corps), and the NMFS regarding the impact of the Water Agency's and Corps' water supply and flood control activities on three fish species listed under the federal Endangered Species Act: Central California Coast steelhead, Central California Coast coho salmon, and California Coastal Chinook salmon. The California Department of Fish and Game (CDFG) issued a consistency determination on November 9, 2009, finding that the Russian River Biological Opinion was consistent with the requirements of the California Endangered Species Act (CESA) and adopted the measures identified in the Russian River Biological Opinion.

NMFS concluded in the Russian River Biological Opinion that the continued operations of Coyote Valley Dam and Warm Springs Dam by the U.S. Army Corps of Engineers and the Water Agency in a manner similar to recent historic practices, together with the Water Agency's stream channel maintenance activities and estuary management, are likely to jeopardize and adversely modify critical habitat for endangered coho salmon and threatened steelhead.

NMFS' Russian River Biological Opinion found that summer flows in the upper Russian River and Dry Creek are too high for optimal juvenile coho salmon and steelhead habitat. Current summer flows in the creek range from 105 to 175 cubic feet per second (cfs). The velocities associated with these summer flows make it difficult for the juvenile fish to thrive. NMFS' Russian River Biological Opinion recognizes that large reductions in the summertime flows in Dry Creek would impair the Water Agency's ability to deliver water to its customers. Therefore, the Russian River Biological Opinion requires habitat enhancement of six miles of Dry Creek to improve summer rearing conditions for coho salmon and steelhead while allowing the Water Agency to maintain the existing flow range in Dry Creek of 105 to 175 cfs for water supply purposes. The six miles of habitat enhancement are to be distributed over the entire length of Dry Creek below Warm Springs Dam and implemented at a minimum of eight locations on the creek. It is intended that the enhancements for summer rearing will also provide winter rearing and refugia habitat. The habitat enhancements are to be implemented in phases to allow for evaluation of their effectiveness as the effort progresses.

One of the Water Agency's first steps toward meeting the requirements of NMFS' Russian River Biological Opinion is to conduct a habitat enhancement feasibility study on Dry Creek. This study, being conducted for the Water Agency by Inter-Fluve, an environmental engineering firm specializing in the sustainable design and construction of river habitat restoration projects, will determine which areas of Dry Creek are candidates for habitat enhancement and will evaluate the feasibility of designing projects that provide habitat enhancement while also accommodating high summertime flows. Inter-Fluve has prepared a Dry Creek Current Conditions Inventory Report (December, 2010) in which they identify numerous promising areas for habitat enhancement along Dry Creek.

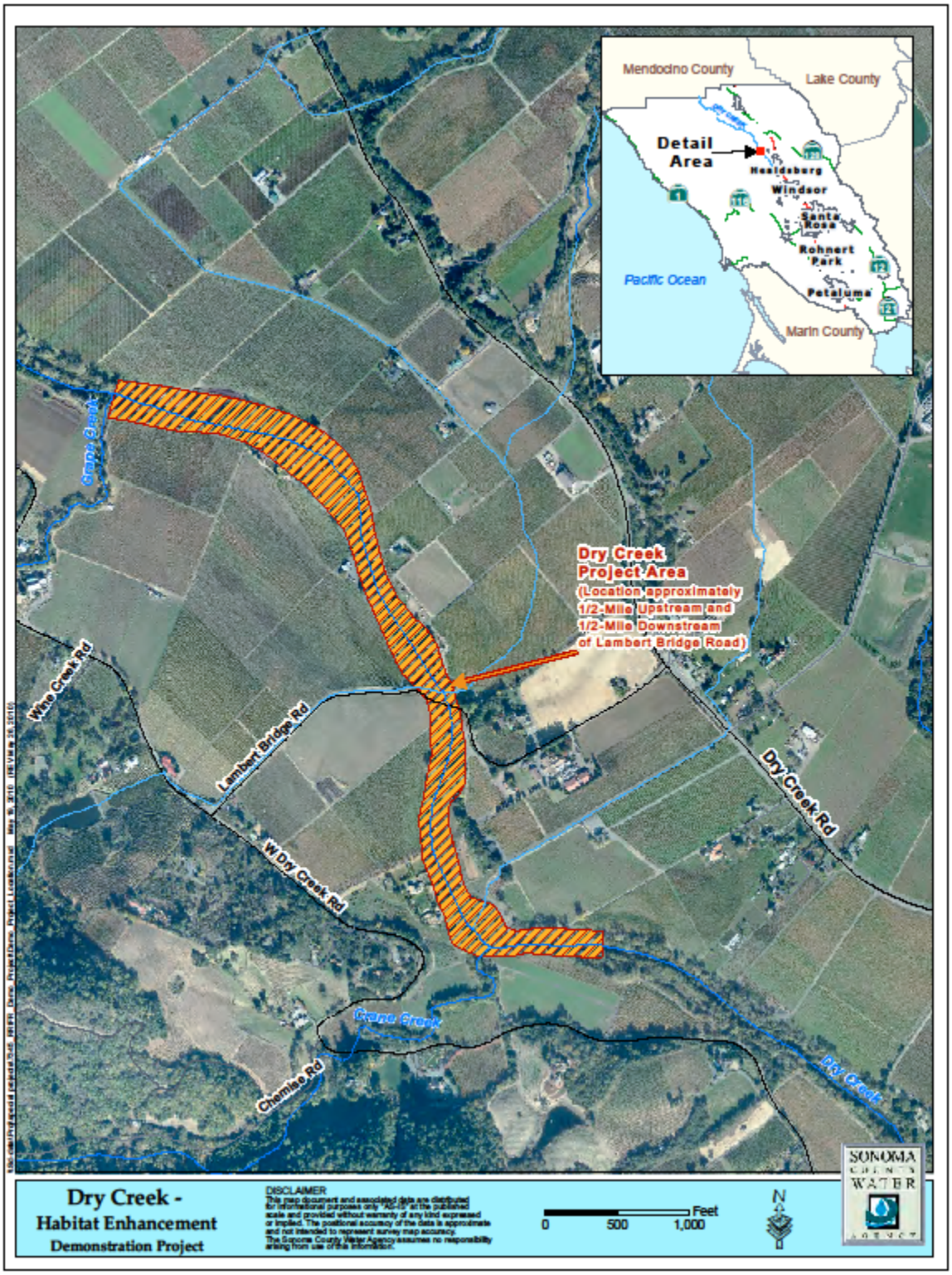


FIGURE 1. PROJECT LOCATION

PROJECT PURPOSE AND NEED

The Dry Creek Habitat Enhancement Demonstration Project (Project) would implement habitat enhancement projects within a one mile reach of Dry Creek, which contains several areas of interest identified by Inter-Fluve. The purpose of the project is to demonstrate to regulators, landowners, and local decision makers the feasibility of Dry Creek habitat enhancements on a smaller scale and, in particular, to determine how they could be constructed, what they may ultimately look like, and how effective they are before implementing the full six miles of habitat enhancements on Dry Creek.

PROJECT DESCRIPTION

The project area is located within the Dry Creek Valley and would be visible from Lambert Bridge Road which crosses through the middle of the project area. Portions of the project area may also be visible from Dry Creek Road and West Dry Creek Road. Project activities would consist of actions such as dewatering and bypass flow pumping, stockpiling of materials, removal of vegetation, excavation of the backwater/alcove areas, and placement of boulder and log structures. These construction activities would be clearly visible from Lambert Bridge Road. Some of the construction activities may also be visible from Dry Creek Road and West Dry Creek Road in the project area.

Construction in or near the streambed would occur during the months of June through October during summer low-flows. Construction is scheduled to occur during the summer and fall of 2012. Because the available construction window is limited to the June through October period, construction activities may need to be halted in October 2012 and resumed the following summer in 2013. All flows in Dry Creek (approximately 100 to 120 cfs) would need to be diverted around the work area during construction. Work areas would be isolated from the moving stream using some type of imported barrier or material (water filled bladders, gravel cofferdams, sheetpile cofferdams, etc.). Typically, the work area would be isolated and the creek flow would be allowed to continue flowing adjacent to the isolated work area. In some cases it may be necessary to completely isolate the creek from bank to bank. In this case, bypass pumping from the upstream end of the work area to the downstream end of the work area would occur to bypass creek flows around the work area. The bypass pumping would result in the work area being dewatered during construction. Dewatering would require installation of cofferdams upstream and downstream of the project site and diverting stream flow around the project site.

Enhancements in the Project area will emphasize natural stream characteristics, or geomorphology, which refers to the manner in which water and sediment combine to create habitat features friendly to fish. By using enhancement practices that emulate natural geomorphic conditions, the benefits provided to young coho and steelhead and their longevity are optimized. The proposed Project would consist of the following enhancement practices, which are described below: streambank

stabilization; backwater channels, alcoves, and ponds; side channels; log jams; pool enhancement; riffle construction; and riparian vegetation management.

Streambank Stabilization (Figures 13 and 14): This enhancement practice is applied in areas of bank erosion to retain property and to enhance the habitat characteristics along the edge of the stream. Two similar, yet slightly different, approaches are proposed in Dry Creek, depending upon streambank height:

1. For low streambanks (less than six to seven feet tall), eroding materials would be excavated and the streambank rebuilt with a combination of logs, boulders, cobbles and soil. The area would then planted with native riparian vegetation.
2. For high streambanks (greater than seven feet tall), the base of the streambank would be rebuilt in a manner similar to the low streambank method described above. The upper part of the streambank would also be rebuilt with a technique that encapsulates soil in strong fabric blankets made from coconut fiber. Native plants are planted right through the fabric. After three to five years, the blankets would decompose and the native vegetation would take over the role of stabilizing the upper part of the streambank.

For streambanks in areas where the erosive forces are projected to be less severe, or where space allows, the streambank may be re-graded to a flatter, more stable bank angle. The re-graded bank would then be treated by coverage with biodegradable erosion control fabrics for near-term erosion protection, and native revegetation for long-term protection.

Backwater Channels, Alcoves, and Ponds (Figures 15 and 16): This enhancement practice consists of areas off to the side of the stream that in summer connect to the mainstem of Dry Creek only at their downstream end. During this time, water backs into these areas and has a very low or no current. In addition to still waters, logs that protrude into or float on the water, in combination with floating and submerged vegetation, and surrounding tall vegetation make these areas very attractive to young fish, particularly coho salmon. They use these areas to search for food, rest, and avoid predators. During winter periods, these backwater areas would continue to have quiet water despite having occasional flow moving through them. In Dry Creek, this type of habitat would be primarily constructed in wider areas of the creek. Construction of these areas would include excavation to form the channel, pool or ponds, and include placement of logs at appropriate locations, planting of aquatic vegetation and management of surrounding vegetation.

Side Channels (Figure 17): Side channels run parallel to the main stream and connect to the main stream at both upstream and downstream ends, even during the summer. The flow of the stream is split between the two channels. This serves to reduce the stream current, which in combination with pools and logs in the water, make these areas attractive to coho salmon and steelhead trout. The fish use these areas to search for food, rest and to avoid predators. In Dry Creek, this type of habitat would also be primarily constructed in wider areas of the creek. In some of these areas, old abandoned channels may be excavated to provide enhanced side channels.

Construction of these areas would entail excavation to form the channel and pools, placement of logs at appropriate locations, and management of the surrounding vegetation.

Log Jams (Figure 18): A log jam is an accumulation of logs that may be constructed in an area where it would be beneficial to provide velocity refuge for fish and/or to initiate or stabilize a turn or fork in the channel. The log jam creates eddies (circulating currents) as the water flows around the logs. These eddies provide resting areas for fish instead of having to fight continuously against the current. The log jam also serves to anchor the stream's location by being an immobile object along one or both banks, acting similar to a bridge abutment or a natural bedrock outcrop. Deep pools may form next to log jams through the interaction of the logs and flowing water, creating excellent fish habitat. To create a log jam, an area is excavated and then logs are stacked and anchored by boulders and "snags" (trunks of dead trees that remain standing vertical to the horizon). This combination stabilizes the log jam during floods.

Pool Enhancements (Figure 19): Pools are deeper areas of the stream. In a healthy stream, pools provide key habitat for young fish because currents are slow, the flow patterns are diverse, and fish can hide beneath logs that project into the water. Pool enhancement in Dry Creek will act to increase the variety of habitat for young fish, and create areas that have sheltered currents that young fish prefer. This would be accomplished through selective grading of existing pool features and the installation of logs in the water.

Riffle Construction (Figure 20): Riffles are areas where the streambed is steeper and the current is swift. Riffles play a key role in controlling the elevation of the streambed and releasing the stream's energy to slow the current flowing through adjoining pools. Much of the food produced in a stream comes from these places. Construction of riffles in Dry Creek will improve the quality of the adjoining pools for fish and stabilize the stream bed while providing the fish with a wider variety of things to eat. Riffles are constructed by building mounds of small boulders, cobbles, gravel, and sand across the stream.

Riparian Vegetation Management: Dry Creek has extensive vegetative growth along the channel, which includes many non-native or invasive weed species. In some areas, overly dense stands of vegetation impair stream function by channelizing the flow of the creek and acting like a levee, which forces energy into the creek bed, and results in pools that are too long, with water that moves too swiftly. Riparian vegetation management would include selective thinning of existing vegetation, removal of invasive weeds, and in some cases, replanting of native vegetation.

Monitoring and Maintenance: The Water Agency would be responsible for monitoring and maintaining the project components throughout the expected lifespan of the proposed structures (15-25 years). Monitoring activities could consist of activities such as fish surveys, stream profile and cross-section measurements, vegetation surveys,

wildlife surveys, and photo documentation of structures. Failing structures, or structures that aren't performing as intended (not inundated properly, inundated too much, buried, having too high of velocities still) may require additional maintenance work in future years after the initial construction to restore or enhance the originally intended functions. Vegetation management is expected to occur annually for the first few years after implementation and then on a three- to five-year recurring basis in order to maintain the desired vegetation species and densities in the project area.

The Demonstration Reach

The 1.1 mile demonstration reach is located in the middle of the Dry Creek Valley, extending from the mouth of Grape Creek downstream to the mouth of Crane Creek. The landowners along this stretch of the creek have partnered with the Water Agency to begin planning the first phase of habitat enhancement on Dry Creek.

Implementation of habitat enhancement in this reach is an important first step in the longer-term process of improving habitat conditions in Dry Creek. The Dry Creek Habitat Enhancement Demonstration Project provides an opportunity to improve habitat while also showcasing a range of fish habitat enhancement approaches that may be used elsewhere in Dry Creek over the next decade. Construction of the demonstration project is scheduled to begin in 2012. Figures 2 through 12 show the general project area and the proposed habitat enhancements proposed for the project area. Figures 13 through 20 show graphical representations of the various habitat enhancement methods proposed. A more detailed description of the proposed project components is included in Appendix D, the Draft 60% Complete Design Report for the Dry Creek Habitat Enhancement Demonstration Project.

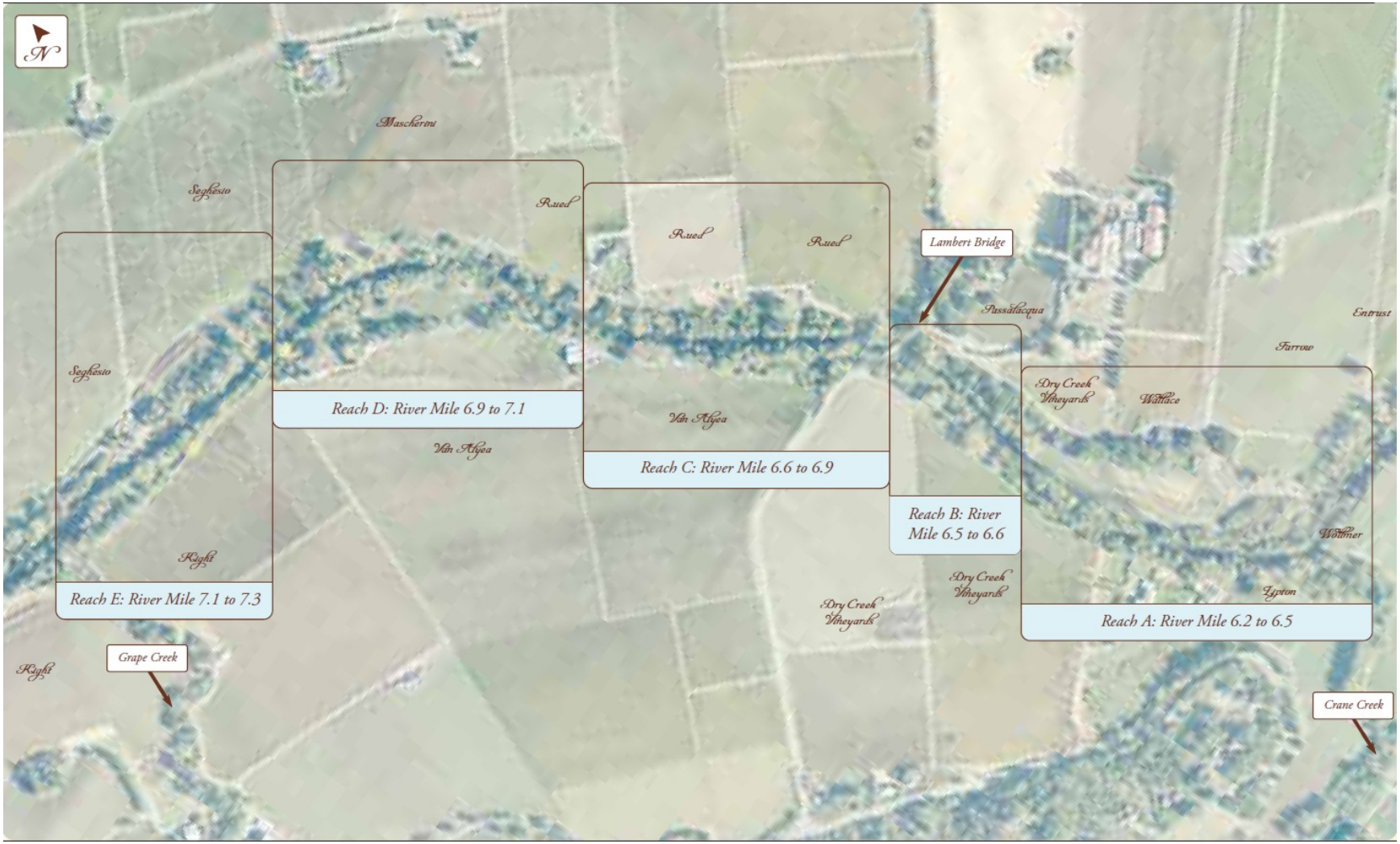


FIGURE 2. KEY TO DEMONSTRATION PROJECT AREA RIVER MILE FIGURES

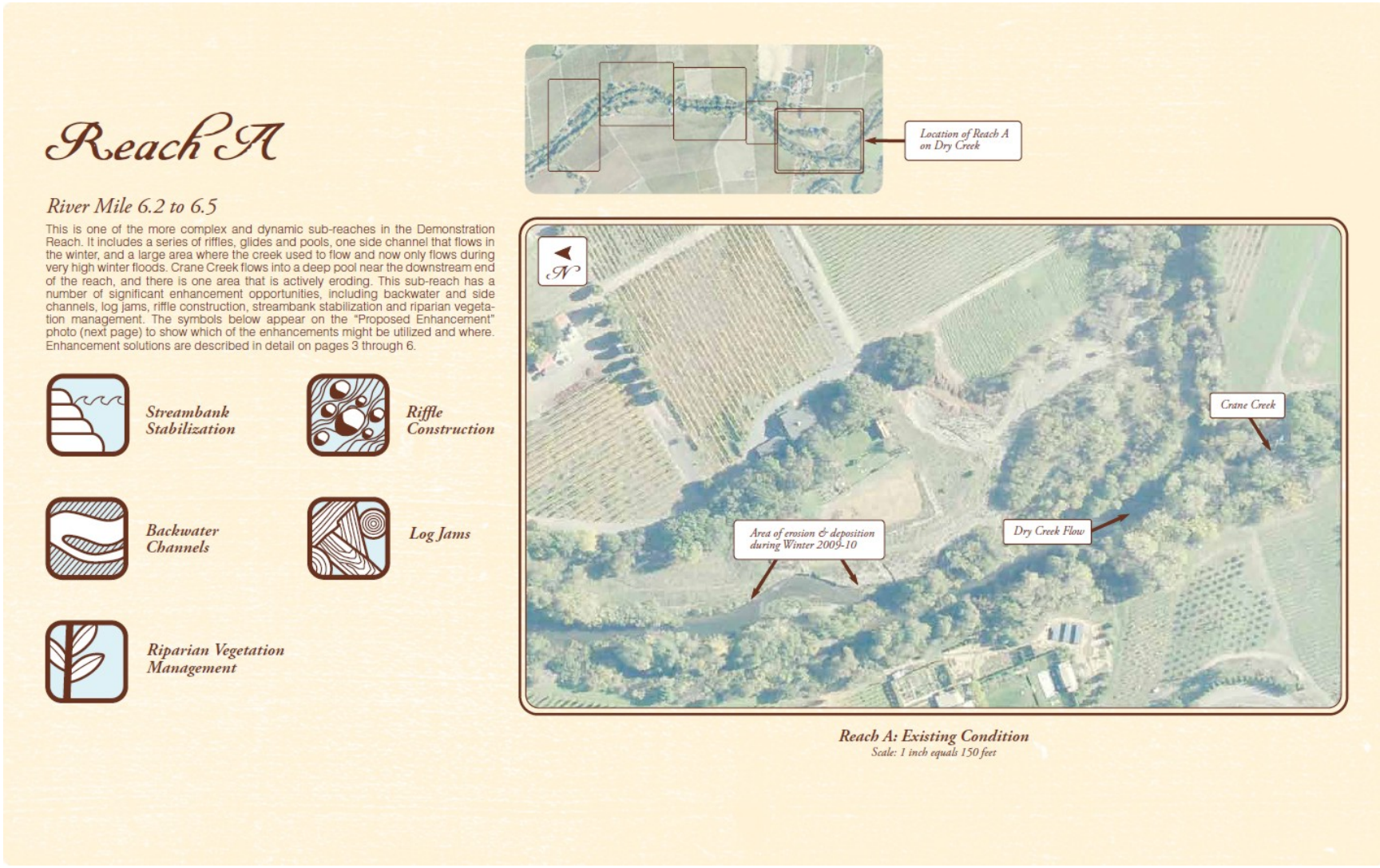


FIGURE 3. EXISTING CONDITIONS FOR RIVER MILE 6.2 TO 6.5

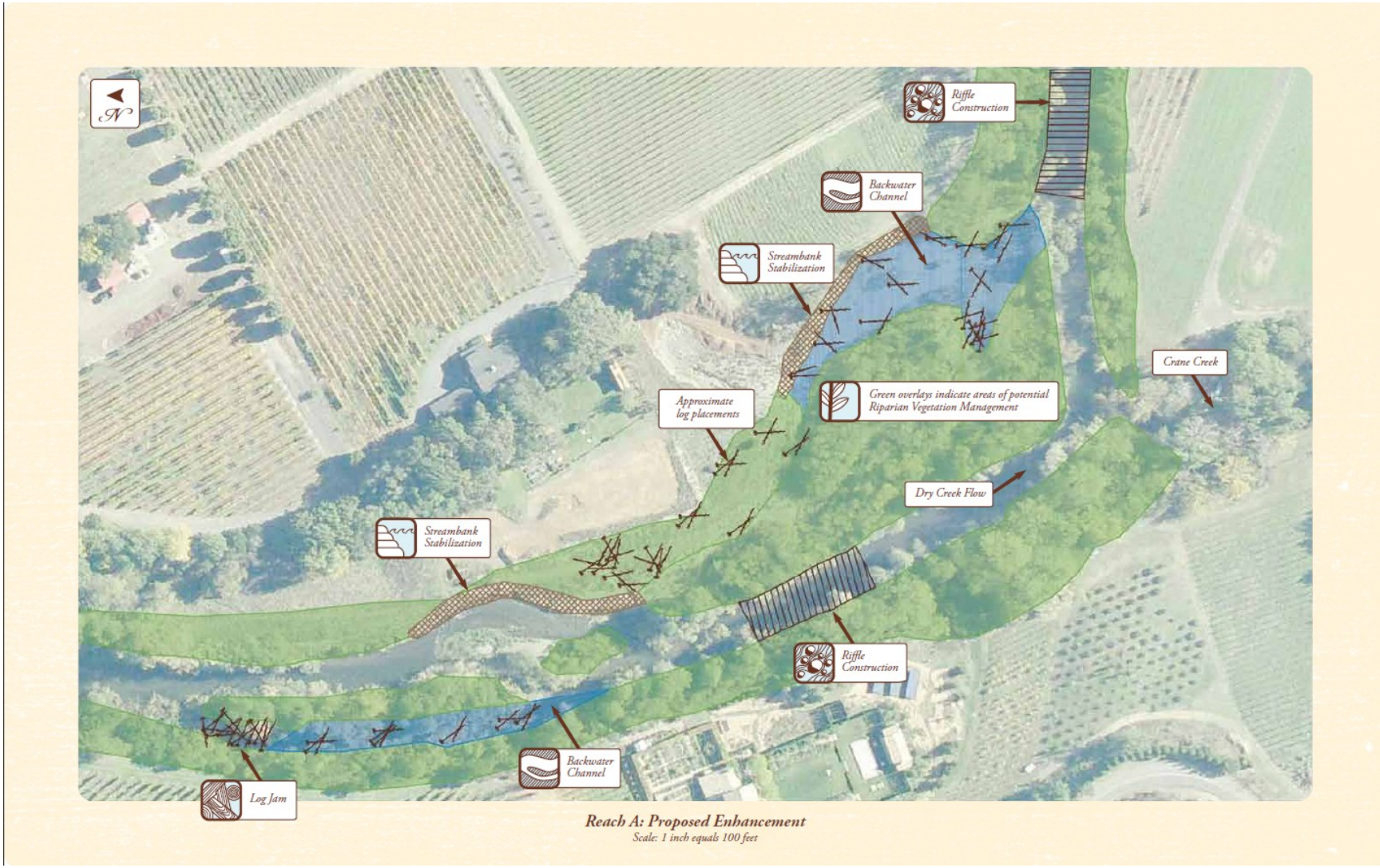


FIGURE 4. PROPOSED ENHANCEMENT FOR RIVER MILE 6.2 TO 6.5

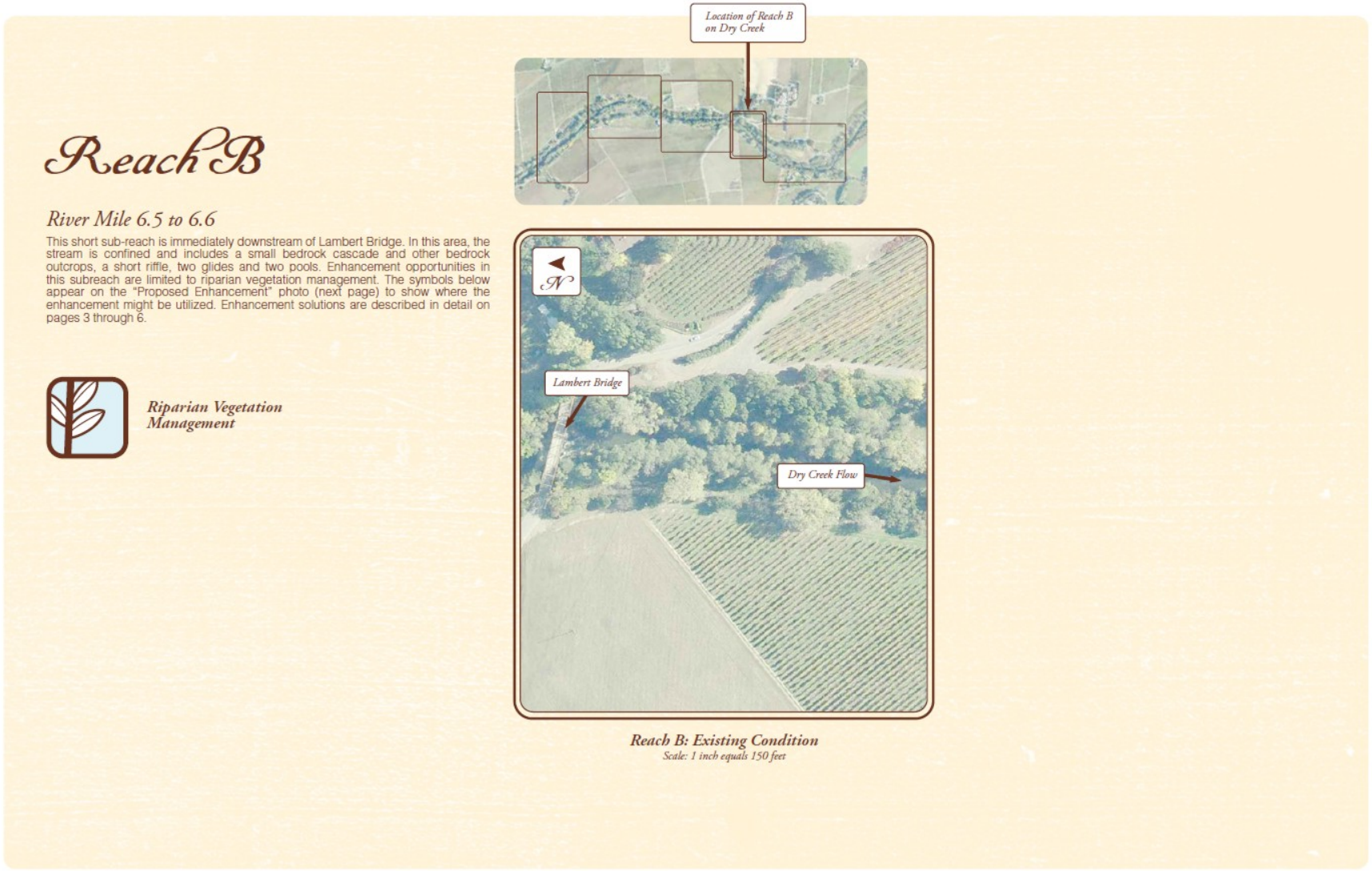


FIGURE 5. EXISTING CONDITIONS FOR RIVER MILE 6.5 TO 6.6

FIGURE 6. PROPOSED ENHANCEMENT FOR RIVER MILE 6.5 TO 6.6

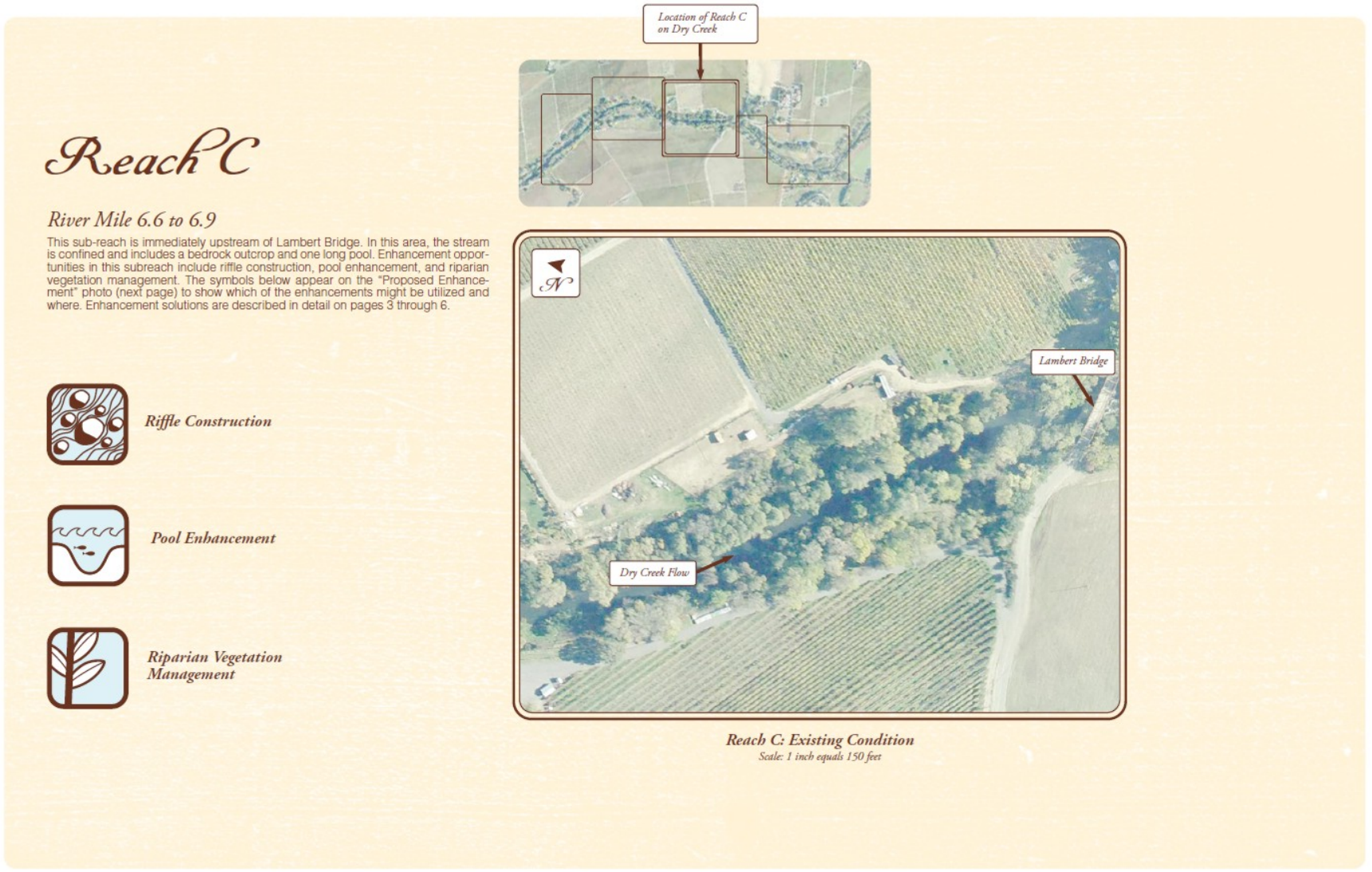


FIGURE 7. EXISTING CONDITIONS FOR RIVER MILE 6.6 TO 6.9

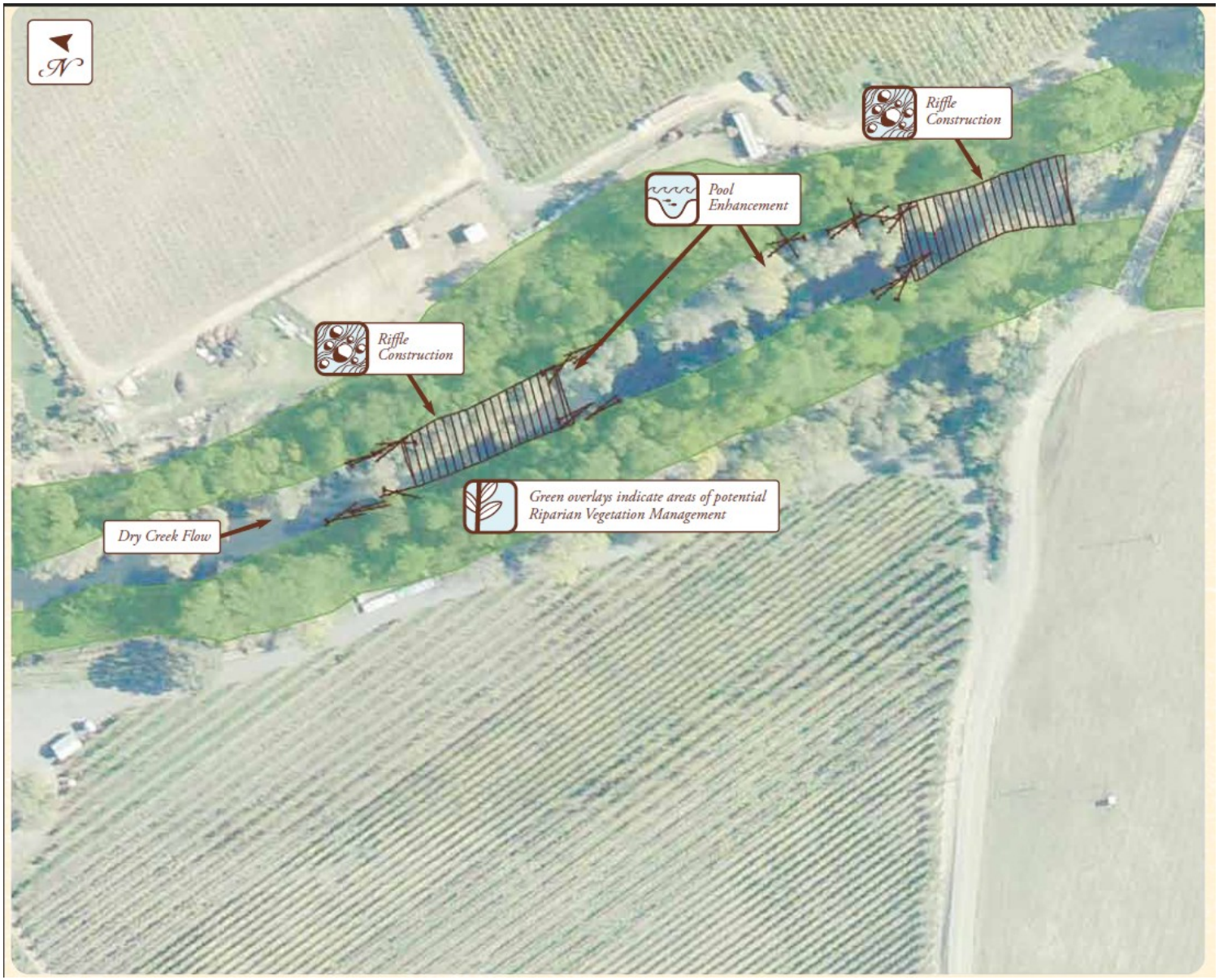


FIGURE 8. PROPOSED ENHANCEMENT FOR RIVER MILE 6.6 TO 6.9

FIGURE 9. EXISTING CONDITIONS FOR RIVER MILE 6.9 TO 7.1

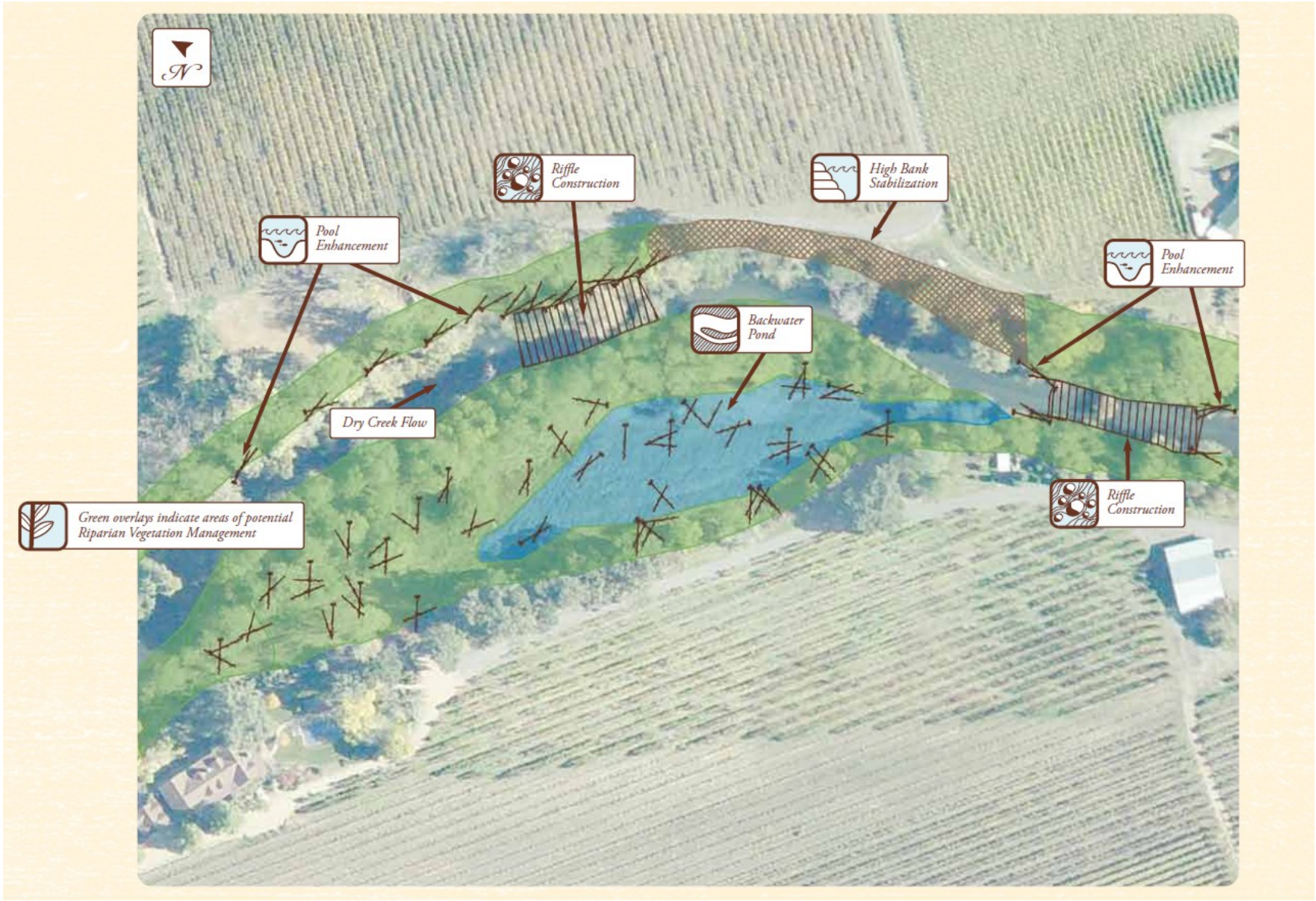


FIGURE 10. PROPOSED ENHANCEMENT FOR RIVER MILE 6.9 TO 7.1

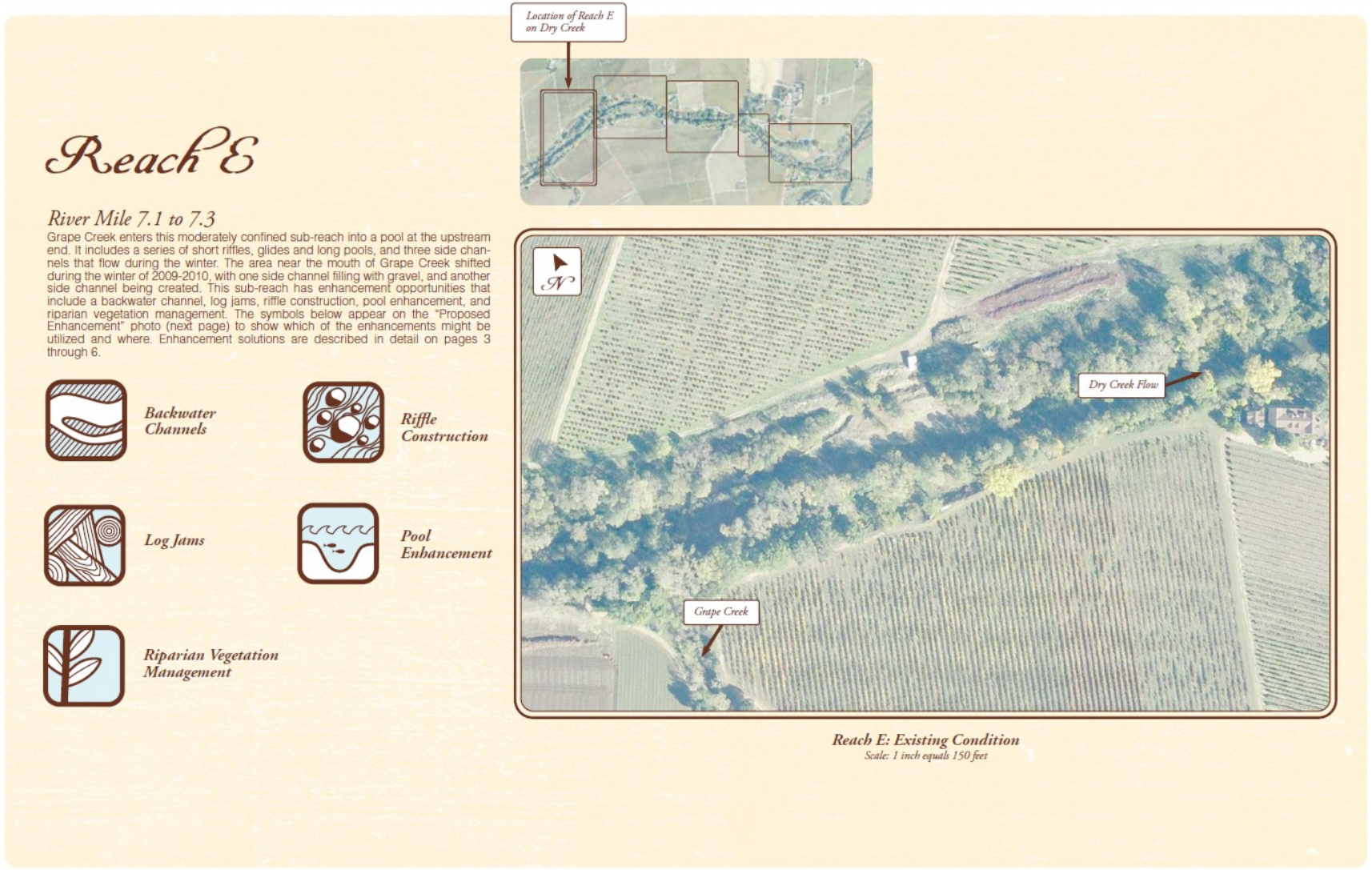


FIGURE 11. EXISTING CONDITIONS FOR RIVER MILE 7.1 TO 7.3

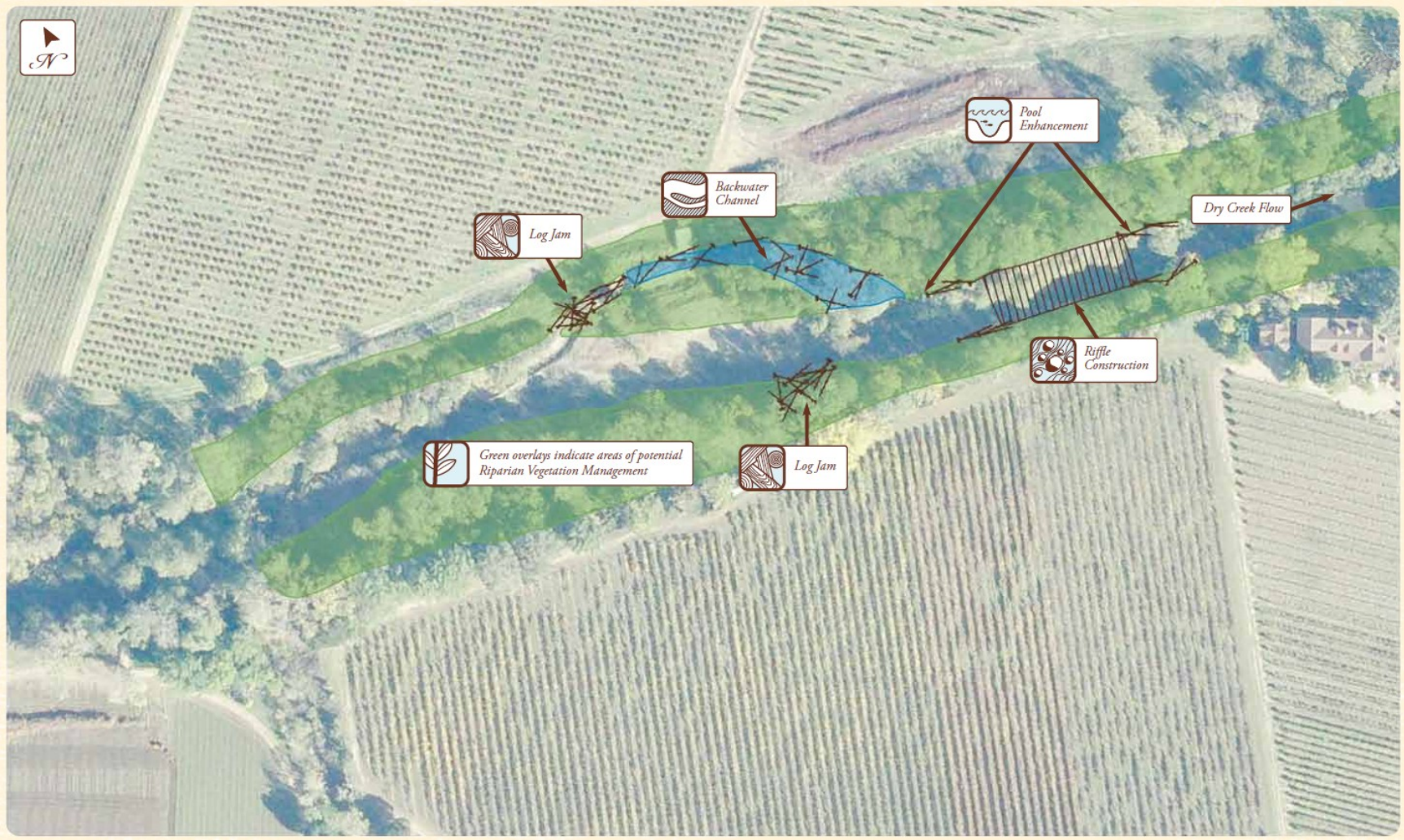


FIGURE 12. PROPOSED ENHANCEMENT FOR RIVER MILE 7.1 TO 7.3

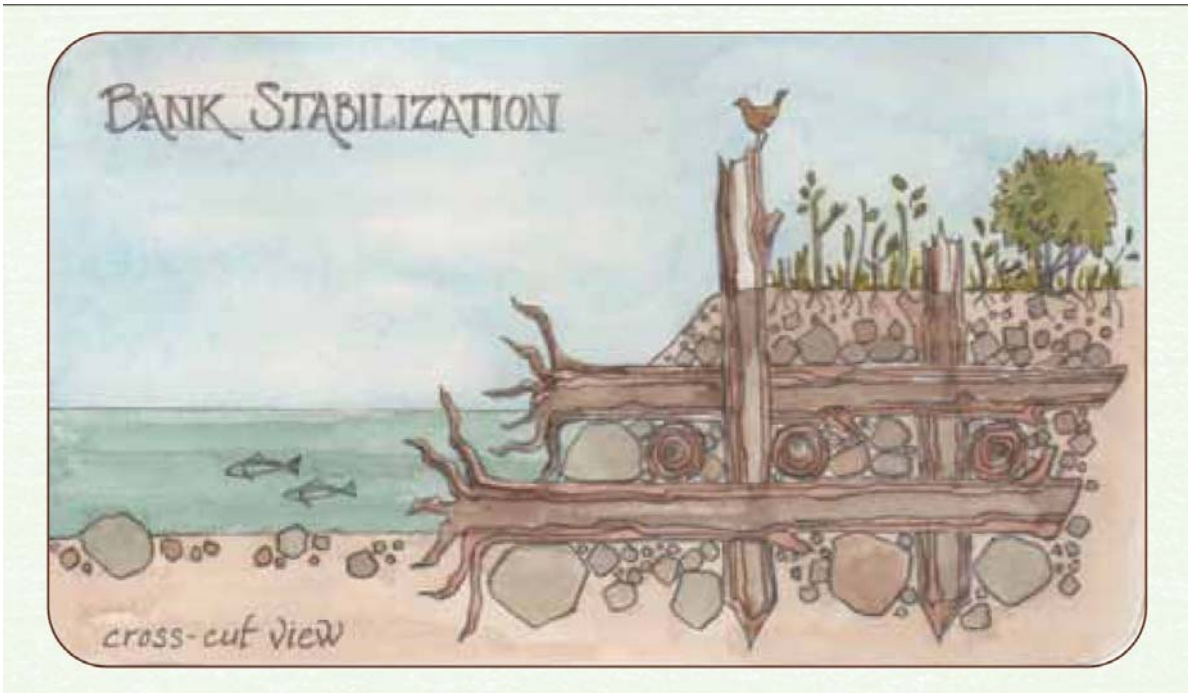


FIGURE 13. BANK STABILIZATION EXAMPLE GRAPHIC

FIGURE 14. DRY HIGH-BANK STABILIZATION EXAMPLE GRAPHIC

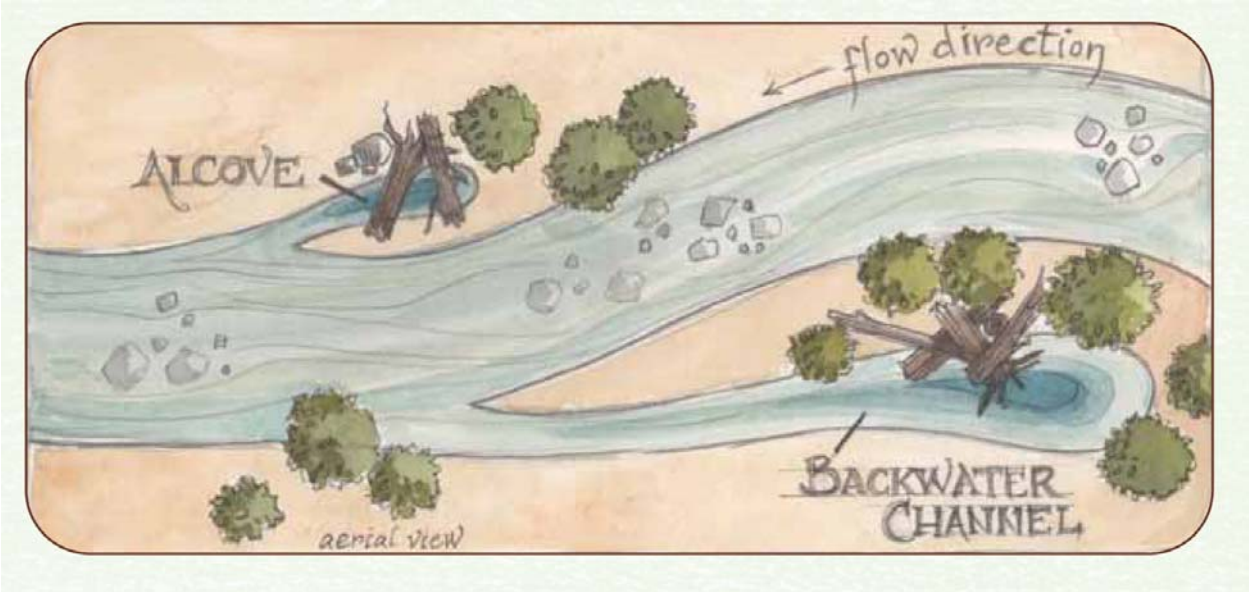


FIGURE 15. BACKWATER CHANNEL EXAMPLE GRAPHIC

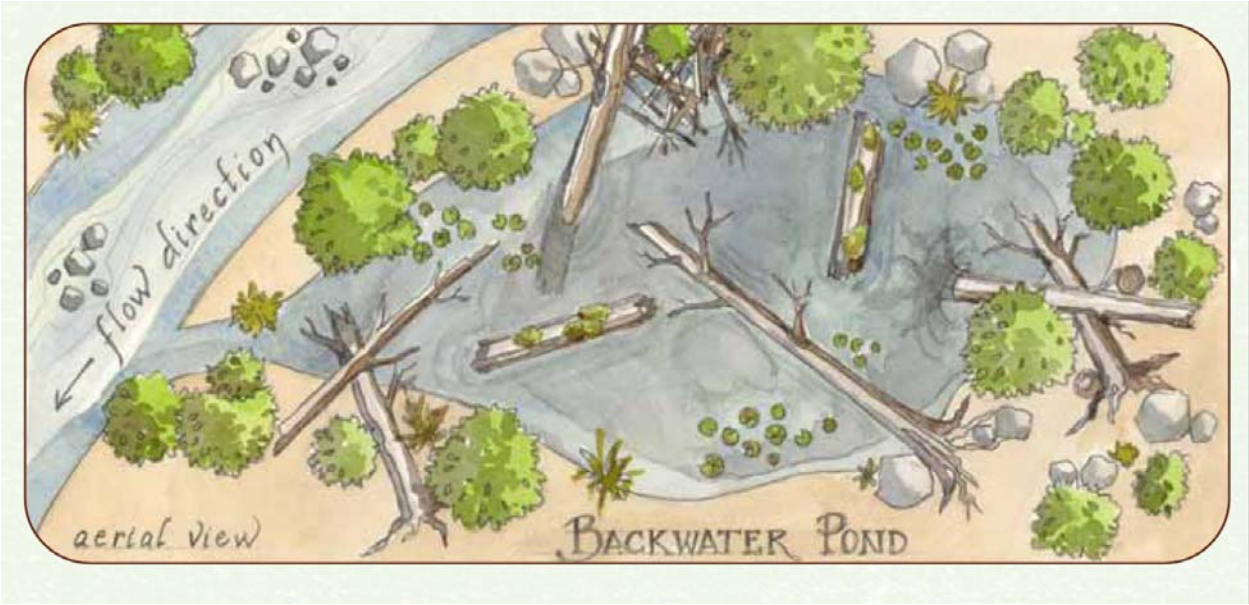


FIGURE 16. BACKWATER POND EXAMPLE GRAPHIC

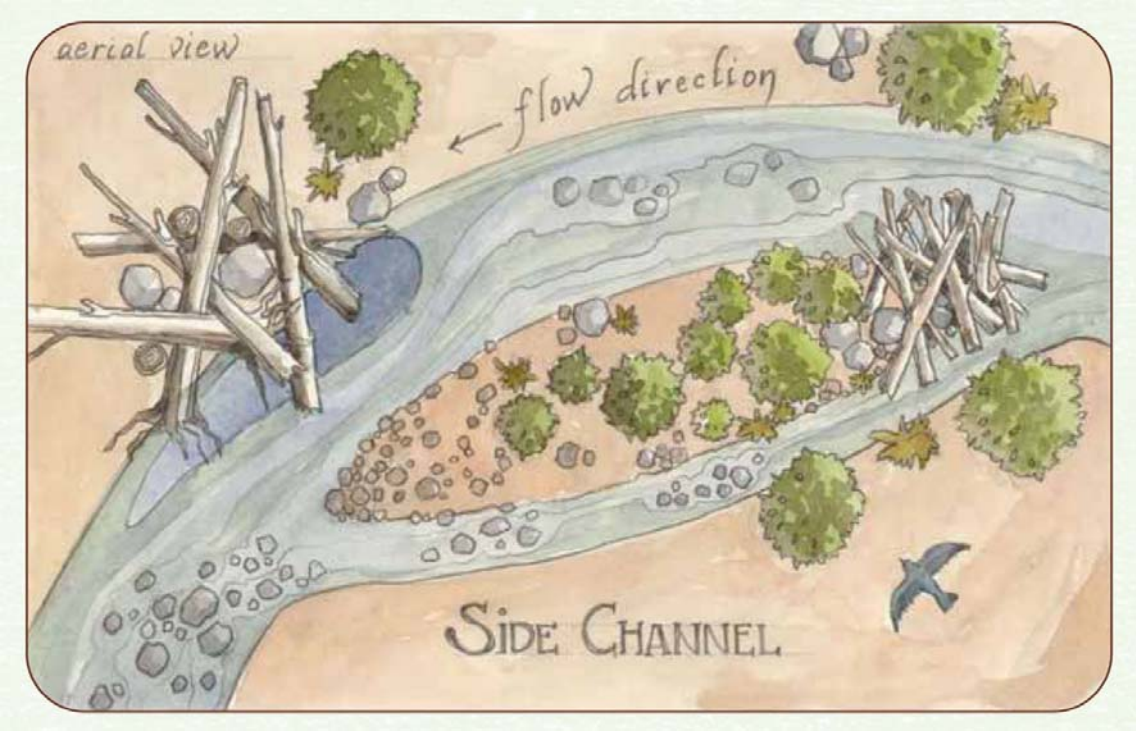


FIGURE 17. SIDE CHANNEL EXAMPLE GRAPHIC

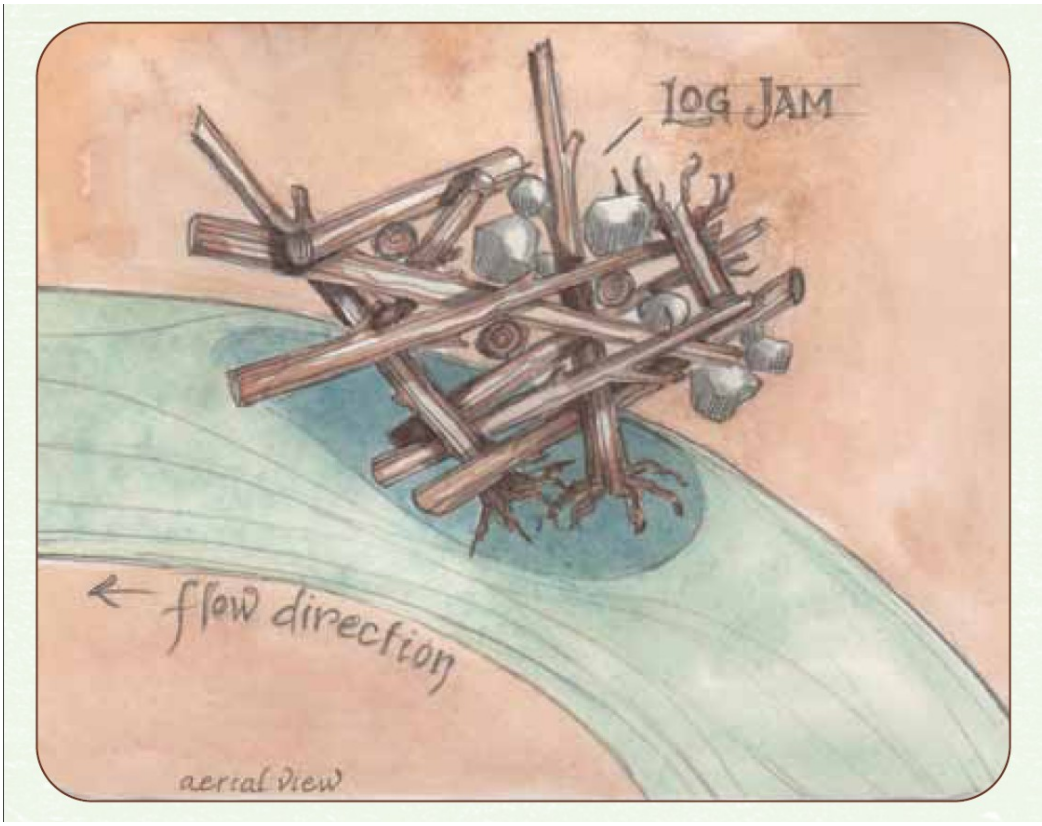


FIGURE 18. LOG JAM EXAMPLE GRAPHIC

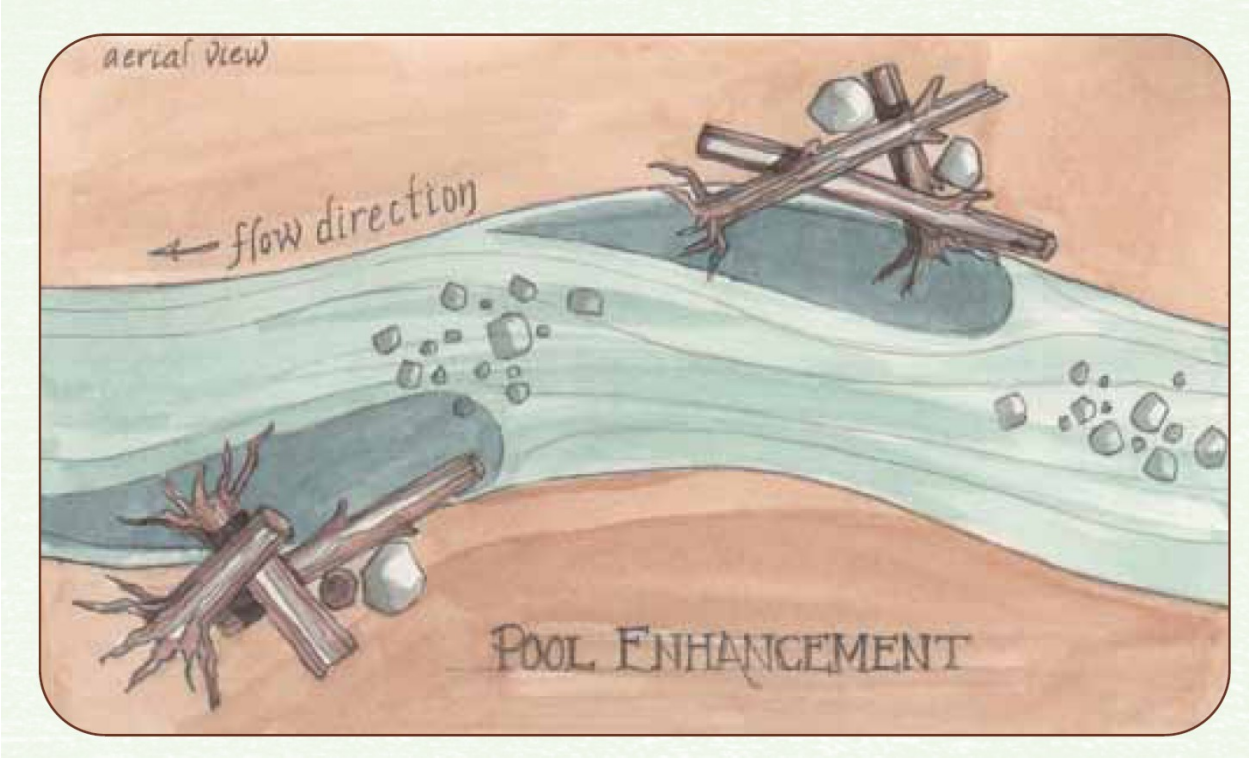


FIGURE 19. POOL ENHANCEMENT EXAMPLE GRAPHIC

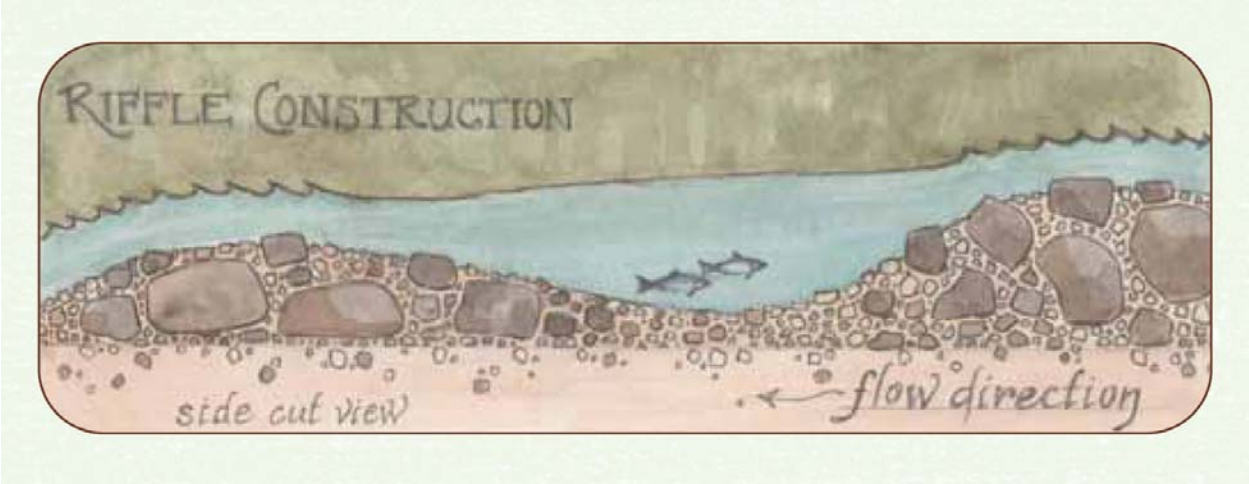


FIGURE 20. RIFFLE CONSTRUCTION EXAMPLE GRAPHIC

A preliminary estimate of proposed habitat types in comparison to the existing conditions within the project area is shown below in Table 1. Figure 21 provides a graphical representation of where the proposed habitat changes would occur within the project area.

Table 1. Existing and Proposed Instream Habitat Types and Areas

Habitat Type	Existing Habitat Area (square feet)	Proposed Habitat Area (square feet)	Change in Area from Existing to Proposed (square feet)
Alcove	7,969	67,047	+59,078
Cascade [a]	6,552	6,552	0
Flatwater [b]	62,044	44,082	-17,962
Pool	211,622	184,956	-26,666
Riffle	30,075	65,500	+35,425

[a] Cascade: Creek flow which descends over a series of rock steps
[b] Flatwater: Creek flow which is level or slow moving

PROJECT ALTERNATIVES

The Water Agency is required under the Russian River Biological Opinion to implement at least one mile of habitat enhancements along the mainstem of Dry Creek by 2014 to demonstrate the feasibility and methods for additional habitat enhancement along Dry Creek to create high quality habitat for coho, Chinook, and steelhead. Because of this requirement under the Russian River Biological Opinion, alternatives to the proposed project are limited to alternative locations and types of enhancements to implement along Dry Creek. Alternative locations, such as working in tributaries to Dry Creek or in other tributaries of the Russian River would not meet the requirement of the Russian River Biological Opinion. As part of the Dry Creek Habitat Enhancement Project design process, the entire 14 miles of Dry Creek from its confluence with the Russian River to Warm Springs Dam was evaluated to identify existing habitats and areas of interest with potential for habitat restoration. Numerous areas of interest were identified along the 14 miles of Dry Creek. The areas of interest selected for the Dry Creek Habitat Enhancement Demonstration Project are areas that provide a range of different habitat enhancement techniques (bank stabilization, creation of alcoves/ponds/backwaters, installation of large woody debris, enhancing pools, and creating riffles) and are located in an area owned by a group of willing landowners.

If the demonstration project shows that habitat enhancement is successful for creating high quality habitat, then an additional 2 miles of habitat enhancement projects would be implemented along Dry Creek. Once the additional 2 miles of habitat are constructed, the success at providing high quality habitat for coho and steelhead would be evaluated. If the habitat construction is determined to have

successfully created high quality coho and steelhead habitat, then an additional 3 miles of habitat enhancement projects would be constructed (for a total of 6 miles of habitat). This Initial Study only covers the first mile considered as part of the Dry Creek Habitat Enhancement Demonstration Project. Additional environmental documentation would be required for any habitat enhancement project proposed beyond the one mile of habitat enhancement being considered as part of the Dry Creek Habitat Enhancement Demonstration Project. The Russian River Biological Opinion also includes an alternative stipulation following construction of a total of 3 miles of habitat enhancement along Dry Creek. If monitoring shows that the habitat enhancement projects have not resulted in the creation of the expected features necessary for high quality coho and steelhead habitat, then the Water Agency is to proceed with implementing a bypass pipeline between Warm Springs Dam and the Russian River to alleviate the need for high flows in Dry Creek for water supply purposes. In the event that habitat enhancement in Dry Creek does not provide the necessary high quality salmonid habitat, the Water Agency would be required to prepare additional environmental documentation before approving and constructing a Dry Creek bypass pipeline.

The No Project alternative would mean that the first mile of habitat enhancement would not be constructed and would result in the continued jeopardy of coho and steelhead in Dry Creek as a result of the Water Agency's existing water supply operations. The No Project alternative would also result in the Water Agency being out of compliance with a federal order and State consistency determination to implement habitat enhancement in Dry Creek in accordance with the Russian River Biological Opinion.

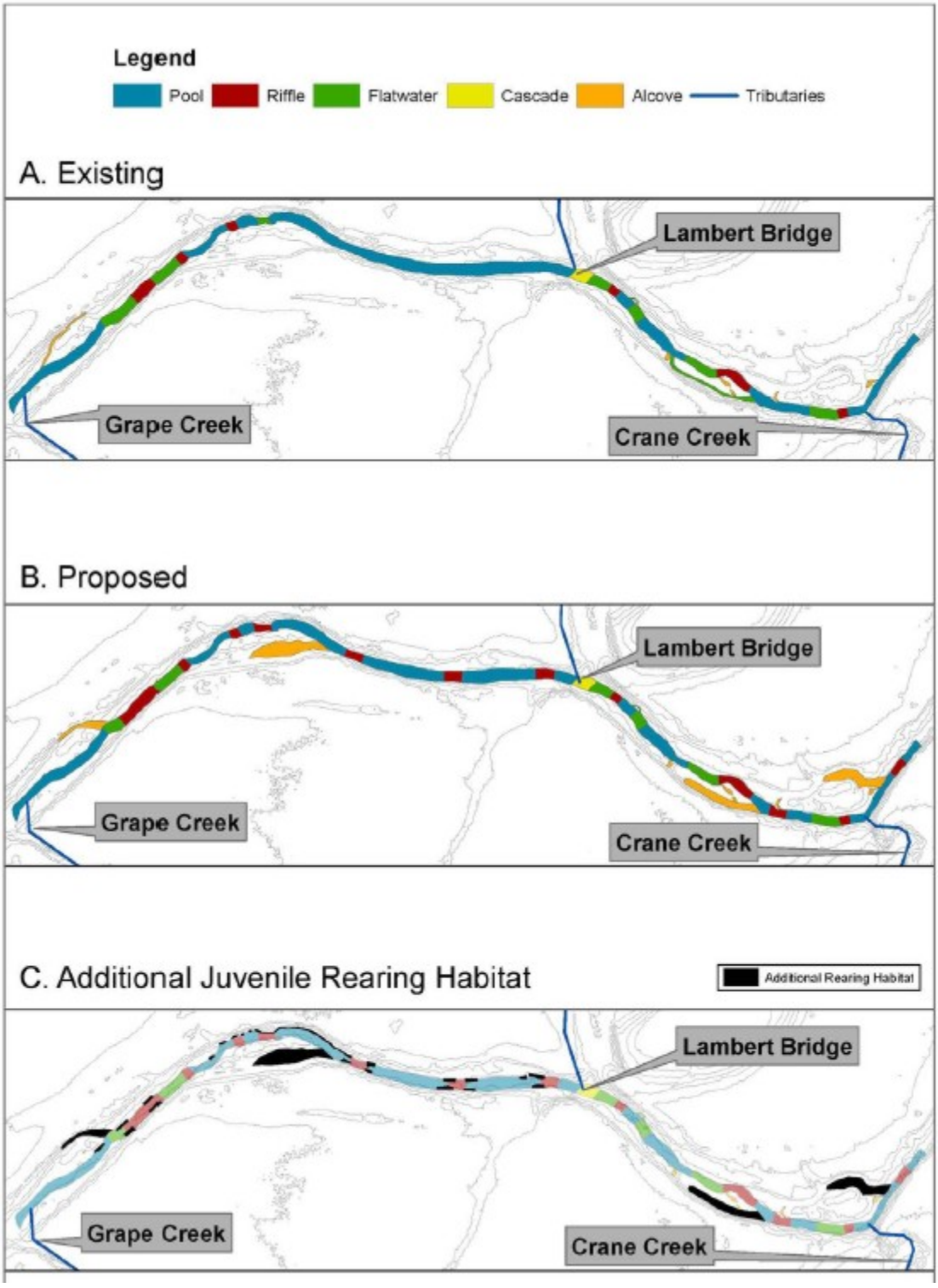


FIGURE 21. PROPOSED HABITAT CHANGES

NOTICE OF PREPARATION AND SUMMARY OF COMMENTS

On June 24, 2010, a Notice of Preparation (NOP) of an Initial Study was distributed to the following jurisdictional and permitting agencies:

- U.S. Army Corps of Engineers
- National Marine Fisheries Service
- U.S. Fish and Wildlife Service
- California Department of Fish and Game
- California Regional Water Quality Control Board, North Coast Region

Copies of the NOP were also posted with the California Governor's Office of Planning and Research's State Clearinghouse, the Sonoma County Clerk, and sent to property owners adjacent to the project area. Comments regarding the proposed project were received from the California Department of Fish and Game, California Department of Toxic Substance Control, Sonoma County Winegrape Commission, and a private landowner. Copies of the NOP and comments received are included in Appendix A. A summary of written comments and the Water Agency's responses are provided below.

California Department of Fish and Game

Summary of Comments: The California Department of Fish and Game (CDFG) submitted comments on the NOP as a means to inform the Water Agency of CDFG's concerns regarding sensitive resources which could potentially be affected by the project. CDFG requested that the Initial Study include a discussion of each of the proposed habitat enhancement types and discuss the expected function, the initial habitat value of each, the long-term benefits to salmonid species, the feasibility of success, and the sustainability and long-term maintenance of each enhancement type. CDFG requested that any enhancement plan should reference and use the guidance provided in the California Salmonid Stream Habitat Restoration Monitoring (CDFG 1998) during the design and review process to ensure compliance with CDFG standards and procedures. CDFG requested that the Initial Study contain a description of the vegetation communities, wildlife habitats, creeks, wetlands, and other important habitat features. The Initial Study should identify and discuss any significant impacts to habitats and special-status species.

Response: The Water Agency has included a description of the proposed project components as well as a breakdown of the intended habitat types that would be created. The Water Agency's design consultant is coordinating their design with NMFS and CDFG staff to ensure that both the project design as well as implementation, effectiveness, and validation monitoring are in compliance with NMFS and CDFG standards. The Water Agency will submit a permit application to CDFG for a Streambed Alteration Agreement under Section 1600 of the California Fish and Game Code.

California Department of Toxic Substances Control

Summary of Comments: The California Department of Toxic Substances Control (CDTSC) recommended that a historical assessment of past uses be done to determine the existence of potential hazardous materials within the project area.

Response: The Water Agency had a hazardous materials assessment conducted for the Dry Creek Valley. The results of the hazardous materials assessment within the project area are discussed in the environmental checklist below.

Sonoma County Winegrape Commission

Summary of Comments: Nick Frey, President of the Sonoma County Winegrape Commission, submitted comments in support of the proposed Dry Creek Habitat Enhancement Demonstration Project.

Response: The Water Agency acknowledges and appreciates the comment in support for this project.

Gordon Winstrom (resident/grape grower in Dry Creek Valley)

Summary of Comments: Mr. Winstrom stated that he has a problem with the amount of money being spent for fish in Dry Creek (especially in comparison to how little we spend per child in education). Mr. Winstrom wanted to know if we have calculated a dollar figure per fish that is being spent.

Response: The Water Agency is complying with the requirements outlined in the Biological Opinion issued by NMFS which directs the Water Agency to implement changes in operations and construction of enhancements to improve habitat for the three listed fish species found in Dry Creek. The Water Agency is obligated to implement the requirements of the Biological Opinion regardless of the costs to implement the project. The Water Agency has not calculated a "dollar spent per fish" number because the overall success of the project will be measured by the quality and quantity of habitat in Dry Creek, not by the number of fish.

ENVIRONMENTAL SETTING

The Dry Creek watershed is located in the interior coast range of northern Sonoma and southern Mendocino counties, approximately 30 miles from the Pacific Ocean and 60 miles north of San Francisco Bay. Dry Creek drains 217 square miles of rugged terrain. The Dry Creek watershed is approximately 32 miles long and 7 miles wide and is in the southwestern portion of the Russian River Basin. Dry Creek flows into the Russian River just downstream of Healdsburg. The Dry Creek Habitat Enhancement Demonstration Project area is located along a 1-mile reach of Dry Creek near Lambert Bridge Road.

The confluence of Grape Creek with Dry Creek marks the upstream extent of the project area, while the confluence of Crane Creek with Dry Creek marks the downstream end of the project area.

Topography

Elevations within the Dry Creek watershed range from 70 feet near the mouth to nearly 3,000 feet near the headwaters, with half of the watershed above 1,100 feet in elevation. Elevations within the project site range from 145 feet to 130 feet. Downstream of the Dry Creek confluence at Healdsburg (Russian River mile 32), the Russian River flows westerly to the Pacific Ocean at Jenner, California. Warm Springs Dam is located on Dry Creek at river mile 13.9, at the confluence of Dry and Warm Springs Creeks. The 130 square mile watershed located above the dam is characterized by steep, mountainous terrain with basin slopes ranging from 30% to 80% and channel gradient ranging from 8 to 200 feet per mile (0.2 to 3.8%; Army Corps of Engineers 1987a). Downstream of the dam, lower Dry Creek is a gravel bed river that flows through a flat agricultural valley, 0.5 to 1 mile wide with approximate average gradient of 0.2%. Principal tributaries entering Dry Creek below Warm Springs Dam include Pena Creek (drainage area 22.3 sq. mi.) and Mill Creek (drainage area 22 sq. mi.). The project area is located approximately 6 to 7 river miles upstream of the confluence of Dry Creek and the Russian River. Throughout the project site, bank heights range from 5 to 30 feet high.

Soils and Geology

The *Sonoma County Soils Survey* (Plate 39, pages 28, 66, 87) shows the project area primarily consisting of riverwash materials (RnA). RnA soils are described as consisting of very recent depositions of gravel, sand, and silt alluvium along major streams and their tributaries. The surrounding higher terrace lands adjacent to Dry Creek are shown as primarily several different classifications of Yolo loam/yolo sandy loam (YnA, YmB, YoB, and YlA) along with a smaller areas of Pajaro gravelly loam (PbB) and Cortina very gravelly loam (CsA). The project site is located within the alluvial valley plain of the Dry Creek Valley. The soil series found in the project area consist of well-drained, recently formed alluvial materials.

Botanical and Wetland Resources

Riparian vegetation, or the plants associated with a stream environment, once covered much of the floodplains of the Russian River and its tributaries. Considerable acreage of riparian vegetation was removed between the mid-1800s and the mid-1900s. Vegetation was removed for agriculture, gravel mining, logging, flood control, and urbanization. Prior to the construction of Warm Springs Dam (1984), the flow regime for Dry Creek was seasonal with intermittent pools each year in the summer and fall coupled with much higher scouring flows in the winter. As a result of land use practices and this highly seasonal flow regime, riparian vegetation along Dry Creek existed in thin and discontinuous strips. After the completion of Warm Springs Dam, summer flows in Dry Creek have had a consistent base flow while winter peak

flows have been much reduced relative to natural flow conditions. These changes have created conditions along Dry Creek where less scour occurs during winter flows and a consistent year-round supply of water is in the creek to support riparian vegetation. Today, relative to pre-dam conditions, riparian vegetation along Dry creek is continuous and more encroached upon the creek channel (Inter-Fluve Current Conditions Inventory Report, Page 30).

Riparian vegetation generally provides the following benefits: [1]

Contributes structure to streams, which provide shelter for fish and aquatic organisms (i.e. scour pools, woody debris, root mass).

- Provides nutrient contributions, in the form of leaf litter and insects, for fish and aquatic organisms.
- Maintains cool water temperatures by shading all or part of the stream.
- Supports wildlife corridors, offering shelter and forage.
- Provides stabilization of banks and/or erosion control, to prevent loss of agricultural land.
- Prevents large woody debris from entering vineyards and orchards during flood peaks.

For the reasons listed above, riparian zones have a high value for wildlife. Often they contain plant species native to California which provide excellent habitat for a variety of wildlife. A list of common native riparian vegetation found along Dry Creek is listed in Table 2.

Table 2. Partial List of Native Riparian Vegetation Common to Dry Creek

COMMON NAME	SCIENTIFIC NAME
Fremont's cottonwood	*Populus fremontii*
Arroyo willow	*Salix lasiolepsis*
Yellow willow	*Salix lucida ssp. lasiandra*
Red willow	*Salix laevigata*
Sandbar willow	*Salix exigua*
White alder	*Alnus rhombifolia*
Northern California black walnut	*Juglans californica var. hindsii*
Mulefat	*Baccharis salicifolia*
California blackberry	*Rubus ursinus*
California wild grape	*Vitis californica*
Oregon ash	*Fraxinus latifolia*
Box elder	*Acer negundo californicum*
Valley oak	*Quercus lobata*
California bay laurel	*Umbellularia californica*
Mugwort	*Artemisia douglasiana*
Blue elderberry	*Sambucus mexicana*
Snowberry	*Symphoricarpos albus*
Dutchman's pipe	*Aristolochia californica*
Honeysuckle	*Lonicera hispidula var. vacillans*

[1] Circuit Rider Productions, Inc. Riparian Habitat Status Report. January 1994.

The vegetated sections of stream banks within the project site are dominated by an overstory of red willows (*Salix leavigata*), box-elders (*Acer negundo*), and white alders (*Alnus rhombifolia*) with an occasional cottonwood (*Populus fremontii*) and California bay (*Umbellularia californica*). The riparian understory is dominated by a mixture of Himalayan blackberry (*Rubus discolor*), California blackberry (*Rubus ursinus* var. *ursinus*), escaped grape (*Vitis vinifera*), and mugwort (*Artimisia douglasiana*). A few open areas without an overstory component exist within the project areas. These open areas are dominated by grasses (*Avena fatua, Bromus diandrus, Hordeum murinum, Lolium multiflorum*) and other herbaceous plants (*Verbascum Thapsus, Melilotus albus, Hirschfeldia incana*).

Areas potentially subject to the jurisdiction of the Corps under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act within the project site are restricted to the Section 404 waters of the United States below the ordinary high water (OHW) mark.[2,3] The total amount of existing potential Corps jurisdictional areas within the project site is approximately 19.4 acres consisting of 6.8 acres of open waters and 12.6 acres of vegetated wetlands within the OHW. Under the proposed project, the amount of potential Corps jurisdictional areas within the project site is estimated to be approximately 20.4 acres consisting of 9.4 acres of open water and 11 acres of vegetated wetlands within the OHW.

A list of special status plant species with potential to occur within the project site is provided in Appendix B-1. The list was developed using recorded occurrences of special status plant species within the Geyserville, California, U.S. Geological Survey (USGS) quadrangle as documented in the California Natural Diversity Data Base (CNDDB).[4] The project area does not provide the potential habitat for any of the special status plant species identified from the Geyserville quadrangle in the CNDDB search. Botanical surveys of the project area were performed on August 31, 2010. Known occurrences of Northern California black walnut (*Juglans californica* var. *hindsii*), were not listed from the Geyserville quadrangle in the CNDDB search, but it is considered to have the potential to occur in the project area because this species occurs in riparian woodlands and is known to occur elsewhere in Sonoma County. Northern California black walnut is not an officially listed rare, threatened, or endangered species, but it is considered a Federal Species of Concern. No Northern California black walnut trees were observed, but black walnut (*Juglans nigra*) was observed within the project site along the upper bank of Dry Creek upstream and downstream of Lambert Bridge. A complete list of plant species observed during the botanical surveys is provided in Appendix C.

[2] The ordinary high water (OHW) mark is a line on the shore established by fluctuations of water indicated by physical characteristics such as a clear, natural line on the bank, shelving, changes in soil, destruction of terrestrial vegetation, or presence of litter and debris.
[3] Waters of the United States are areas ponded for a duration to preclude vegetation from establishing and are subject to Section 404 of the Clean Water Act and U.S. Army Corps of Engineers jurisdiction.
[4] California Natural Diversity Data Base, search of Geyserville , California USGS 7.5 minute quadrangles, 2011.

Wildlife and Fisheries

A habitat inventory was conducted in 2009 to census aquatic habitat (measured at approximately 100 cfs) for coho salmon and steelhead in Dry Creek downstream of the Warm Springs Dam. The inventory found that Dry Creek is composed of 26% riffles, 23% pools, 7% scour pools, 44% flatwaters and less than 1% cascades based on the relative frequency of mainstem habitats. Pool depths generally decreased in the downstream direction, with a greater proportion of scour pools in the middle to upstream end of the survey area. Overall, there was far more flatwater than riffle habitat (44% of mainstem habitats by frequency versus 26% for riffles).

Dry Creek has been substantially altered from its pre-Warm Springs Dam conditions. Prior to the construction of Warm Springs Dam, the middle and lower reaches of Dry Creek were moderately warm (based on fish assemblage present) and went dry in its lower reaches.[5] The pre-Warm Springs fish community was assessed in the early 1950s as part of a non-game species eradication program conducted by the CDFG. This program was designed to reduce non-salmonid populations through poisoning large sections of tributaries and the mainstem where these species dominated the fish assemblages.[6] The rationale for this project was the belief that these "rough fish" were responsible for depressing steelhead populations. Dry Creek was partially treated with Rotenone (a fish toxicant) in 1952 and 1953 and sampled with electrofishing gear in 1954 and 1955. Areas treated included Dry Creek from just upstream of Cherry Creek (above the current Warm Springs Dam site) downstream 8 miles to where streamflow became subsurface, as well as in Galloway, Cherry, Warm Springs, Pena, and Mill creeks. At the time of the treatment, California roach, Sacramento sucker, and pikeminnow dominated the fish assemblages in the treated streams. Tule perch were noted as being well distributed in small numbers. Juvenile steelhead were reported to be locally abundant, but scarce overall.

Currently, flows in lower Dry Creek are maintained well above pre-dam summertime levels through releases from Warm Springs Dam. In addition, the releases originate from deep within Lake Sonoma, so that artificially cold water temperatures are maintained. The changes have had mixed impacts on the fish community in the creek. It was assumed that the cold water released from the dam would likely result in a change in the fish community from one dominated by a warm water assemblage to one dominated by salmonids. However, the increased streamflow resulted in stream velocities above suitable levels for rearing juvenile salmonids. This latter impact was assessed through a flow-habitat assessment study.[7] The conclusion reached was that, overall, lower flows provide superior habitat for rearing salmonids in Dry Creek

[5] Pintler, H.E. and W.C. Johnson. Chemical control of rough fish in the Russian River drainage, California. Inland Fisheries Administrative Report No. 56-13. 1956.

[6] Pintler, H.E. and W.C. Johnson. Chemical control of rough fish in the Russian River drainage, California. Inland Fisheries Administrative Report No. 56-13. 1956.

[7] Russian River Biological Assessment Executive Committee. Flow-Habitat Assessment Study. Prepared by Entrix, Inc. November 21, 2003.

compared to higher flows. While this result may at first appear counterintuitive, several factors affect fish habitat in Dry Creek. Flood control operations have greatly altered the frequency, timing, duration, and magnitude of high flow events. Channel incision and the loss of a functional floodplain have resulted in a relatively narrow channel. In reaches confined by bank stabilization projects, armoring of streambanks has led to a loss of stream sinuosity. Stable low flows in the summer and reduced flood flows in the winter have led to an encroachment of a relatively stable riparian community along the shoreline. The combination of these factors has resulted in a loss of habitat diversity and an overall increase in stream velocities, which reduces habitat quality for juvenile salmonids. Under current conditions, Dry Creek is thought to provide little habitat for rearing coho salmon.[8] The reason for the lack of coho habitat was cited as poor channel structure (high velocities and the lack of deep pools with woody debris). The purpose of the Dry Creek Habitat Enhancement Demonstration Project is to implement and evaluate a variety of enhancement methods. Although the existing quantity of rearing habitat for coho is considered low, coho are known to occur in the area. Coho have also been stocked in different tributaries of Dry Creek, including in Grape Creek at the upstream end of the Project Area, as part of a hatchery program to help recover the species. In addition to coho, both Chinook and steelhead are known to occur in the project area. Besides salmonids, California roach, sculpin (prickly and riffle), Sacramento sucker, pacific lamprey, western brook lamprey, bluegill, green sunfish, fathead minnow, hardhead, hitch, Russian River tule perch, Sacramento pikeminnow, Sacramento sucker, and threespine stickleback are other species known to occur within Dry Creek. Western pond turtles, a CDFG species of special concern, are known to occur in Dry Creek, although the existing high velocities, incised channel, and shaded canopy result in limited or marginal Western pond turtle habitat. An incidental benefit of the project would be that the backwater areas and woody structures could result in improved habitat for Western pond turtle in addition to the targeted salmonid species.

The project site provides a continuous strip of riparian habitat that is utilized by a variety of wildlife species. Dense vegetation and occasional snags are present to support nesting habitat for riparian bird species. The riparian habitat in the project area is also connected to continuous strips of riparian habitat both upstream and downstream of the project area running the length of Dry Creek from Warm Springs Dam to the Russian River. The riparian habitat along Dry Creek also connects to the riparian habitat found running up tributary streams in the area. The continuous nature of the riparian vegetation provides important habitat for wildlife utilizing the riparian corridor for food, shelter, and movement. Table 3 provides a representative list of terrestrial wildlife species utilizing riparian corridors in the Lake Sonoma and Dry Creek areas. Figure 22 shows species observed in the project area as identified in the CNDDB. The only species previously reported to the CNDDB in the project area are occurrences of pallid bat (*Antrozous pallidus*), which are a DFG species of special

[8] Russian River Biological Assessment Executive Committee. Flow-Habitat Assessment Study. Prepared by Entrix, Inc. November 21, 2003.

concern. Previous occurrences of pallid bat in the area were roost sites associated with residential buildings or winery structures.

Cultural Resources

A cultural resources survey was performed for the project site.[9] The survey goal was to evaluate the project area for the potential presence of any cultural or historic resources. The study included contacting the Native American Heritage Commission, Federated Indians of Graton Rancheria, Lytton Rancheria of Pomo Indians, Mishewal-Wappo Tribe of Alexander Valley, Ya-Ka-Ama and Suki Waters (Coast Miwok, Pomo), as well as performing archival research. Archival research included examination of library and project files at Tom Origer and Associates, a review of records on file at the Northwest Information Center at Sonoma State University, and a review of the State Office of Historic Preservation Historic Property Directory. A field reconnaissance of the study area was performed on November 17, 2010.

Archival research findings showed that five previous cultural resource surveys have been conducted in the vicinity of the project area including one that included the current project area. The previous surveys identified two archaeological sites within a one-mile radius of the current project. No cultural resources were recorded within the current study area. Historical maps show no buildings within the project area. The Lambert Bridge is a historic-era bridge that is located within the study area. No archaeological sites were found within the study area during the November 17, 2010 field survey.

RIGHT-OF-WAY

The proposed project is located on private property. The Water Agency would need to obtain the necessary property rights from the landowners to construct, monitor, and maintain the project.

LAND USE AND CONFORMANCE WITH GENERAL PLAN

The proposed project would not change the current approved land uses for the project site, which are zoned as agricultural lands and rural residential.[10] The proposed project would be constructed within areas that are already within the active high flow area of Dry Creek. Because the site is frequently inundated, existing land uses are restricted. The proposed project would not limit or restrict the existing agricultural activities that occur in the project area.

[9] Del Bondio, Lauren and Thomas M. Origer, M.A./R.P.A *An Archaeological Survey for the Dry Creek Habitat Enhancement Demonstration Project. Sonoma County, California.* December 23, 2010.

[10] Mendocino County Planning Department, *Land Use Inset Number 2*, adopted April 26, 1993.

Table 3. Representative Terrestrial Wildlife Species of Lake Sonoma and Dry Creek

COMMON NAME	SCIENTIFIC NAME
Birds	
Red-tailed hawk	*Buteo jamaicensis*
Golden eagle	*Aquila chrysaetos*
Peregrine falcon	*Falco peregrinus anatum*
California quail	*Lophortyx californicus*
Band-tailed pigeon	*Columba fasciata*
Great horned owl	*Bubo virginianus*
Acorn woodpecker	*Melanerpes formicivorus*
Steller's jay	*Cyanocitta stelleri*
Western Scrub jay	*Aphelocoma californica*
Common bushtit	*Psaltriparus minimus*
Wrentit	*Chamaea fasciata*
Western meadowlark	*Sturnella neglecta*
Red-winged blackbird	*Agelaius phoeniceus*
Black-headed grosbeak	*Pheucticus melanocephalus*
Brown towhee	*Pipilo fuscus*
White-crowned sparrow	*Zonotrichia leucophrys*
Mammals	
Raccoon	*Procyon lotor*
Striped skunk	*Mephitis mephitis*
Gray fox	*Urocyon cinereoargenteus*
Mountain lion	*Felis concolor*
Bobcat	*Lynx rufus*
California ground squirrel	*Spermophilus beecheyi*
Western gray squirrel	*Sciurus griseus*
Deer mouse	*Peromyscus maniculatus*
Brush mouse	*Peromyscus boylei*
Dusky-footed woodrat	*Neotoma fuscipes*
Brush rabbit	*Sylvilagus bachmani*
Blacktail deer	*Odocoileus hemionus columbianus*
Feral pig	*Sus scrofa*
Pallid bat	*Antrozous pallidus*
Amphibians	
California newt	*Taricha torosa*
California slender salamander	*Batrachoseps attenuatus*
Arboreal salamander	*Aneides lugubris*
Pacific treefrog	*Hyla regilla*
Foothill yellow-legged frog	*Rana boylii*
Reptiles	
Western pond turtle	*Emys marmorata*
Western fence lizard	*Sceloporous occidentalis*
Northern alligator lizard	*Gerrhonotus coeruleus coerulens*
Western yellow-bellied racer	*Coluber constrictor mormon*
Pacific gopher snake	*Pituophis melanoleucus catenifer*
Common garter snake	*Thamnophis sirtalis*
Western rattlesnake	*Crotalus viridis*

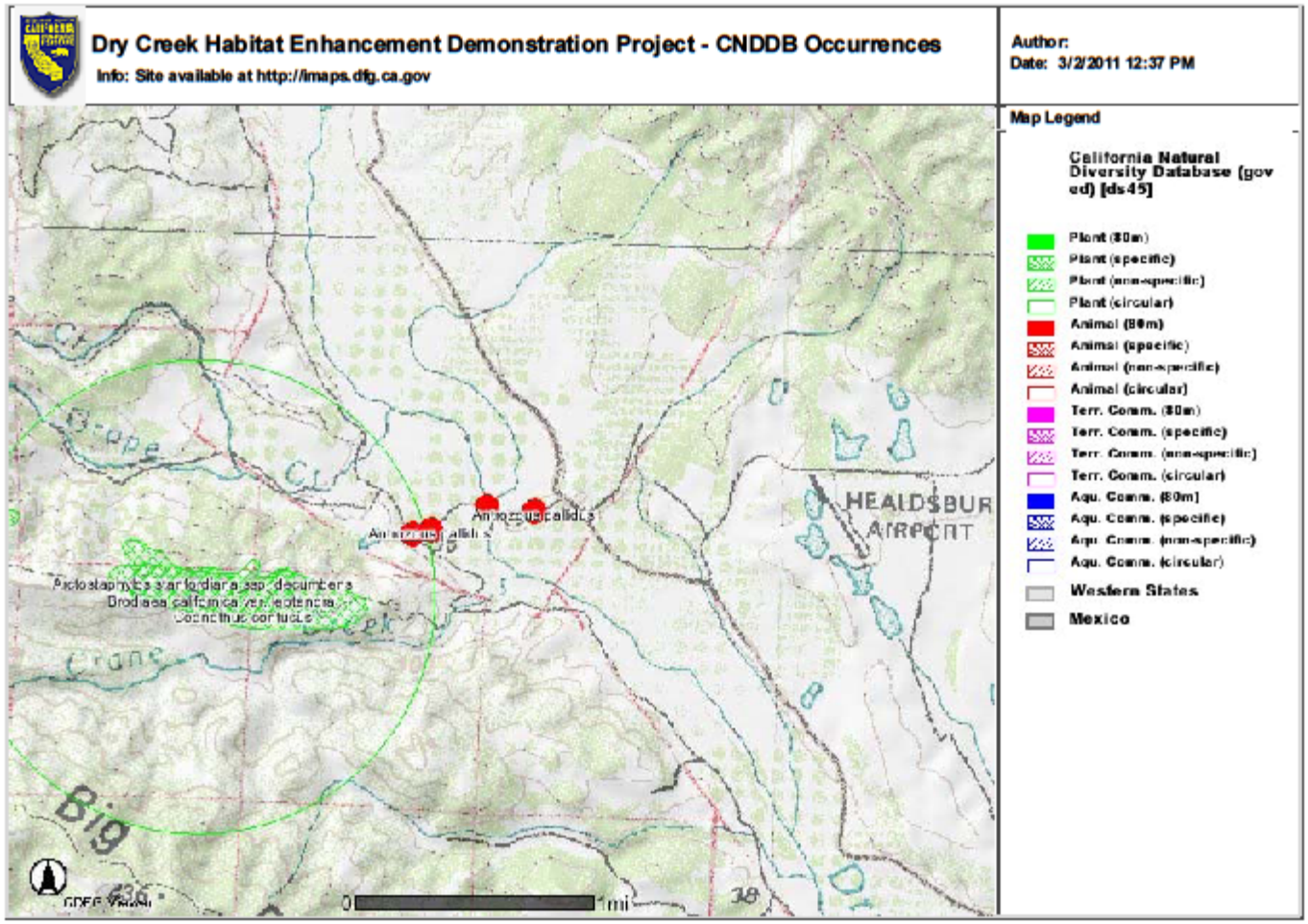


FIGURE 22. CNDDB OCCURRENCES

ENVIRONMENTAL EVALUATION AND MITIGATION MONITORING

The potential environmental impacts of the proposed project and related mitigation measures are identified in the Environmental Checklist. All of the impacts identified in the checklist can be mitigated to a level considered less than significant. Mitigation measures have been developed for impacts that fall within the "Less Than Significant with Mitigation" category. In addition, mitigation measures have been developed for some impacts that are not potentially significant, even without mitigation. The Water Agency proposes implementation of these mitigation measures to further minimize the less than significant impacts.

In compliance with Section 21081.6 of CEQA and the Water Agency's Jurisdiction-Wide Mitigation Monitoring Program, a Draft Mitigation Monitoring Plan (MMP) has been prepared and is included in Appendix E. At the conclusion of the Initial Study public review period, a Final MMP will be prepared, if needed, to incorporate any additional mitigation measures proposed by regulatory agency representatives or the public during the public review period. The Final MMP will be submitted to the Water Agency's Board of Directors, along with the Initial Study and Negative Declaration, for consideration and approval and adoption.

JURISDICTIONAL/PERMITTING AGENCIES

The following are public entities and agencies that may require review of the project or that may have jurisdiction over the project area:

- U.S. Army Corps of Engineers
- National Marine Fisheries Service
- U.S. Fish and Wildlife Service
- California Department of Fish and Game
- California Regional Water Quality Control Board, North Coast Region
- Sonoma County Permit and Resources Management Department

FINDING

On the basis of the Initial Study, the General Manager of the Sonoma County Water Agency has determined that although the proposed project may have a significant effect on the environment, there will not be a significant effect in this case because the effects can be mitigated to a less than significant level. Mitigation measures that have been incorporated in the proposed project are discussed below in the Environmental Checklist and in the MMP in Appendix E.

SUMMARY OF ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" or

"Less Than Significant with Mitigation" as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Agriculture and Forestry Resources	☐ Air Quality
☒ Biological Resources	☒ Cultural Resources	☐ Geology/Soils
☐ Greenhouse Gas Emissions	☐ Hazards & Hazardous Materials	☐ Hydrology/Water Quality
☐ Land Use/Planning	☐ Mineral Resources	☐ Noise
☐ Population/Housing	☒ Public Services	☐ Recreation
☐ Transportation/Traffic	☐ Utilities/Service Systems	☐ Mandatory Findings of Significance

ENVIRONMENTAL CHECKLIST

The following checklist is based on the Environmental Checklist Form (Checklist) included as Appendix G to the CEQA Guidelines (California Code of Regulations Title, Sections 15000 et. seq.) as adopted December 30, 2009 (effective March 18, 2010). The checklist provides a summary of potential impacts that may result from implementation of the proposed project.

With regard to the checklist, a "No Impact" response indicates that no impact would result from implementation of the project. A "Less Than Significant Impact" response indicates that an impact is involved, but is at a level which is less than significant. A "Less Than Significant With Mitigation" response indicates that an impact may potentially be significant, but the incorporation of mitigation measures would reduce the impact to a level of insignificance. For these responses, mitigation measures are included after the discussion of the impact. A "Potentially Significant Impact" response indicates that impacts may be significant if mitigation measures are unknown, infeasible, or not proposed. Each response is discussed at a level of detail commensurate with the potential for adverse environmental effect. The mitigation measures identified in this section would be incorporated into the project, and included in the Mitigation Monitoring Plan.

Supporting Information Sources for each response are indicated in parentheses after each impact topic. Refer to the end of the Checklist for a listing of the Supporting Information Sources.

I. AESTHETICS

Would the proposal:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista? (1,2)	☐	☐	☒	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway? (2)	☐	☐	☒	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings? (2)	☐	☐	☒	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area? (2)	☐	☐	☒	☐

DISCUSSION OF POTENTIAL IMPACTS

a) The project area is located within the Dry Creek Valley, which is identified as a Scenic Landscape Unit in the Sonoma County General Plan 2020. The project area would be visible from Lambert Bridge Road which crosses through the middle of the project area. Portions of the project area may also be visible from Dry Creek Road and West Dry Creek Road. There would be a short-term visual impact associated with construction activities. Project activities, such as dewatering and bypass flow pumping, stockpiling of materials, removal of vegetation, excavation of the backwater/alcove areas, and placement of boulder and log structures, may be considered an aesthetic impact by some people. These construction activities would be clearly visible from Lambert Bridge Road. Some of the construction activities may also be visible from Dry Creek Road and West Dry Creek Road in the project area. Initially after construction, the project area will exhibit signs of being recently disturbed. However, visible portion of the structures built will be natural materials (logs/boulders) that have been designed to be naturally functioning and appearing stream features. These newly placed rocks and log structures and areas that have had vegetation removed would initially be clearly visible. However, within a year, once the project site has gone through winter high flows and a spring growing season, debris deposited by creek flows and new vegetative growth is expected to blend these newly constructed features with existing creek features. Therefore no long-term aesthetic impacts are expected as a result of the project.

b) Please refer to Item I a). The proposed project would not result in any long-term damage of scenic resources.

c) Please refer to Item I a). The proposed project would not result in any long-term degradation of the project area.

d) Lighting will likely be required during the construction phase of the project. Bypass pumping during construction could occur on a 24-hour basis while the project site is de-watered. An operator would be required on site at all times to maintain the pumping equipment while flows are being bypassed. For safety purposes, portable lighting would be brought in to light the work area during nighttime hours. All lighting would be removed at the completion of construction. There would be no permanent lighting associated with features proposed. Construction of the proposed project would not create new sources of light or glare.

II. AGRICULTURAL AND FOREST RESOURCES

In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board.

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use? (3)	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use or a Williamson Act contract? (2)	☐	☐	☒	☐
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))? (2)	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use? (2)	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) The proposed project will not result in the conversion of any farmlands to other uses. The California Department of Conservation designates the entire project area as Prime Farmland. Prime Farmland is defined as having the best combination of physical and chemical features able to sustain long-term agricultural production. Prime Farmlands have the soil quality, growing season, and moisture supply needed to produce sustained high yields. The entire project area is located within the active flow area of the Dry Creek channel. None of the proposed enhancement areas are under agricultural production. Because the bank stabilization sites will require that the existing bank be excavated out and rebuilt, this may require encroachment during construction into adjacent vineyard areas. While this may impact some vineyard land during construction, the long-term

effect to the bank stabilization work would be to protect the vineyard land from future losses as a result of continued erosion that would occur without the bank stabilization.

b) The proposed project will not result in the conversion of any farmlands to other uses or require the cancellation of any existing Williamson Act Contracts. One potential conflict that could occur is due to the fact that the proposed project would need to be constructed during the summer and fall (generally between June 15th and October 15th). There is a potential for construction activities to conflict with harvest activities because the construction time period overlaps with when grapes from the vineyards are harvested and because road access in the vineyard areas is limited. Construction coordination and road use would need to be coordinated with the landowners and vineyard managers in order to avoid potential conflicts.

c) The proposed project is located within the riparian zone of Dry Creek with vineyard, wineries, and residential land uses adjacent to the riparian corridor. No timber harvest activities are occurring or expected to occur within the project area,

d) The proposed project is located within the riparian zone of Dry Creek with vineyard, wineries, and residential land uses adjacent to the riparian corridor. No timber harvest activities are occurring or expected to occur within the project area,

e) The proposed project would not result in a change in existing land use.

III. AIR QUALITY

Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations.

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Conflict with or obstruct implementation of the applicable air quality plan? (2)	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation? (4,5)	☐	☐	☒	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)? (2,4)	☐	☐	☒	☐
d) Expose sensitive receptors to substantial pollutant concentrations? (2,4)	☐	☐	☒	☐
e) Create objectionable odors affecting a substantial number of people? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) The proposed project is not anticipated to conflict with any air quality plan.

b) The project site is within the boundaries of the Northern Sonoma County Air Pollution Control District (NSCAPCD). The NSCAPCD is primarily rural and mountainous, and contains only two urbanized areas (Healdsburg and Cloverdale). According to the State of California Air Resources Board, based on 2006 to 2008 air quality monitoring, the NSCAPCD area is in attainment for the State Particulate Matter (PM10) standard. PM10 is dust less than 10 microns in diameter. Fugitive dust is a source of particulate matter emissions. Dust generation during restoration activities is anticipated to be minimal, principally because the soils that would be moved would have a high moisture content due to their proximity to the creek. The proposed project is also located in an agricultural and rural residential area and is not anticipated to result in any air quality violations. The following measures are included to minimize fugitive dust generation during restoration activities.

Mitigation Measure DCHED-1*: The project specifications will require the contractor to comply with the dust control provisions of the Sonoma County Water Agency's Standard Contract Documents and the Northern Sonoma County Air Pollution Control District's Rule 430 that regulate fugitive dust emissions. Measures to reduce dust emissions may include, but are not limited to: sprinkling unpaved construction areas with water; covering trucks hauling dirt; limiting dust*

generating activities during periods of high winds (greater than 15 miles per hour); replacing ground cover in disturbed areas as soon as possible; enclosing, covering, watering, or applying soil binders to exposed stock piles; removing earth tracked onto neighboring paved roads at least once daily; and limiting equipment speed to 10 miles per hour in unpaved areas.

Mitigation Measure DCHED-2: *The project specifications will require that all construction vehicles and equipment emission levels meet current air quality standards and that idling time for all heavy equipment be minimized to reduce on-site emissions.*

c) Please refer to Item III b).

d) Please refer to Item III b).

e) No objectionable odors would result from restoration activities proposed for the project.

IV. BIOLOGICAL RESOURCES

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service? (2)	☐	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service? (2)	☐	☒	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act, including, but not limited to, marsh, vernal pool, coastal, through direct removal, filling, hydrological interruption, or other means? (2)	☐	☐	☒	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites? (2)	☐	☐	☒	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance? (2)	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local regional, or state habitat conservation plan? (2,6,7)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) The project area currently provides limited rearing habitat for salmonids, in particular for the federal Endangered Species Act listed as endangered coho salmon. The project is a requirement of the Reasonable and Prudent Alternatives of an Endangered Species Act Section 7 Biological Opinion issued by the National Marine Fisheries Service in 2008. The purpose of the proposed project is to restore rearing habitat by increasing shelter and moderating flow conditions in Dry Creek. The proposed habitat changes are also expected to benefit the federally listed as threatened Chinook salmon and the federally and California Endangered Species Act listed threatened steelhead, which are known to occur in the project area.

Construction in or near the streambed is scheduled for the months of June through October during summer low-flows. All flows in Dry Creek (approximately 100 to 120 cfs) would need to be diverted around the construction work area. Work areas would be isolated from the moving stream using some type of imported barrier or

material (water filled bladders, gravel cofferdams, sheetpile cofferdams, etc.). Typically, the work area would be isolated and the creek flow would be allowed to continue flowing adjacent to the isolated work area. In some cases it may be necessary to completely isolate the creek from bank to bank. In this case, bypass pumping from the upstream end of the work area to the downstream end of the work area would occur to bypass creek flows around the work area. The bypass pumping would result in the work area being dewatered during construction and remain unavailable to fish for the duration of construction. There is potential for upstream migrating adult Chinook salmon to be present within the project area during these months. Juvenile steelhead, coho salmon, and Chinook salmon could potentially be present within the project area during these months. Special-status fish species including hardhead and Pacific lamprey, as well as any other resident fish species, could also be present during the construction period. Dewatering would require installation of cofferdams upstream and downstream of the project site, diverting stream flow around the project site, and removing fish from within the project site. The following mitigation measure is incorporated into the project to minimize impacts to special status fish species as a result of temporary loss of habitat availability during construction activities through the removal of fish species to appropriate habitat outside of the project site.

Mitigation Measure DCHED-3: *During dewatering activities, fish located within the project site would be removed and relocated to appropriate habitat downstream of the project site. Qualified fisheries biologists, using methods approved by the National Marine Fisheries Service and California Department of Fish and Game, would perform the fish rescue and relocation.*

The project site provides potential habitat for foothill yellow-legged frog and northwestern pond turtle. Construction activities would result in temporary loss of habitat availability within the project site. The following mitigation measure is incorporated into the project to reduce impacts to foothill yellow-legged frog and northwestern pond turtle habitat to less than significant.

Mitigation Measure DCHED-4: *Prior to beginning construction activities, pre-construction surveys will be performed within the project site. Should foothill yellow-legged frog or northwestern pond turtle be found within the construction area, individuals will be relocated by a qualified biologist to an area of appropriate habitat outside of the construction area.*

Removal of existing riparian habitat within the project site would reduce available breeding and foraging habitat for special-status bird species such as lark sparrow, osprey, yellow warbler, yellow-breasted chat, and Pacific-slope flycatcher. Planting of recontoured banks would reestablish riparian habitat within the project site and in some cases would provide new riparian habitat in portions of the project site where such habitat currently does not exist. The construction schedule would likely avoid impacts to breeding activities of these species. However, should construction activities begin in July, the following measure would be implemented to reduce the impact to less than significant.

Mitigation Measure DCHED-5: *Prior to beginning construction activities, pre-construction surveys will be performed within the project site to determine the presence of special status species nests. If special status species nests are encountered within the project site, a nest protection zone of 500 feet for raptors and 50 feet for other birds will be defined, and physical barriers such as fencing will be installed to prevent construction equipment from disturbing the nest. Nests will be monitored weekly during construction activities, and protection measures or construction activities will be modified as necessary.*

Foraging habitat for special status species such as hermit warbler, loggerhead shrike, merlin, fringed myotis, long-eared myotis, long-legged myotis, Yuma myotis, Pacific western big-eared bat, pallid bat, and pale big-eared bat would be temporarily impacted during construction activities. The temporary impact would be less than significant as appropriate foraging habitat is available upstream and downstream of the project site. Habitat enhancement work associated with the project would also restore foraging habitat to the site.

b) Habitat enhancement work, including bank recontouring, installation of log and boulder structures, and vegetation management throughout the project site, would require removal of existing riparian vegetation. Riparian trees and shrubs dominate vegetated sections of stream banks within the project site. Replanting of native riparian trees and shrubs in specific locations, such as at bank stabilization sites, is a component of the proposed project. The following measure is included to reduce potential impacts to less than significant.

Mitigation Measure DCHED-6: *The Water Agency will prepare and implement a revegetation plan to mitigate the loss of native riparian vegetation. Recontoured banks will be seeded and revegetated. Erosion control fabric will be placed on all exposed banks to prevent erosion. Plant species selected for revegetation will be based upon surveys of riparian habitat along Dry Creek upstream and downstream of the project site. Planting requirements in the revegetation plan will be based upon species composition and density recommendations associated with the overall habitat enhancement design for the project. The final revegetation plan will include details regarding planting, implementation, maintenance, and monitoring.*

c) The proposed project is a restoration project intended to improve aquatic habitat and water quality within the project site. For work proposed within Dry Creek, the Water Agency will apply for an Individual Permit from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act, a water quality certification from the North Coast Regional Water Quality Control Board under Section 401 of the Clean Water Act, and a Streambed Alteration Permit from the California Department of Fish and Game under Section 1600 of the California Fish and Game Code. The total amount of existing Corps of Engineers jurisdictional area within the project area is 19.4 acres (6.8 acres of open water area and 12.6 acres of vegetated wetland areas within the OHW). The project would require work and fill material within Corps jurisdictional areas; however, the habitat enhancement project is anticipated to result in a net increase in the total Corps jurisdictional

area to 20.4 acres (9.4 acres of open water area and 11 acres of vegetated wetland areas within the OHW). The proposed project does not require mitigation for impacts to wetlands, as the proposed activities are anticipated to improve the quality and increase the acreage of waters of the United States within the project site. No substantial adverse effects to wetlands or other waters of the United States are anticipated to result from the proposed project.

d) Construction activities would temporarily restrict fish movements into the project site. Cofferdams would be located at the upstream and downstream ends of the project site that would restrict fish passage into the project site. Chinook salmon have the potential to be present in the project area; however, the proposed construction period is in the early portion of the Chinook salmon run in Dry Creek and instream work would be complete before the peak migration period. This temporary impact is considered less than significant because the restriction is temporary, would not occur during a critical life stage for passage, and the fish habitat in the project area is anticipated to improve as a result of the project. Construction activities would temporarily restrict wildlife movements through the project site. This impact will be temporary (June-October) and is limited to the project site. The impact is considered less than significant because alternative corridors would be available during construction activities.

e) The proposed project would not conflict with any local policies or ordinances protecting biological resources.

f) The proposed project would not conflict with any Habitat Conservation, Natural Community Conservation, or any other conservation plans within the project area. The project would support the goals of the NMFS's *Recovery Plan for the Evolutionary Significant Unit of Central California Coast Coho Salmon* and the California Department of Fish and Game's *Recovery Strategy for California Coho Salmon*.

V. CULTURAL RESOURCES

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource as defined in CEQA Guidelines §15064.5? (8)	☐	☒	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to CEQA Guidelines §15064.5? (8)	☐	☒	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature? (8)	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries? (8)	☐	☒	☐	☐

DISCUSSION OF POTENTIAL IMPACTS

a) An archaeological investigation of the project site did not identify any cultural resources within the project area. The Lambert Bridge was identified as a historical resource within the project area. The project does not involve any changes or modifications to Lambert Bridge. Therefore, the project is not anticipated to have an adverse effect to historical or archaeological resources. However, excavation during project construction has the potential to expose and affect subsurface cultural resources that were not visible and identified during cultural resource field survey for the project. The potential for impacts to potential unknown cultural resources in the project area would be less than significant with incorporation of the following mitigation measure.

Mitigation Measure DCHED-7: *The project specifications will require the contractor to comply with the Sonoma County Water Agency's Standard Contract Documents regarding the discovery of cultural resources. The Water Agency Construction Inspector and construction personnel will be notified of the possibility of encountering archaeological materials during project construction. The project specifications will provide that if discovery is made of items of historical, archaeological or paleontological interest, the contractor will immediately cease all work activities in the area of discovery. Archaeological indicators may include, but are not limited to, dwelling sites, locally darkened soils, stone implements or other artifacts, fragments of glass or ceramics, animal bones, human bones, and fossils. After cessation of excavation, the contractor will immediately contact the Water Agency's Construction Inspector. The contractor will not resume work until authorization is received from the Construction Inspector. If archaeological indicators are discovered during construction, the Water Agency will retain the services of a qualified professional archaeologist to evaluate the significance of the items prior to resuming any activities that could impact the site. If it is determined that the find is unique and/or potentially eligible for listing in the California Register, and the site cannot be avoided, an archaeologist shall provide a research design and*

excavation plan outlining recovery of the resource, analysis, and reporting of the find. The research design and excavation plan will be submitted to the Water Agency's Construction Inspection Section and approved by the Water Agency prior to construction being resumed.

b) Please refer to Item V a).

c) No unique paleontological resources or unique geologic features were identified within the project site.

d) No human remains have been identified within the project site. Please refer to Item V a).

VI. GEOLOGY AND SOILS

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
1) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42. (2, 9)	☐	☐	☒	☐
2) Strong seismic ground shaking? (2,9)	☐	☐	☒	☐
3) Seismic-related ground failure, including liquefaction? (2,9)	☐	☐	☒	☐
4) Landslides? (2)	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil? (2)	☐	☐	☒	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse? (2)	☐	☐	☒	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property? (10)	☐	☐	☒	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of wastewater? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a1) Regional geologic mapping show several strands of the Healdsburg fault within and immediately adjacent to the Dry Creek drainage. The project consists of habitat modifications along an existing stream. The project would not result in the construction of buildings or other occupied structures. Construction of the proposed project would not expose people or property to risks associated with potential fault rupture greater than those that exist under present conditions, therefore the impact is considered less than significant.

a2) Please refer to Item a1 above. Construction of the proposed project would not expose people or property to risks associated with potential fault rupture greater than those that exist under present conditions, therefore the impact is considered less than significant.

a3) Please refer to Item a1 above. Construction of the proposed project would not expose people or property to risks associated with potential seismic-related ground failure, including liquefaction, greater than those that exist under present conditions, therefore the impact is considered less than significant.

a4) The project is located in a valley, which is relatively more stable than surrounding hillsides. Construction of the proposed project would not expose people or property to risks associated with potential landslides greater than those that exist under present conditions, therefore the impact is considered less than significant.

b) The proposed project is a restoration project intended to improve aquatic habitat and water quality within the project site. The project would reduce soil erosion into Dry Creek during high flows. Stabilized stream bank areas would reduce the loss of streambanks and adjacent agricultural lands. All areas above the low-flow water line that are disrupted by construction activities will be protected from erosion through the use of seeding/revegetation and/or protected with erosion control fabric to minimize erosion potential. Therefore, the impact is considered less than significant.

c) The project site is located in an area that is alluvial material and saturated due to the year-round flows in the creek. It is indicated as being subject to liquefaction potential in the Sonoma County General Plan 2020. However, as noted above in a3 and a4, construction of the proposed project would not expose people or property to risks associated with potential seismic-related ground failure, including liquefaction, or failure due to landslides, greater than those that exist under present conditions. It is not anticipated that the project area would result in the area becoming unstable or result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse, therefore the impact is less than significant.

d) The project site is primarily on soils classified as Riverwash with adjacent lands outside of the creek primarily part of the Yolo soils series. Riverwash materials consist of very recent depositions of gravel, sand, and silt alluvium. Yolo series soils consist of well-drained loams underlain by recent alluvium. Shrink-swell potential is a description of the extent to which a soil type shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads and other structures. The soil types in the project area have low levels of clay and therefore have correspondingly low shrink-swell potential. In addition, the types of structures proposed would not be subject to damage even if minor amounts of shrinking and swelling were to occur. The proposed project would not create substantial risks to life or property as a result of construction on expansive soils, therefore the impact is less than significant.

e) The proposed project would not include septic tanks or alternative wastewater disposal systems.

VII. GREENHOUSE GAS EMISSIONS

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment? (2)	☐	☐	☐	☒
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) Construction activities would require equipment such as vehicles and generators that would generate greenhouse gas emissions. Periodic monitoring and maintenance activities would also require additional vehicle trips which would generate greenhouse gas emissions. Vehicle trips associated with construction, monitoring, and maintenance activities is not anticipated to result in a substantial increase in traffic in the Dry Creek corridor. The project itself would not generate any greenhouse gas emissions. Given the limited and temporary nature of the greenhouse gas emission sources associated with the project, significant emissions, either directly or indirectly, of greenhouse gases is not anticipated as a result of the proposed project

b) Being the largest energy user in Sonoma County, in 2006, the Water Agency committed to the goal of operating a carbon free water system by 2015. To achieve this goal, the Water Agency is actively working to diversify its energy portfolio and reduce its energy and fuel needs through efficiency and renewable energy production. Through this effort the Water Agency is helping to pioneer new technologies that have been carefully evaluated for economic viability. The proposed project would not negatively conflict with any of the Water Agency's efficiency and renewable energy production programs. The proposed project is not anticipated to conflict with any other applicable plans, policies, or regulations adopted for the purpose of reducing the emissions of greenhouse gases.

VIII. HAZARDS AND HAZARDOUS MATERIALS

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal, of hazardous materials? (2)	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment? (2,11)	☐	☐	☒	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school? (2)	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment? (2,11)	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area? (2)	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area? (2)	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan? (2)	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) The proposed project would require the occasional transport of vehicles, construction equipment, and construction materials that use hazardous materials (e.g. motor oil, gasoline), but will not include the routine transport or disposal of hazardous materials. Therefore, the impact is considered less than significant.

b) A Preliminary Hazard Waste Assessment that included the project area was conducted in 2010. The Preliminary Hazardous Waste Assessment identified two wineries within the project boundaries that are active industrial facilities that treat and/or dispose of winery wastes generated from onsite operations. These ongoing stormwater/wastewater management issues associated with existing winery operations are not expected to be impacted by the proposed project. No

other known or suspected hazardous materials sites were identified within the project area. Construction of the project would require the use of vehicles and equipment that may have a slight potential for accidentally spilling oil or fuel. Accidental release of any hazardous materials (e.g. motor oil, gasoline) would not create a significant hazard to the public or environment because the project is located in a sparsely populated area, the quantity and toxicity of materials that could be released would be low, best management practices would be employed to prevent a spill from occurring, and the project site would be isolated by cofferdams from upstream and downstream sections of Dry Creek. Therefore, the construction of the proposed project would not create a significant hazard to the public or environment. However, the following mitigation measure is included to reduce the impact further.

Mitigation Measure DCHED-8: *The project specifications will require the contractor to comply with the Sonoma County Water Agency's Standard Contract Documents to protect the project area from being contaminated by the accidental release of any hazardous materials and/or wastes. Disposal of all hazardous materials will be in compliance with all current hazardous waste disposal laws. The construction contractor will contact the local fire agency and the Sonoma County Department of Environmental Health for any site-specific requirements regarding hazardous materials or hazardous waste containment or handling.*

Mitigation Measure DCHED-9: *The project specifications will require the contractor to prepare a Safety Plan in accordance with the Sonoma County Water Agency's Standard Contract Documents. If hazardous materials are encountered during construction activities, the contractor will be required to halt construction immediately and notify the Water Agency's Construction Inspection Section. Disposal of all hazardous materials will be in compliance with all applicable hazardous waste disposal laws.*

c) As noted above in Item VII a) and b), the potential for release of hazardous materials is low and limited to only during construction. In addition, the nearest existing or proposed school is over 3 miles southeast of the project site. Therefore, no impact to an existing or proposed public school within one-quarter mile of the project site is expected.

d) Please refer to the Item VII b) above.

e) The project site is approximately 1.5 miles west of the Healdsburg Municipal Airport. The project would not alter existing elevations or involve the construction of any structures that might interfere with airport operations.

f) The project site is not located near a private airstrip.

g) The proposed project is located on private property and would not interfere with an adopted emergency response plan or emergency evacuation plan.

h) The project site is located in an area of mixed agricultural and residential uses adjacent to wildlands. The proposed project would not expose people or structures to a significant risk of loss, injury or death involving wildland fires beyond the risks that currently exist in the vicinity of the project area.

IX. HYDROLOGY AND WATER QUALITY

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Violate any water quality standards or waste discharge requirements? (2)	☐	☐	☒	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g. the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)? (2)	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river in a manner which would result in substantial erosion or siltation on- or off-site? (2)	☐	☐	☒	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site? (2)	☐	☐	☒	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff? (2)	☐	☐	☐	☒
f) Otherwise substantially degrade water quality? (2)	☐	☐	☒	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map? (2)	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows? (12)	☐	☐	☒	☐
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam? (2,12)	☐	☐	☒	☐
j) Inundation by seiche, tsunami, or mudflow? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) The proposed project would require installation of cofferdams, diverting flows around the project site, dewatering the project area, and earthwork within the bed and bank of a creek. These activities have the potential to violate water quality or waste discharge requirements. Construction of the project would require a water quality certification from the California Regional Water Quality Control Board, North Coast Region, under Section 401 of the Clean Water Act associated with the placement of fill within waters of the United States. The

Water Agency will submit a dewatering plan and stormwater pollution control plan to the California Regional Water Quality Control Board, North Coast Region for their approval prior to commencing construction.

b) The proposed project could require diverting flows around portions of the project site during construction. This short-term diversion of flows around the work area is not anticipated to deplete groundwater supplies or interfere with groundwater recharge because of the limited distance of the proposed diversion area and underflow through the gravels beneath the work area would likely still occur. Proposed biotechnical channel adjustments (raising of the streambed and placement of cross vane weirs) would use rock that would not affect groundwater recharge along the river.

c) The proposed project is a restoration project intended to improve aquatic habitat and water quality within the project site. Streambank stabilization aspects of the project would reduce soil erosion into Dry Creek. The project would result in backwater and side channel areas along Dry Creek where flow velocities would be lower to enhance fisheries habitat; however, the overall drainage pattern through the project area would remain the same.

d) Refer to the Items VIII a, b, and c above. The proposed project is a restoration project intended to improve aquatic habitat and water quality within the project site. It would not substantially change the existing drainage pattern of the site or area or result in flooding on- or off-site.

e) The proposed project would not affect stormwater drainage systems or water quality because the proposed project would not create additional runoff water or provide an additional source of polluted runoff.

f) The proposed project is a restoration project intended to improve aquatic habitat within the project site. The proposed project would not degrade water quality because construction in or near the streambed is scheduled for months (June-October) when there would be minimal surface flow. The project site would be dewatered during construction. Dewatering would require installation of cofferdams and project construction would comply with applicable requirements of the California State Regional Water Quality Control Board, North Coast Region. The proposed project would reduce contribution of sediment into Dry Creek through stabilization and revegetating eroding streambanks.

g) The proposed project would not include the construction of housing.

h) Existing hydraulic patterns and proposed changes in the creek bed were assessed using the United States Army Corps of Engineers Hydraulic Engineering Center River Analysis System (HEC-RAS). HEC-RAS is a computer program that models the hydraulics of water flow through natural rivers and other channels. The HEC-RAS modeling indicates that 100-year flood water surface profiles would be similar between existing and proposed conditions, though slight increases are predicted in select locations, primarily in areas adjacent to proposed riffle construction. For the 100-year flood flow, increases in water surface profile range from 0 to 1.1 feet, although the flood waters are still predicted to be contained in the creek

corridor. Therefore, the proposed project would not impede or redirect flood flows within the project area. The one hundred year flood flow was used as a standard Base Flood as used by the Federal Emergency Management Agency (FEMA) in their flood insurance programs. A one hundred year flood is a storm event that has a one-in-one hundred chance of occurring in any year.

i) Please refer to Item VIII h). The proposed project would include placement of rock and logs within the stream channel area of Dry Creek. The project design anticipates the potential winter high flow events. The design intention is to have the boulder and log structures anchored so that they do not become mobilized and moved downstream during high flow events. There is always the potential that any habitat enhancement structures or portions of structures placed within the active channel area can fail and move downstream. The concern with debris moving downstream is that it can hang up somewhere else down the channel and cause water to back up or erode channels in an unexpected manner. However, this is a potential issue that also exists for the existing riparian vegetation along Dry Creek. The proposed project is not anticipated to substantially increase the risk of debris being mobilized and moved downstream during high flow events. Monitoring of the project site for at least five years after construction is planned as part of project implementation. One component of post-project monitoring would be to evaluate the durability of the structures. Construction of the proposed project would not expose people or structures to risks involving flooding, including failure of a levee or dam, greater than those that exist under present conditions, therefore, the impact is considered less than significant.

j) The proposed project is not located in an area subject to inundation by seiche, tsunami, or mudflow.

X. LAND USE AND PLANNING

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Physically divide an established community? (2)	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project adopted for the purpose of avoiding or mitigating an environmental effect (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance)? (2)	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) The proposed project would not physically divide or otherwise alter an established community.

b) The project site is located in an area zoned for agricultural lands and rural residential uses. The proposed project would not change the existing land use of the project site or adjacent land uses.

c) Please refer to Item IV f).

XI. MINERAL RESOURCES

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state? (2)	☐	☐	☒	☐
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) No gravel mining operations are currently operating within Dry Creek, although gravel mining has occurred in the past. The proposed project is not anticipated to result in a loss of availability of any known mineral resources. The proposed project would rely on the continued natural movement of gravel and sediment through the project area during high flows. The structures may induce scour in some locations and enhance deposition of bedload in other areas. However, the ability for Dry Creek to move alluvial materials is not expected to change significantly and high flows through the structures would allow for deposition and resuspension of gravels, so bedload movement would not be significantly inhibited. Construction would also occur during the summer low-flow period when bedload movement in Dry Creek is not occurring in any significant manner. The temporary diversion of flows around the work area during the summer low-flow period would not impact sediment bedload transport in Dry Creek. Therefore, the impact is less than significant.

b) There are no known locally-important mineral resource recovery sites within the project vicinity.

XII. NOISE

Would the project result in:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance or applicable standards of other agencies? (2,13)	☐	☐	☒	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels? (2)	☐	☐	☒	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project? (2)	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project? (2)	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels? (2)	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) Construction of the proposed project would result in a temporary increase in noise associated with construction activities. Due to the nature of having to divert stream flow in order to construct the project, construction activities could occur on a 24-hour basis in order to limit the time that doversion of stream flows is required. There are residences adjacent to the project site that could be exposed to increased noise levels during construction activities; however, the overall project area setting is an agricultural setting. Existing noise-generating agricultural activities can and do occur at various hours over a 24-hour period depending upon needs (e.g. harvest, frost protection activities). The proposed construction activities would be te,porary during the construction period and would not represent a significant new source of noise in the project area. Future maintenance activities would occur during regular daytime work hours (weekdays, 8:00 a.m. to 5:00 p.m.).

b) Please refer to Item XI a).

c) The proposed project would not result in any permanent increase in ambient noise levels.

d) Construction of the proposed project would result in a temporary increase in noise associated with the operation of construction vehicles and equipment. Construction of the project would not result in substantial temporary or periodic

increases in ambient noise levels above levels existing without the project because the project is located in an agricultural area subject to temporary and periodic increases in noise levels as a result of farm equipment operations. Therefore, the impact is less than significant.

e) The proposed project site is approximately 1.5 miles from the Healdsburg Municipal Airport; however, the Healsburg Municipal Airport does not generate a significant amount of noise in the project area. In addition, since the project does not consist of the construction of any new homes or work locations, the project does not consist of any components that would result in placing new sensitive receptors in the project area.

f) The proposed project is not located within the vicinity of a private airstrip.

XIII. POPULATION AND HOUSING

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)? (2)	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere? (2)	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) The proposed project would not directly or indirectly induce population growth in the area because no new homes and businesses are proposed. The proposed project would not require extension of roads or other infrastructure.

b) The proposed project would not displace housing because no homes exist within the project site.

c) The proposed project would not displace people because there are no inhabitants within the project site.

XIV. PUBLIC SERVICES

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Would the project result in: 1) substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities; or 2) the need for new or physically altered governmental facilities, of which the construction could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the following public services:				
1) Fire protection? (2)	☐	☐	☐	☒
2) Police protection? (2)	☐	☐	☐	☒
3) Schools? (2)	☐	☐	☐	☒
4) Parks? (2)	☐	☐	☐	☒
5) Other public facilities? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a1) The proposed project would not require alteration of existing or construction of new governmental facilities, including fire protection.

a2) The proposed project would not require alteration of existing or construction of new governmental facilities, including police protection.

a3) The proposed project would not require alteration of existing or construction of new governmental facilities, including schools.

a4) The proposed project would not require alteration of existing or construction of new governmental facilities, including parks.

a5) The proposed project would not require alteration of existing or construction of new public facilities.

XV. RECREATION

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated? (2)	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) There are no parks or other recreational facilities located within the project site. The proposed project would not impact parks or other recreational facilities.

b) The proposed project does not include the construction or expansion of recreation facilities.

XVI. TRANSPORTATION/TRAFFIC

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit? (2,14)	☐	☐	☒	☐
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways? (2)	☐	☐	☒	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks? (2)	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)? (2)	☐	☐	☐	☒
e) Result in inadequate emergency access? (2)	☐	☐	☐	☒
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) Construction vehicles may cause a short-term delay of traffic along Lambert Bridge Road, and possibly Dry Creek Road and West Dry Creek Road, as vehicles enter and exit the project site, but it is not anticipated that the project would substantially increase traffic or cause traffic congestion in relation to the capacity of the road. Lambert Bridge Road and West Dry Creek Road are designated as Rural Minor Collectors. Dry Creek Road is designated as a Rural Major Collector. Traffic control would be implemented by the construction contractor if necessary to allow the passage of construction vehicles and the delivery of materials to the site.

b) Construction vehicle traffic is expected to temporarily increase by approximately 45 vehicle trips per day. Vehicles traveling to and from the site during project construction would not exceed, either individually or cumulatively, the level of service standard for Dry Creek Road. The increase in vehicle traffic would be temporary and would primarily be concentrated over a few months during the

construction period. Therefore, the temporary impact would be less than significant.

c) The proposed project does not include air transportation and would not affect air traffic patterns.

d) The proposed project would not change any road design or cause any road obstructions.

e) The proposed project would not change emergency access from the existing conditions.

f) The proposed project would not conflict with alternative transportation policies, plans, or programs. The proposed project would be located on private property. There is adequate room to stage construction vehicles, equipment, and materials. No off-site parking would be necessary.

XVII. UTILITIES AND SERVICE SYSTEMS

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects? (2)	☐	☐	☐	☒
b) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board? (2)	☐	☐	☐	☒
c) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments? (2)	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed? (2)	☐	☐	☐	☒
e) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects? (2)	☐	☐	☐	☒
f) Comply with federal, state, and local statutes and regulations related to solid waste? (2)	☐	☐	☐	☒
g) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) The proposed project would not require or result in the construction or expansion of wastewater treatment facilities.

b) The proposed project would not require wastewater treatment.

c) The proposed project would not require wastewater treatment.

d) The proposed project would not require new potable water supplies.

e) The proposed project would not require or result in the construction or expansion of stormwater drainage features.

f) Excess soil and construction debris would be disposed at a nearby landfill or an appropriate recycling facility.

g) The proposed project would require the disposal of construction-related debris and soil. The quantity of solid waste is not expected to substantially affect the capacity of the landfill. In addition, all materials that can be recycled (e.g. metal, concrete) would be taken to appropriate recycling facilities.

XVIII. MANDATORY FINDINGS OF SIGNIFICANCE

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory? (2)	☐	☒	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)? (2)	☐	☐	☐	☒
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly? (2)	☐	☐	☐	☒

DISCUSSION OF POTENTIAL IMPACTS

a) The proposed project is a habitat enhancement project designed specifically to improve the quality of habitat in Dry Creek for rare and threatened fish populations. An archaeological investigation of the project area did not identify any known cultural resources within the project area. The proposed project does not have potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or pre-history.

b) The proposed project does not have impacts that are individually limited, but cumulatively considerable. This project is an initial demonstration project along a one mile section of Dry Creek. If the demonstration project shows that habitat enhancement is feasible and effective for increasing habitat in Dry Creek for coho, Chinook, and steelhead, then an additional 5 miles of Dry Creek habitat would undergo similar habitat enhancement. Additional environmental documentation would be prepared for this additional habitat enhancement. The intent is that the demonstration project along with future habitat enhancement projects in Dry Creek would be cumulatively beneficial for rare and threatened fish populations in Dry Creek.

c) The proposed project does not have environmental effects that would cause substantial adverse effects on human beings.

DETERMINATION

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

Signature: _____ Date: 5/24/11

for Grant Davis - General Manager

SUPPORTING INFORMATION SOURCES

1. County of Sonoma Permit and Resource Management Department. *Sonoma County General Plan 2020*. Figure OSRC-1. 2008.
2. Professional observations and judgment of the document preparer and other Water Agency staff.
3. California Department of Conservation. Division of Land Resource Protection. Farmland Mapping and Monitoring Program. *Sonoma County Important Farmland 2008* Map. ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/pdf/2008/son08.pdf
4. California Air Resources Board. 2010 State Area Designation Maps. http://www.arb.ca.gov/desig/adm/adm.htm
5. Northern Sonoma County Air Pollution Control District – Rule 430 –Fugitive Dust Emissions. http://www.arb.ca.gov/DRDB/NSC/CURHTML/R1-4-430.HTM
6. National Marine Fisheries Service. Mendocino County Planning Department. *Recovery Plan for the Evolutionary Significant Unit of Central California Coast Coho Salmon.* Draft -March 2010.
7. California Department of Fish and Game. *Recovery Strategy For California Coho Salmon*. February 2004.
8. Del Bondio, Lauren and Thomas M. Origer, M.A./R.P.A *An Archaeological Survey for the Dry Creek Habitat Enhancement Demonstration Project. Sonoma County, California.* December 23, 2010.
9. Inter-Fluve. *Current Conditions Inventory Report Dry Creek: Warm Springs Dam to Russian River, Sonoma County, CA.* Draft- March 2010.
10. United States Department of Agriculture. Soil Survey – Sonoma County California. 1972.
11. Kennedy/Jenks. Draft Technical Memorandum. Preliminary Hazardous Waste Assessment Dry Creek Bypass Pipeline Feasibility Study. Figure 6-7 and Appendix A. August 2010.
12. Inter-Fluve. *60% Complete Design Report – Dry Creek Habitat Enhancement Demonstration Projects: River Miles 6.2 to 7.3. Sonoma County, CA*. Draft- October 1, 2010.
13. County of Sonoma Permit and Resource Management Department. *Sonoma County General Plan 2020*. *Noise Element*. 2008.
14. County of Sonoma Permit and Resource Management Department. *Sonoma County General Plan 2020*. Figure CT-4c - Roadway Classifications. 2008.

APPENDIX A
Notice of Preparation and Comment Letters Received

June 24, 2010

NOTICE OF PREPARATION OF INITIAL STUDY

TO: State Clearinghouse,
Responsible and Trustee Agencies,
Property Owners and Interested Parties

FROM: Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, CA 95403

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT

The Sonoma County Water Agency (Agency) is preparing an Initial Study for the Dry Creek Habitat Enhancement Demonstration Project. An Initial Study is a preliminary analysis of a project's potential environmental impacts used to determine whether a Negative Declaration or an Environmental Impact Report will be prepared. It is a public document that analyzes the potential environmental effects related to construction, operation, and maintenance of a project and describes ways to reduce or avoid possible environmental damage.

The Initial Study for the Dry Creek Habitat Enhancement Demonstration Project will be prepared in accordance with the provisions of the California Environmental Quality Act (CEQA), the State CEQA Guidelines, and the Agency's Procedures for the Implementation of CEQA. The Agency will act as the Lead Agency pursuant to CEQA, and will consider all comments received in response to this Notice of Preparation (NOP), including comments from responsible and trustee agencies, property owners, and interested parties regarding the scope and content of the information to be included in the Initial Study. Agencies and interested members of the public are invited to provide input on the scope and content of the environmental information that should be included in the Initial Study.

PROJECT BACKGROUND AND NEED: The Agency was created in 1949 by the California Legislature as a special district to provide flood protection and water supply services. The Sonoma County Board of Supervisors acts as the Agency's Board of Directors. The Agency's powers and duties, as authorized by the California Legislature, include the production and supply of surface water and groundwater for beneficial uses, control of flood waters, generation of electricity, providing recreational facilities (in connection with the Agency's facilities), and the treatment and disposal of wastewater.

From its outlet in Warm Springs Dam, Dry Creek meanders 14 miles to the Russian River. The creek is home to endangered coho salmon and threatened Chinook salmon and steelhead (including steelhead raised at the Don Clausen Fish Hatchery). The creek also serves as a conduit for water that is released from Lake Sonoma by the U.S. Army Corps of Engineers in the winter for flood control purposes and by the Agency in the summer for water supply.

The National Marine Fisheries Service (NMFS) issued the *Biological Opinion for Water Supply, Flood Control Operations, and Channel Maintenance conducted by the U.S. Army Corps of Engineers, the Sonoma County Water Agency, and the Mendocino County Russian River Flood Control and Water Conservation District in the Russian River Watershed* (Russian River BO) on September 24, 2008.[1] NMFS' Russian River BO is a culmination of more than a decade of consultation between the Agency, the U.S. Army Corps of Engineers (Corps), and the NMFS regarding the impact of the Agency's and Corps' water supply and flood control activities on three fish species listed under the federal Endangered Species Act: Central California Coast steelhead, Central California Coast coho salmon, and California Coastal Chinook salmon. The California Department of Fish and Game (CDFG) issued a consistency determination on November 9, 2009, finding that the Russian River BO was consistent with the requirements of the California Endangered Species Act (CESA) and adopted the measures identified in the BO.

NMFS concluded in the Russian River BO that the continued operations of Coyote Valley Dam and Warm Springs Dam by the U.S. Army Corps of Engineers and SCWA in a manner similar to recent historic practices, together with the Agency's stream channel maintenance activities and estuary management, are likely to jeopardize and adversely modify critical habitat for endangered coho salmon and threatened steelhead.

NMFS' Russian River BO found that summer flows in the upper Russian River and Dry Creek are too high for optimal juvenile coho salmon and steelhead habitat. Current summer flows in the creek range from 110 to 175 cubic feet per second (cfs), which makes it difficult for the juvenile fish to thrive. NMFS' Russian River BO recognizes that large reductions in the summertime flows in Dry Creek would impair the Agency's ability to deliver water to its customers. Therefore, the Russian River BO requires habitat enhancement of six miles of Dry Creek to improve summer rearing conditions for coho salmon and steelhead while allowing the Agency to maintain the existing flow range in Dry Creek of 110 to 175 cfs for water supply purposes. The six miles of habitat enhancement are to be distributed over the entire length of Dry Creek below Warm Springs Dam, implemented at a minimum of eight locations on the creek. It is intended that the enhancements for summer rearing will also provide winter rearing and refugia habitat. The habitat enhancements are to be implemented in phases to allow for evaluation of their effectiveness as the effort progresses.

One of the Agency's first steps toward meeting the requirements of NMFS' Russian River BO is to conduct a habitat enhancement feasibility study on Dry Creek. This study, being conducted for the Agency by Inter-Fluve, an environmental engineering firm specializing in the sustainable design and construction of river habitat restoration projects, will determine which areas of Dry Creek are candidates for habitat enhancement and will evaluate the feasibility of designing projects that provide habitat enhancement while also accommodating high summertime flows. Inter-Fluve has prepared a draft Dry Creek Current Conditions Inventory Report[2] in which they identify numerous promising areas for habitat enhancement along Dry Creek.

[1] NMFS' Russian River BO may be accessed online at www.sonomacountywater.org and may be reviewed at SCWA's office at 404 Aviation Boulevard, Santa Rosa, CA.

[2] Inter-Fluve. *Draft Current Conditions Inventory Report – Dry Creek: Warm Springs Dam to Russian River, Sonoma County, CA.* March 2010.

The Dry Creek Habitat Enhancement Demonstration Project would implement habitat enhancement projects at two to three of the areas of interest identified by Inter-Fluve. The purpose of the project is to demonstrate to regulators, landowners, and local decision makers the feasibility of Dry Creek habitat enhancements on a smaller scale and, in particular, to determine how they could be constructed, what they may ultimately look like, and how effective they are before implementing the full six miles of habitat enhancements on Dry Creek.

PROJECT LOCATION AND DESCRIPTION: The project site is within the Dry Creek channel and on private properties in an unincorporated area of Sonoma County, California (see attached figure). The project sites are located in and along Dry Creek from approximately ½ mile upstream of Lambert Bridge to ½ mile downstream of Lambert Bridge.

The type and extent of habitat modifications is still being determined; however, NMFS' Russian River BO stresses the availability of off-channel habitats in low velocity areas with substantial cover and features such as log or rock weirs, deflectors, log jams, constructed alcoves, side channels, backwaters, and dam pools that have successfully increased the quantity and quality of summer and winter rearing habitat for coho and steelhead.[3]. Inter-Fluve will identify feasible and sustainable enhancement techniques that will likely be implemented at the project scale.

The proposed enhancements are likely to include combinations of pool and riffle enhancement, off-channel backwater and alcove enhancement and/or creation, side-channel enhancement and/or creation, and enhancement and stabilization of streambanks. For example, pools may be enhanced with large woody debris to improve pool quality in terms of cover and shelter rating. Enhancements of riffles may include expanding existing riffles or constructing new riffles in appropriate locations, which may also enhance pools by slowing pool velocities. Streambank enhancements may address chronic erosion in critical locations and provide additional cover along the channel margins. Construction activities will vary depending upon what structures are installed and where they are located, but typically these types of construction activities can include dewatering the construction area, grading, installation of large boulders as anchor material, installation of large wood logs, planting of vegetation, and installation of erosion control measures (e.g. fabric, straw, seeding). It's not anticipated that the habitat enhancement structures will require regular maintenance work; however, future maintenance activities may include repair to damaged structures or adjustments to structures if they are not functioning as intended.

JURISDICTIONAL/PERMITTING AGENCIES: The following are public entities and agencies that may require review of the project or that may have jurisdiction over the project area:

- U.S. Army Corps of Engineers
- National Marine Fisheries Service
- California Department of Fish and Game
- Regional Water Quality Control Board, North Coast Region

[3] Russian River BO, page 264.

- Sonoma County Permit and Resource Management Department

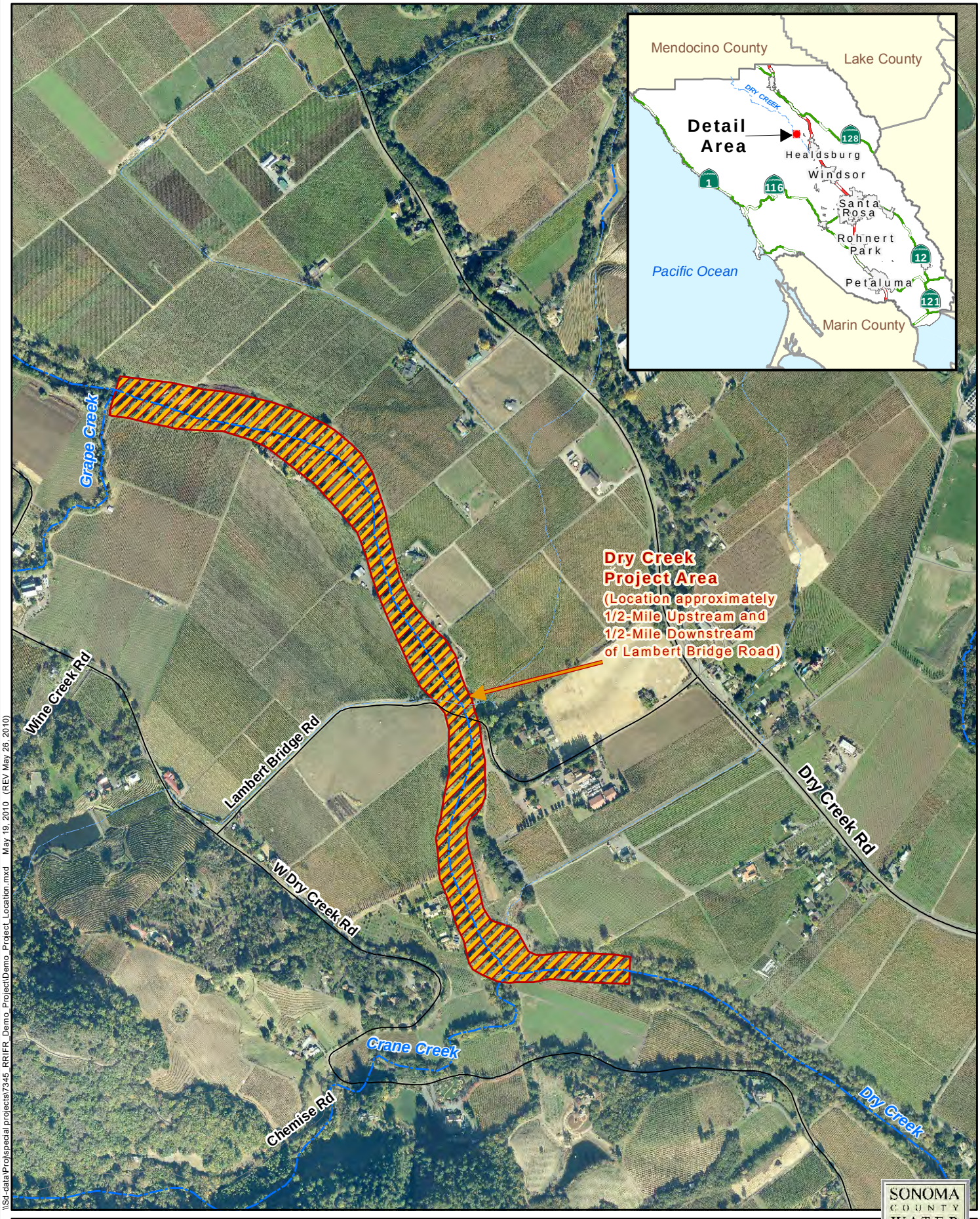
POTENTIAL ENVIRONMENTAL IMPACT AREAS: The Initial Study will analyze the environmental impacts, either individually or cumulatively, associated with the construction, operation, and maintenance of the proposed project. Specific areas of analysis in the Initial Study will include: Aesthetics, Agricultural Resources, Air Quality, Biological/ Fisheries Resources, Cultural Resources, Geology and Soils, Greenhouse Gas Emissions, Hazards and Hazardous Materials, Hydrology and Water Quality, Land Use, Noise, Public Services, Recreation, Transportation/Circulation, and Utilities and Service System.. Where feasible, mitigation measures will be proposed to reduce or avoid impacts. Other areas of analysis may be added based on input from the public and public agencies during the Notice of Preparation review period. Decision-makers, responsible and trustee agencies under CEQA, property owners, and interested persons and parties will also have an opportunity to comment on the Initial Study after it is published and circulated for public review.

PUBLIC COMMENT PERIOD FOR THIS NOTICE OF PREPARATION: The public comment period will close at 5:00 p.m. on July 29, 2010, which is 35 days after the date of publication. Please include a name, address, and telephone number of a contact person in your agency for all future correspondence on this subject. **Please send comments to:**

David Cuneo
Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, CA 95403.

Comments may also be submitted electronically to: david.cuneo@scwa.ca.gov

Documents or files related to the Dry Creek Habitat Enhancement Demonstration Project are available for review online at www.sonomacountywater.org, or at the Agency's office located at 404 Aviation Boulevard, Santa Rosa, California, 95403. If you have any questions regarding this Notice of Preparation, or if you wish to update information on our mailing list, please contact David Cuneo, Senior Environmental Specialist, at (707) 547-1935.



\\Sd-data\Proj\special projects\7345_RRIFR_Demo_Project\Demo_Project_Location.mxd May 19, 2010 (REV May 26, 2010)

Dry Creek - Habitat Enhancement Demonstration Project

DISCLAIMER
This map document and associated data are distributed for informational purposes only "AS-IS" at the published scale and provided without warranty of any kind expressed or implied. The positional accuracy of the data is approximate and not intended to represent survey map accuracy. The Sonoma County Water Agency assumes no responsibility arising from use of this information.

0 500 1,000 Feet

N

SONOMA COUNTY WATER AGENCY

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Bay Delta Region
7329 Silverado Trail
Napa, CA 94558
(707) 944-5500
www.dfg.ca.gov

***ARNOLD SCHWARZENEGGER**, Governor*
***John McCamman**, Director*

July 27, 2010

Mr. David Cuneo
Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, CA 95403

Dear Mr. Cuneo:

Subject: Dry Creek Habitat Enhancement Demonstration Project, Notice of Preparation of the Initial Study, SCH #2010062082, County of Sonoma

The Department of Fish and Game (DFG) has reviewed the Notice of Preparation (NOP) of the Initial Study (IS) for the Dry Creek Habitat Enhancement Demonstration Project (Project). The NOP was received in our office on June 29, 2010.

DFG is identified as a Trustee Agency pursuant to the California Environmental Quality Act (CEQA) Section 15386 and is responsible for the conservation, protection, and management of the State's biological resources. DFG is submitting comments on the NOP as a means to inform the Lead Agency of our concerns regarding sensitive resources which could potentially be affected by the Project.

The Project proposes to implement habitat enhancement projects at two or three areas within a one-mile section of Dry Creek near Lambert Bridge in order to demonstrate to regulatory agencies, landowners, and local decision makers the feasibility of Dry Creek habitat enhancements. To comply with the National Marine Fisheries Service Russian River Biological Opinion and DFG's Consistency Determination, the Sonoma County Water Agency (SCWA) is required to enhance six miles of in habitat in Dry Creek to improve summer rearing conditions for coho salmon and steelhead trout. The demonstration Project will help determine the design features of the enhancement projects, how enhancements will be constructed, and how effective they are before implementing the full six miles of habitat enhancements on Dry Creek.

Habitat Modifications
The IS should include a discussion of each of the proposed habitat enhancement types and at a minimum discuss the expected function of each enhancement project, the initial habitat value of each, the long term benefits to salmonid species, the feasibility of success in the short- and long term, and the sustainability and long term maintenance of each enhancement type. The cumulative effect of each enhancement in relation to other enhancements should be considered and addressed in the IS.

Habitat enhancement analysis should review each enhancement and their effect on the Department of Fish and Game's *Recovery Strategy for the California Coho Salmon* (2004; Recovery Strategy). Any enhancement undertaken in the Project has a potential impact on the success of the Recovery Strategy and DFG's ability to manage the recovery efforts.

Enhancement plans should reference and use the guidance provided in the *California Salmonid Stream Habitat Restoration Monitoring* (DFG 1998) during the design and review process to ensure compliance with DFG standards and procedures.

Biological Resources
The IS should contain a complete description and map of the vegetation communities, wildlife habitats, creeks, wetlands, and other important habitat features on and around the Project area which will be affected by the Project for each of the alternatives under consideration. Acreage of vegetation communities and habitat types should be described. The IS should identify and discuss any significant impacts to habitats and special-status species. The discussion on impacts to vegetative communities and wildlife should be addressed for each of the expected enhancement sites and individual types of enhancement.

Lake and Streambed Alteration Agreement
Any Project activity that will divert or obstruct the natural flow, or change the bed, channel, or bank (which may include associated riparian resources) of a river or stream, or use material from a streambed, will require a Lake and Streambed Alteration Agreement (LSAA), pursuant to Section 1600 et seq. of the Fish and Game Code, with the applicant. Issuance of an LSAA is subject to CEQA. DFG, as a responsible agency under CEQA, will consider the CEQA document for the project for issuance of LSAAs for the project. The CEQA document should fully identify the potential impacts to the stream or riparian resources and provide adequate avoidance, mitigation, monitoring and reporting commitments for completion of the agreement. To obtain information about the LSAA notification process, please access our website at http://www.dfg.ca.gov/habcon/1600/ or to request a notification package, contact the Lake and Streambed Alteration Program at (707) 944-5520.

California Endangered Species Act
Please be advised that a California Endangered Species Act (CESA) Permit must be obtained if the project has the potential to result in take of species of plants or animals listed under CESA, either during construction or over the life of the project. Issuance of a CESA Permit is subject to CEQA documentation; therefore, the CEQA document must specify impacts, mitigation measures, and a mitigation monitoring and reporting program. If the project will impact CESA listed species, early consultation is encouraged, as significant modification to the project and mitigation measures may be required in order to obtain a CESA Permit.

DFG appreciates the opportunity to comment on the Dry Creek Habitat Enhancement Demonstration Project. DFG staff is available to meet with you to further clarify our comments and provide technical assistance on any changes necessary to protect resources. If you have any questions, please contact Mr. Adam McKannay, Environmental Scientist, at (707) 944-5534; or Mr. Richard Fitzgerald, Coastal Habitat Conservation Supervisor, at (707) 944-5568.

Sincerely,

Scott Wilson FOR

Charles Armor
Regional Manager
Bay Delta Region

cc: State Clearinghouse

Department of Toxic Substances Control

Linda S. Adams
Secretary for
Environmental Protection

Maziar Movassaghi
Acting Director
700 Heinz Avenue
Berkeley, California 94710-2721

Arnold Schwarzenegger
Governor

July 21, 2010

David Cuneo
Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, California 95403

Dear Mr. Cuneo:

Thank you for the opportunity to comment on the Notice of Preparation (SCH #2010062082) for the Dry Creek Habitat Enhancement Demonstration Project draft Environmental Impact Report (EIR). As you may be aware, the California Department of Toxic Substances Control (DTSC) oversees the cleanup of sites where hazardous substances have been released pursuant to the California Health and Safety Code, Division 20, Chapter 6.8. As a potential Resource Agency, DTSC is submitting comments to ensure that the environmental documentation prepared for this project to address the California Environmental Quality Act (CEQA) adequately addresses any required remediation activities which may be required to address any hazardous substances release.

The Notice of Preparation does not include a thorough description of the property's historical uses. Without this information we are unable to determine whether hazardous substances may have been released into the soil at the Site. We strongly recommend that a historical assessment of past uses be done. Based on that information, sampling may need to be conducted to determine if there is an issue which will need to be addressed in the CEQA compliance document. If hazardous substances have been released, they will need to be addressed as part of this project.

For example, if the remediation activities include the need for soil excavation, the CEQA document should include: (1) an assessment of air impacts and health impacts associated with the excavation activities; (2) identification of any applicable local standards which may be exceeded by the excavation activities, including dust levels and noise; (3) transportation impacts from the removal or remedial activities; and (4) risk of upset should be there an accident at the Site.

DTSC and the Regional Water Quality Control Boards (Regional Boards) signed a Memorandum of Agreement, March 1, 2005 (MOA) aimed to avoid duplication of efforts among the agencies in the regulatory oversight of investigation and cleanup activities at brownfield sites. Under the MOA, anyone requesting oversight from DTSC or a Regional Board must submit an application to initiate the process to assign the appropriate oversight agency. The completed application and site information may be submitted to either DTSC or Regional Board office in your geographical area. The application is available at http://www.calepa.ca.gov/brownfields/MOA/application.pdf.

Should you have any questions regarding this letter, please contact me by phone at (510) 540-3773 or via email at CGribble@dtsc.ca.gov.

Sincerely,

Chip Gribble, P.G.
Project Manager
Brownfields and Environmental Restoration Program
Berkeley Office

cc: Governor's Office of Planning and Research
State Clearinghouse
P. O. Box 3044
Sacramento, California 95812-3044

Guenther Moskat
CEQA Tracking Center
Department of Toxic Substances Control
P.O. Box 806
Sacramento, California 95812-0806

From: Nick Frey
To: David Cuneo
Subject: Dry Creek Habitat Enhancement Demonstration Project
Date: Monday, June 28, 2010 11:52:26 AM

I am writing in support of the proposed Dry Creek Habitat Enhancement Demonstration Project. This project is being supported by grape grower, landowners in Dry Creek Valley. This project addresses the need to provide refuge for salmonids while allowing for higher flow releases from Lake Sonoma than would otherwise be possible under the Biological Opinion from National Marine Fisheries. This demonstration project would not be possible without the cooperation of landowners along Dry Creek, which shows their commitment to improving fish habitat.

Thank you for the opportunity to comment on this project.

Sincerely,

Nick Frey
President
Sonoma County Winegrape Commission
3637 Westwind Blvd
Santa Rosa, CA 95403
Ph 707-522-5861; Cell 707-291-2857
www.sonomawinegrape.org

Sonoma County Water Agency
Phone Contact Record

Name of Caller: Gordon Winstrom
Address/Phone Number: 433-1886

SCWA Contact: David Cuneo

Date of Contact: July 9, 2010

Subject: Dry Creek Habitat Demonstration Project

Notes: Gordon Winstrom called in response to the Notice of Preparation of an Initial Study that we issued for the Dry Creek Habitat Enhancement Demonstration Project.

Gordon stated that he has been in Dry Creek since 1971 and a grape grower for 36 years. He said he has a problem with the amount of money being spent for fish in Dry Creek (especially in comparison to how little we spend per child in education). He wanted to know if we have calculated a dollar figure per fish that is being spent. He said someone has to have a backbone in the system to stand up to the feds forcing the local ratepayers to spend so much on the fish. He said, "If I were Mike McGuire, I would ask how much money on fish improvements have we spent over the last 10 years and how have the fish responded? What is the dollar per fish cost to the ratepayers?"

Follow Up:

APPENDIX B

Special Status Species Potentially Occurring Within the Dry Creek Habitat Enhancement Demonstration Project

SPECIAL STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT

Special status plant, wildlife, and fish species include those that are legally protected under the federal and California Endangered Species Acts (ESA) or other regulations, and species that are considered rare by the scientific community. Special status species are defined as:

- plants or animals that are listed or proposed for listing as threatened or endangered under the California ESA (Fish and Game Code §2050 *et seq*.; 14 CCR §670.1 *et seq*.) and/or the federal ESA (50 CFR 17.11 for animals; various notices in the Federal Register [FR] for proposed species);
- plants or animals that are candidates for possible future listing as threatened or endangered under the federal ESA (66 FR 54808 October 30, 2001);
- plants or animals that meet the definition of rare or endangered under the California Environmental Quality Act (CEQA) (14 CCR §15380), which includes species not found on state or federal endangered species lists;
- plants or animals that are designated as "species of concern" (former category 2 candidates for listing) by the U.S. Fish and Wildlife Service or "species of special concern" by the California Department of Fish and Game;
- animal species that are "fully protected" in California (Fish and Game Code §3511, §4700, §5050, §5515);
- plants listed under the California Native Plant Protection Act (Fish and Game Code §1900 *et seq*.); and
- plants included in the California Native Plant Society's *Inventory of Rare and Endangered Vascular Plants of California* that can be shown to meet criteria for state listing (CEQA Section 15380).

APPENDIX B-1
SPECIAL STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

Genus species **Common Name**	**Status[2]**	**Habitat**	**Comments**	**Flowering/ Survey Period**
Carex californica California sedge	2	Bogs and fens, closed-cone coniferous forest, coastal prairie, meadows, marshes and swales	No potential habitat within project site.	May - August
Ceanothus confusus Rincon Ridge ceanothus	FSC, 1B	Closed-cone coniferous forest, chaparral, and cismontane woodland on volcanic or serpentine soils	No potential habitat within project site.	Feb - April
Eriastrum brandegeae Brandegee's eriastrum	FSC, 1B	Chaparral and cismontane woodland on volcanic soils	No potential habitat within project site. Known from Colusa, Glenn, Lake, Santa Clara, Tehama, and Trinity counties.	May - August
Fritillaria pluriflora adobe-lily	1B	Chaparral, valley and foothill grasslands, and cismontane woodland often on adobe soil	No potential habitat within project site. Known from Butte, Colusa, Glenn, Lake, Napa, Plumas, Solano, Tehama, and Yolo counties	Feb - April
Fritillaria roderickii Roderick's fritillary	SE, 1B	Coastal bluff scrub, coastal prairie, valley and foothill grasslands	No potential habitat within project site. Known from less than 10 occurrences	March - May
Hesperolinon adenophyllum glandular dwarf-flax	FSC, 1B	Chaparral, valley and foothill grasslands on serpentine soil	No potential habitat within project site.	May - August
Horkelia bolanderi Bolander's horkelia	FSC, 1B	Lower coniferous forest, meadows (edges, vernally mesic), valley and foothill grasslands (edge habitats)	No potential habitat within project site. Known from 3 extant occurrences. Unknown if plant occurs in Mendocino County.	June - August
Juglans californica var. *hindsii* northern California black walnut	FSC, 1B	Riparian woodlands, floodplain terraces	Potential habitat present within project site. No known occurrences in Mendocino County.	April - May
Lasthenia conjugens Contra Costa goldfields	FE, 1B	Valley and foothill grasslands (mesic), vernal pools	No potential habitat within project site. Known from 4 occurrences after 1993 surveys.	March - June
Layia septentrionalis Colusa layia	1B	Chaparral, cismontane woodland, and valley and foothill grasslands on sandy or serpentine soils	No potential habitat within project site.	April - May

APPENDIX B-1
SPECIAL STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

Genus species **Common Name**	**Status[2]**	**Habitat**	**Comments**	**Flowering/ Survey Period**
Lupinus milo-bakeri Milo Baker's lupine	FSC, ST, 1B	Foothill woodland, valley grassland, disturbed roadsides	No potential habitat within project site. Known from less than 20 occurrences.	June - Sept
Malacothamnus mendocinensis Mendocino bush mallow	FSC, 1A	Cismontane woodland	No potential habitat within project site. Known from 2 historical collections.	May - June
Perideridia gairdneri ssp. *gairdneri* Gairdner's yampah	FSC	Broadleaf upland forests, chaparral, valley and foothill grasslands at mesic sites, vernal pools	No potential habitat within project site.	June - October
Plagiobothrys lithocaryus Mayacamas popcorn-flower	FSC, 1A	Chaparral, cismontane woodland, and valley and foothill woodlands at mesic sites	No potential habitat within project site. Known from only Lakeport in Lake County and possibly Potter Valley in Mendocino County. Last seen in 1899.	April - May
Pleuropogon hooverianus North Coast semaphore grass	FSC, SR, 1B	Broadleaf upland forest, meadows, north coast coniferous forest at mesic sites, vernal pools	No potential habitat within project site. Known from 12 occurrences.	May - August
Sanguisorba officinalis great burnet	2	Bogs and fens, broadleaf upland forest, meadows, marshes and swales, north coast coniferous forests, and riparian forests often on serpentine soil	No potential habitat within project site.	July - Sept
Sidalcea oregana ssp. *hydrophila* water-loving checkermallow	1B	Meadows and riparian forests at mesic sites	No potential habitat within project site.	July - August
Trifolium amoenum showy indian clover	FE, 1B	Valley and foothill grassland, sometimes serpentine	No potential habitat within project site. One plant rediscovered in Marin County in 1993.	April - June

APPENDIX B-1
SPECIAL STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

Genus species **Common Name**	**Status[2]**	**Habitat**	**Comments**	**Flowering/ Survey Period**

1. List of species based on review of California Department of Fish and Game Natural Diversity Data Base for the Geyserville U.S. Geological Survey 7.5 minute quadrangles and species lists provided by the U.S. Fish and Wildlife Service.
2. Status
   FE: Endangered under federal Endangered Species Act (ESA).
   FT: Threatened under federal ESA.
   FPE: Proposed endangered under federal ESA.
   FC: Candidate for listing under federal ESA.
   FSC: U. S. Fish and Wildlife Service Species of Concern.
   SE: Endangered under California ESA.
   ST: Threatened under California ESA.
   SR: Listed as rare under the California Native Plant Protection Act.
   1A: California Native Plant Society List 1A: Plants presumed extinct in California.
   1B: California Native Plant Society List 1B: Plants rare, threatened or endangered in California.
   2: California Native Plant Society List 2: Plants rare, threatened, or endangered in California, but more common elsewhere.

APPENDIX B-2
SPECIAL STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

CLASS **Common Name** *Genus species*	**Status[2]**	**Habitat and Distribution[3]**	**Potential Occurrence on Project Site**
INVERTEBRATES			
California freshwater shrimp Syncaris pacifica	FE	Streams that are structurally diverse with undercut banks, exposed roots, overhanging woody debris, or overhanging vegetation.	Unlikely to occur on project site due to lack of necessary shelter coupled with high stream velocities.
Leech's skyline diving beetle *Hydroporus leechi*	FSC	Shallow water, pond shores. Previously believed to occur only in the San Francisco Bay, now appears that the species occurs throughout the western United States.	Potential habitat may be present on project site, but additional information required on distribution data.
Sonoma artic skipper *Carterocephalus palaemon* ssp.	FSC	Grasses including purple reedgrass (*Calamagrostis purpurascens*) host caterpillars. Adults found in glades and openings in heavily forested woods, moist meadows, and streamsides.	Unlikely to occur on project site due to lack of suitable habitat.
FISH			
Chinook salmon, California coastal ESU *Oncorhynchus tshawytscha*	FT	Area includes all rivers and streams accessible to Chinook from San Pablo Bay to Cape Blanco, excluding the Klamath River. Adults spawn in areas of moderate velocities and gravel to small cobble substrates. Juveniles rear along stream margins in riffle and run habitats.	Potential to occur on project site. Suitable habitat identified on project site. Known to occur in project area.
coho salmon, central CA coast ESU *Oncorhynchus kisutch*	FE, SE	Coho migrate into freshwater between November and January and spawn in streams that flow directly to the ocean or in tributaries of large rivers. Spawning areas typically are at heads of riffles or tails of pools with beds of loose, silt-free coarse gravel and cover nearby for adults. Juveniles require deep, well-shaded pools with abundant overhead cover. Juveniles prefer cover consisting of rootwads, undercut banks, and large boulders.	Potential to occur on project site. Suitable habitat identified on project site. . Known to occur in project area.
Clear Lake-Russian River roach *Lavinia symmetricus* ssp.	FSC, SSC	Habitat generalists; found in small, warm intermittent streams; cold, well-oxygenated streams, and main channels of rivers. Tolerance to warm temperatures (86 to 95 ^{0}F) and low dissolved oxygen levels (1-2 ppm) allow roach to thrive in the lower reaches of rivers and isolated pools of tributaries throughout the summer.	Unlikely to occur on project site. Project site outside of known range for this species.

APPENDIX B-2
SPECIAL STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

CLASS **Common Name** *Genus species*	**Status[2]**	**Habitat and Distribution[3]**	**Potential Occurrence on Project Site**
hardhead *Mylopharodon conocephalus*	SSC	Low to mid-elevation streams with clear, deep pools and sand-gravel-boulder bottoms and slow water velocities	Potential to occur on project site. Suitable habitat identified on project site.
Navarro roach *Lavinia symmetricus navarroensis*	SSC	Habitat generalists; found in small, warm intermittent streams; cold, well-oxygenated streams, and main channels of rivers. Tolerance to warm temperatures (86 to 95 ^{o}F) and low dissolved oxygen levels (1-2 ppm) allow roach to thrive in the lower reaches of rivers and isolated pools of tributaries throughout the summer.	Potential to occur on project site. Suitable habitat identified on project site.
Pacific lamprey *Lampetra tridentata*	FSC	Adults enter rivers between April and June to spawn in areas with moderate velocities and gravel or cobble substrates. Juveniles or ammocoetes rear in low velocity habitats within silt or sand substrate.	Potential to occur on project site. Suitable habitat identified on project site.
river lamprey *Lampetra ayresi*	FSC	Most often found in lower reaches of rivers and small fresh-water tributary streams; demersal, freshwater, brackish, marine environments.	Potential to occur on project site. Suitable habitat identified on project site.
Russian River tule perch *Hysterocarpus traski pomo*	FSC, SSC	Exist in large, low-elevation streams with beds of emergent aquatic plants or overhanging banks. Require clear, flowing water and suffer high annual mortalities in turbid or low water years.	Potential to occur on project site. Suitable habitat identified on project site.
steelhead, central CA coast ESU *Oncorhynchus mykiss*	FT	Spawn and rear in cool, clear, well-oxygenated headwater streams. Spawning occurs between December and May, with most from January to March. Juveniles prefer swift water habitats of riffles and runs.	Potential to occur on project site. Suitable habitat identified on project site. Known to occur in project area.
AMPHIBIANS			
California red-legged frog *Rana aurora draytonii*	FT, SSC, PN	Permanent water bordered by dense, grassy or shrubby vegetation associated with deep ($\leq$ 0.7 m), still or slow-moving water.	Unlikely to occur on project site. Project site outside of known range for this species.

APPENDIX B-2
SPECIAL STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

CLASS **Common Name** *Genus species*	**Status[2]**	**Habitat and Distribution[3]**	**Potential Occurrence on Project Site**
Del Norte salamander *Plethodon elongatus*	FSC, SSC	Rock rubble of old riverbeds, road fills, outcrops, talus, older forest stands.	Unlikely to occur on project site. Project site outside of known range for this species.
foothill yellow-legged frog *Rana boylii*	FSC, SSC, PN	Shallow, flowing water in small to moderate-sized streams with at least some cobble-sized substrates.	Potential to occur on project site. Suitable breeding and foraging habitat identified on project site.
northern red-legged frog *Rana aurora aurora*	FSC, SSC, PN	Permanent or temporary water bordered by dense, grassy or shrubby vegetation. Requires 4-6 months of permanent water for larval development.	Potential to occur on project site. Suitable foraging habitat.
tailed frog *Ascaphus truei*	FSC, SSC	Clear, cold, rocky streams in humid mixed forests. Grassland, chaparral, or shrub growth may be interspersed.	Unlikely to occur on project site due to a lack of suitable habitat.
western spadefoot toad *Scaphiopus hammondii*	FSC, PN	Lowlands in washes, river floodplains, alluvial fans, playas, alkali flats, and into foothills and mountains. Open vegetation, short grasses where soil is sandy or gravelly. Valley and foothill grasslands, open chaparral, pine-oak woodlands. Quiet streams and temporary pools. Temporary rainpools with temperatures between 9 and 30 °C (48-86 °F), and with inundation lasting greater than three weeks. Require burrow refuge sites for aestivation.	Unlikely to occur on project site. Project site outside of known breeding range for this species.
REPTILES			
California horned lizard *Phrynosoma coronatum frontale*	FSC, SSC, PN	Areas with exposed gravelly-sandy substrates with scattered shrubs; clearings in riparian woodlands; dry uniform chamise chaparral; and annual grassland with scattered perennial seepweed (*Suadea fruticosa*) or saltbush (*Atriplex polycarpa*).	Unlikely to occur on project site due to lack of suitable habitat
northwestern pond turtle *Arctinemys marmorata marmorata*	FSC, SSC, PN	Ponds, marshes, rivers, streams, and irrigation ditches with rocky or muddy bottoms and aquatic vegetation. Slack or slow-moving aquatic habitat with available aerial and aquatic basking sites. Upland oviposition sites are typically on unshaded, south facing slopes with soils of high clay or silt composition.	Potential to occur on project site. Suitable basking sites identified within project site.
BIRDS			

APPENDIX B-2
SPECIAL STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

CLASS **Common Name** *Genus species*	**Status[2]**	**Habitat and Distribution[3]**	**Potential Occurrence on Project Site**
Allen's hummingbird *Selasphorus sasin*	FSC	Pacific coastal fog belt in meadows, moist canyon bottoms, humid woody or brushy ravines, brushy edges of coniferous forest, coastal chaparral, parks.	Unlikely to occur on project site due to lack of suitable habitat
American bittern *Botaurus lentiginosus*	FSC	Nests in tall, dense, fresh emergent wetlands. Forages in tall, fresh or saline, emergent wetlands.	Unlikely to occur on project site due to lack of suitable habitat (emergent vegetation).
American peregrine falcon (nesting) *Falco peregrinus anatum*	FE-delisted/ SE, FP	In open habitats from tundra, savanna, and coasts to high mountains. Known to occur in urban areas on tall buildings. Usually nests in scrapes on cliff ledges.	No suitable breeding habitat identified on project site, but possibly in adjacent woodlands. May occasionally forage in the project area.
bald eagle (nesting & wintering) *Haliaeetus leucocephalus*	FE-delisted FT, SE, FP	Found on coasts, rivers, and large lakes in open areas. Nests primarily in coniferous trees and on cliffs.	Unlikely to occur on project site due to lack of suitable habitat and the presence of human activity and development.
bank swallow (nesting) *Riparia riparia*	ST	Open country near running water. Nests in burrows along the banks of streams, creeks, and rivers.	Unlikely to occur on project site as it is outside the known breeding range for this species.
Bell's sage sparrow (nesting) *Amphispiza belli belli*	WL	Found in sage-covered brushlands and arid chaparral-covered hillsides.	Unlikely to occur on project site due to lack of suitable habitat.
black-crowned night heron (rookery site) *Nycticorax nycticorax*	FSC	Marshes, swamps, wooded streams, mangroves, shores of lakes, ponds, lagoons; salt water, brackish, and freshwater situations. Roosts by day in mangroves or swampy woodland. Nests in groves of trees near coastal marshes or on marine islands, swamps, marsh vegetation, clumps of grass on dry ground, orchards, and in many other situations. Nests usually with other heron species.	No suitable breeding habitat on project site, but may occasionally forage in the project area.
California horned lark *Eremophila alpestris actia*	WL	Grasslands and other open habitats with low, sparse vegetation. Builds grass-lined nest; cup-shaped in depression on open ground.	Unlikely to occur on project site due to lack of suitable habitat.

APPENDIX B-2
SPECIAL STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

CLASS **Common Name** *Genus species*	**Status[2]**	**Habitat and Distribution[3]**	**Potential Occurrence on Project Site**
Cooper's hawk (nesting) *Accipiter cooperii*	WL	Riparian, oak woodland, or other forest habitats near water. Occurs in variety of habitats during migration.	No suitable breeding habitat identified on project site, but possibly in adjacent woodlands. May occasionally forage in the project area.
ferruginous hawk (wintering) *Buteo regalis*	BCC, WL	Open country, usually prairies and plains. Nests in coniferous trees with expansive view.	Unlikely to occur on project site due to the presence of human activity and development.
golden eagle (nesting & wintering) *Aquila chrysaetos*	WL, FP	Open habitats, particularly hills and mountains. Nests on cliffs or in high tree tops.	No suitable breeding habitat identified on project site, but possibly in adjacent woodlands. May occasionally forage in the project area.
grasshopper sparrow (nesting) *Ammodramus savannarum*	FSC	Dense, dry or well-drained grassland with scattered shrubs for perching.	Unlikely to occur on project site due to lack of suitable habitat.
hermit warbler (nesting) *Dendroica occidentalis*	FSC	During breeding, older stands of coniferous forests in higher and cooler elevations. During migration, mixed deciduous woodlands and scrub habitats.	Potential to occur on project site during migration. No suitable breeding or wintering habitat identified on project site.
lark sparrow (nesting) *Chondestes grammacus*	FSC	Herbaceous ground cover with scattered shrubs or trees for lookout and song perches.	Potential to occur on project site. Suitable breeding and foraging habitat identified on project site.
Lewis' woodpecker (nesting) *Melanerpes lewis*	FSC	Interior open woodlands.	Potential to occur on project site. Suitable foraging habitat identified on project site. Unlikely to breed on project site due to a lack of suitable habitat.
little willow flycatcher (nesting) *Empidonax traillii brewsterii*	FSC, SE	Swamps, willow thickets, riparian woodland. Nests in the forks of trees or shrubs, approximately 0.5 to 3 meters above ground.	Unlikely to breed on project site. Project site outside known breeding range for this species.
loggerhead shrike (nesting) *Lanius ludovicanus*	BCC, SSC	Open habitats with sparse shrubs and trees, other suitable perches, bare ground, and low or sparse herbaceous cover.	Potential to occur on site. Suitable breeding and foraging habitat identified on project site.

APPENDIX B-2
SPECIAL STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

CLASS **Common Name** *Genus species*	**Status[2]**	**Habitat and Distribution[3]**	**Potential Occurrence on Project Site**
long-billed curlew (nesting) *Numenius americanus*	BCC, WL	Upland shortgrass prairies and wet meadows are used for nesting; coastal estuaries, open grasslands, and croplands are used in winter.	Unlikely to breed on project site. Project site outside known breeding range for this species.
long-eared owl (nesting) *Asio otus*	SSC	Dense riparian and live-oak thickets near meadow edges, and nearby woodland and forest habitats.	Project site outside of known breeding range for this species, however, some records indicate that breeding pairs identified in Sonoma County previously along Russian River.
merlin (wintering) *Falco columbarius*	SSC	Does not breed in California. Winters on coastlines, open grasslands, savannahs, woodlands, lakes, wetlands, and early successional stages.	Potential to occur on project site. Suitable foraging habitat identified on project site.
northern harrier (nesting) *Circus cyaneus*	SSC	Prairie, savanna, slough, wet meadow, marshes. Nests on elevated ground or in thick vegetation.	Unlikely to occur on project site due to lack of suitable habitat on project site.
northern spotted owl (including critical habitat) *Strix occidentalis caurina*	FT	Dense coniferous and deciduous forests. Nests primarily in coniferous trees, occasionally on cliffs in heavily wooded canyons.	Unlikely to occur on project site due to lack of suitable habitat on project site.
olive-sided flycatcher (nesting) *Contopus cooperi*	BCC, SSC	Summer resident. Breeds in forest and woodland especially where burns or slashing has occurred. Also in eucalyptus trees in foothill canyons.	Unlikely to occur on project site due to lack of suitable habitat on project site.
osprey (nesting) *Pandion haliaetus*	WL	Found along rivers, lakes, and coasts. Nests in deciduous or coniferous trees or standing snags (occasionally power poles) near or over water.	Potential to occur on project site. Suitable foraging and marginal breeding habitat identified on project site.
red-breasted sapsucker (nesting) *Sphyrapicus ruber*	SC	Coastal ranges in moist coniferous or mixed forests at low elevations.	Unlikely to occur on project site due to lack of suitable habitat.
rufous hummingbird (nesting) *Selasphorus rufus*	SC	Open arid scrub, brushy slopes, desert vegetation.	Unlikely to occur on project site due to lack of suitable habitat. Project site on periphery of breeding range.

APPENDIX B-2
SPECIAL STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

CLASS **Common Name** *Genus species*	**Status[2]**	**Habitat and Distribution[3]**	**Potential Occurrence on Project Site**
sharp-shined hawk (nesting) *Accipiter striatus*	WL	Nests in dense, pole and small-tree stands of conifers, which are cool, moist, well-shaded, with little ground cover, near water. Forages in openings at woodland edges, hedgerows, brushy pastures, and shorelines.	Unlikely to breed on project site due to lack of suitable habitat.
short-eared owl (nesting) *Asio flammeus*	SSC	Found in open, treeless areas with elevated sites for perches, and dense vegetation for roosting and nesting. Nests on dry ground in a depression concealed with vegetation, and lined with grasses, forbs, sticks, and feathers; occasionally nests in burrows.	Unlikely to breed on project site due to lack of suitable habitat.
summer tanager (nesting) *Piranga rubra*	SSC	Found in cottonwoods and willows, especially older, dense stands along rivers and streams, which provide nesting, feeding, and other cover.	Unlikely to occur on project site. Project site outside known breeding range for this species.
tricolored blackbird (nesting colony) *Agelaius tricolor*	BCC, SSC	Nest located over or near fresh water, especially in emergent wetland. Usually nests in dense cattails or tules; also nests in thickets of willow, blackberry, wild rose, tall herbs.	Unlikely to occur on project site due to lack of suitable habitat.
Vaux's swift (nesting) *Chaetura vauxi*	FSC	Old-growth coniferous forests, esp. coast redwood, and mixed deciduous/coniferous forests. Nests in hollow or broken top trees, stumps, and chimneys.	Unlikely to breed on project site due to a lack of suitable habitat. Suitable foraging habitat identified on project site and adjacent open country.
western yellow-billed cuckoo *Coccyzus americanus occidentalis*	FC, BCC, SE	Open woodlands, especially with dense undergrowth, riparian woodlands, and thickets. Nests in deciduous trees or shrubs approximately one to two meters from the ground.	Unlikely to occur on project site. Project site outside known breeding range for this species.
white-tailed kite (nesting) *Elanus leucurus*	SSC, FP	Nests in dense-canopied woodlands adjacent to grasslands, agricultural fields, and wetlands.	Unlikely to occur on project site due to lack of suitable habitat.
yellow warbler (nesting) *Dendroica petechia brewsteri*	SSC	Riparian; open to medium-density woodlands and forests with a heavy brush understory.	Potential to occur on site. Suitable breeding and foraging habitat identified on project site.
yellow-breasted chat (nesting) *Icteria virens*	SSC	Dense brushy thickets and tangles near water and thick understory in riparian woodland.	Potential to occur on site. Marginal breeding and foraging habitat identified on project site.
MAMMALS			

APPENDIX B-2
SPECIAL STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

CLASS **Common Name** *Genus species*	**Status[2]**	**Habitat and Distribution[3]**	**Potential Occurrence on Project Site**
American badger *Taxidea taxus*	SSC	Herbaceous, shrub, and open stages of most habitats with dry, friable soils.	Unlikely to occur on project site due to lack of suitable habitat.
fringed myotis bat *Myotis thysanodes*	FSC	Pinyon-juniper, valley foothill hardwood, and hardwood-conifer habitats at 4,000-7,000 feet are optimal, but occurs in a wide variety of habitats. Breeds in caves and old buildings.	No suitable roosting habitat on project site. Potential foraging habitat identified on project site.
greater western mastiff-bat *Eumops perotis californicus*	FSC, SSC	Extensive open areas with abundant roost locations provided by crevices in rock outcrops and buildings.	No suitable roosting habitat on project site. Potential foraging habitat identified on project site.
long-eared myotis bat *Myotis evotis*	FSC	Coniferous forests and woodlands preferred, but found in nearly all brush, woodland and forested habitats. Does not roost colonnially. Roosts in buildings, crevices, spaces under bark, and snags. Caves used primarily as night roosts.	Potential to occur on project site. Marginal roosting habitat identified on project site. Suitable foraging habitat identified on project site.
long-legged myotis bat *Myotis volans*	FSC	Forages in chaparral, coastal scrub, early successional woodlands and forests. Roosts in trees, buildings, rock crevices, under tree bark, in snags, and crevices in cliffs. Caves and mines used as night roosts.	Potential to occur on project site. Marginal roosting habitat identified on project site. Suitable foraging habitat identified on project site.
Pacific fisher *Martes pennanti pacifica*	FC, SCT, SSC	Occurs in intermediate to large-tree stages of coniferous forests and deciduous-riparian habitats with a high percent canopy closure. Uses cavities in large trees, snags, logs, rock areas, upturned trees, or slash and brush piles.	Unlikely to occur on project site due to lack of suitable habitat. Project site on periphery of breeding range.
Townsend's big-eared bat *Corynorhinus townsendii*	FSC, SSC	Forages in variety of habitats: cliff, desert, and coniferous, riparian hardwood, and mixed forests, grasslands, savannah, and chaparral. Roosts in caves, mine shafts, and buildings.	Potential to occur on project site. Suitable foraging habitat identified on project site.
pallid bat *Antrozous pallidus*	SSC	Forages in variety of habitats. Roosts in caves, crevices, mines, and occasionally hollow trees and buildings. Prefers mesic sites.	Unlikely to occur on project site due to lack of suitable habitat.

APPENDIX B-2
SPECIAL STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE VICINITY OF DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT[1]

CLASS **Common Name** *Genus species*	**Status[2]**	**Habitat and Distribution[3]**	**Potential Occurrence on Project Site**
Sonoma tree vole *Arborimus pomo*	SSC	North coast coniferous forest	Unlikely to occur on project site due to lack of suitable habitat.
Yuma myotis bat *Myotis yumanensis*	FSC, SSC	Commonly occurs along wooded canyon bottoms with sources of water to forage over. Roosts in caves and old buildings.	No suitable roosting habitat on project site. Potential foraging habitat identified on project site.

1. List of species based on review of California Department of Fish and Game Natural Diversity Data Base for the Ukiah and Redwood Valley U. S. Geological Survey 7.5 minute quadrangles and species lists provided by the U. S. Fish and Wildlife Service.
2. Status:
   FE: Endangered under federal Endangered Species Act (ESA).
   FT: Threatened under federal ESA.
   FPE: Proposed for listing under the federal ESA.
   WL: California Department of Fish and Game Watch List
   BCC: U.S. Fish and Wildlife Service Birds of Conservation Concern
   FC: Federal Candidate for Listing
   SCT: State Candidate for Listing
   FSC: Species previously identified as a Species of Concern. Please note that The U.S. Fish and Wildlife Service Sacramento Office no longer maintains a "Species of Concern" list. Species of Concern is not defined in the federal Endangered Species Act, but the term commonly refers to species that are declining or appear to be in need of conservation.
   SE: Listed as endangered under the California ESA.
   ST: Listed as threatened under the California ESA.
   SC: Candidate for listing under the California ESA
   SSC: A California Department of Fish and Game Species of Special Concern.
   FP: Fully protected under California Fish and Game Code (Birds §3511; Mammals §4700; Reptiles and Amphibians §5050; Fish §5515).
   PN: Protected under California Code of Regulations, Title 14, Chapter 5, §41 (native amphibians) and §42 (native reptiles).
3. Source of Information:
   Burridge, Betty (ed.). 1995. *Sonoma County Breeding Bird Atlas: detailed maps and accounts of our nesting birds*. Madrone Audubon Society.
   California Department of Fish and Game. 2001. California Natural Diversity Data Base for the Redwood Valley and Ukiah U.S. Geological Survey 7.5 minute quadrangles.
   Zeiner, D.C., Laudenslayer, W.F., and K.E. Mayer (eds.). 1988. *California's Wildlife: Amphibians and Reptiles. Volume I.* State of California, The Resources Agency, Department of Fish and Game. Sacramento, California.
   _____. 1988. *California's Wildlife: Birds. Volume II.* State of California, The Resources Agency, Department of Fish and Game. Sacramento, California.
   _____. 1988. *California's Wildlife: Mammals. Volume III.* State of California, The Resources Agency, Department of Fish and Game. Sacramento, California.

APPENDIX C
Plant Species Observed Within the Dry Creek Habitat Enhancement Project

PLANT SPECIES OBSERVED WITHIN THE
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT

DIVISION *Class* **Family**	Scientific Name *Genus species*	Common Name
ANTHOPHYTA		**FLOWERING PLANTS**
Dicotyledonae		*Dicots*
Aceraceae	*Acer negundo* var. *californicum*	**Maple Family** box elder
Apiaceae		**Carrot Family**
	Conium maculatum	poison hemlock
Apocynaceae		**DogbaneFamily**
	Vinca major	periwinkle
Asteraceae		**Sunflower Family**
	Artemisia douglasiana	mugwort
	Baccharis pilularis	coyote brush
	Lactuca serriola	prickly lettuce
	Senecio vulgaris	groundsel
	Sonchus asper ssp. *asper*	prickly sowthistle
	Xanthium strumarium	cocklebur
Betulaceae		**Birch Family**
	Alnus rhombifolia	white alder
Brassicaeceae		**Mustard Family**
	Raphanus sativus	wild radish
	Rorippa nasturtium-aquatica	water cress
Caprifoliaceae		**Honeysuckle Family**
	Sambucus mexicana	blue elderberry
Chenopodiaceae		**Goosefoot Family**
	Chenopodium sp.	pigweed
Equisetaceae		**Horestail Family**
	Equisetum sp.	
Fabaceae		**Pea Family**
	Lotus corniculatus	birdfoots trefoil
	Melilotus alba	white sweetclover
	Trifolium sp.	clover
Fagaceae		**Oak Family**
	Quercus agrifolia	coast live oak
	Quercus dumosa	Nuttall's scrub oak
	Quercus lobata	valley oak
	Quercus wislizenii	interior live oak
Geraniaceae		**Geranium Family**
	Erodium cicutarium	Red-stemmed filaree
	Geranium sp.	
Hippocastanaceae		**Buckeye Family**
	Aesculus californica	California buckeye
Juglandaceae		**Walnut Family**
	Juglans nigra	black walnut
Lamiaceae		**Mint Family**
	Mentha spicata	spearmint
	Stachys sp.	hedge nettle
Lauraceae		**Laurel Family**
	Umbellaria californica	California bay

PLANT SPECIES OBSERVED WITHIN THE DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT

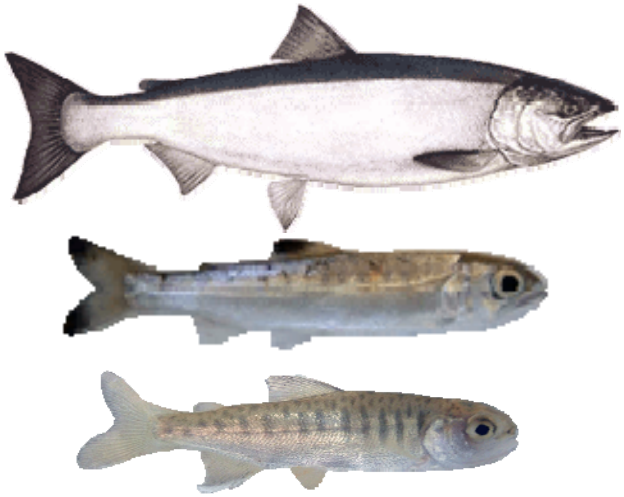
DIVISION *Class* **Family**	Scientific Name *Genus species*	Common Name
Lythraceae		**Loosestrife Family**
	Lythrum hyssopifolium	hyssop-leaved lythrum
Oleaceae		**Olive Family**
	Fraxinus latifolia	Oregon ash
Papaveraceae		**Poppy Family**
	Eschscholzia californica	California poppy
Plantaginaceae		**Plantain Family**
	Plantago lanceolata	English plantain
Polygonaceae		**Buckwheat Family**
	Polygonum sp.	smartweed
Primulaecae		**Primrose Family**
	Anagallis arvensis	scarlet pimpernel
Rosaeceae		**Rose Family**
	Rubus discolor	Himalayan blackberry
	Rubus ursinus	California blackberry
Rubiaceae		**Madder Family**
	Galium sp.	bedstraw
Salicaceae		**Willow Family**
	Populus fremontii	Fremont's cottonwood
	Salix exigua	narrow-leaved willow
	Salix laevigata	red willow
	Salix lucida ssp. *lasiandra*	shining willow
	Salix lasiolepis	arroyo willow
Scrophulariaceae		**Snapdragon Family**
	Kickxia elatine	fluellin
	Verbascum blattaria	moth mullein
	Veronica anagallis-aquatica	water speedwell
Vitaceae		**Grape Family**
	Vitis vinifera	wine grape
Monocotyledonae		*Monocots*
Cyperaceae		**Sedge Family**
	Carex nudata	torrent sedge
	Cyperus eragrostis	nutsedge
Juncaceae		**Rush Family**
	Juncus bufonius	toad rush
Poaceae		**Grass Family**
	Agrostis sp.	bent grass
	Arundo donax	giant reed
	Avena fatua	wild oats
	Briza maxima	big quaking grass
	Briza minor	little quaking grass
	Bromus diandrus	ripgut grass
	Bromus hordeaceus	soft chess
	Cynosurus echinatus	hedgehog dogtail
	Festuca rubra	red fescue
	Glyceria sp.	mannagrass
	Holcus lanatus	common velvet grass

PLANT SPECIES OBSERVED WITHIN THE
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT

DIVISION *Class* **Family**	Scientific Name *Genus species*	Common Name
	Hordeum marinum ssp. *gussoneanum*	barley meadow barley
	Hordeum murinum ssp. *leporinum*	
	Lolium multiflorum	Italian wild rye
	Polypogon interruptus	ditch beard grass
	Vulpia sp.	annual fescue
Typhaceae		**Cattail Family**
	Typha sp.	cattail

APPENDIX D
Draft 60% Complete Design Report – Dry Creek Habitat Enhancement Demonstration Projects: River Miles 6.2 to 7.3

Please note, the following 60% complete design report and drawings for the Dry Creek Habitat Enhancement Demonstration Project is in the process of being reviewed by various regulatory agencies and landowners within the project area. This report is a draft and is subject to change.



DRAFT

60% Complete Design Report

Dry Creek Habitat Enhancement Demonstration Projects: River Miles 6.2 to 7.3

Sonoma County, CA

Prepared for:

Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, CA 95403

Prepared by:

Inter-Fluve, Inc.
1020 Wasco Street, Suite I
Hood River, OR 97031

April 15, 2011

TABLE OF CONTENTS

1 INTRODUCTION 2

2 SCOPE OF REPORT 2

3 PREVIOUS STUDIES BY INTER-FLUVE 4

4 DRY CREEK CURRENT CONDITIONS 4

4.1 Watershed Context 4
4.2 Current Geomorphology of Dry Creek 5
4.3 Fish Habitat in Dry Creek 7
4.4 Habitat Enhancement Demonstration Reach Current Conditions 8
4.5 Demonstration Reach Habitat Classification 12

5 DRY CREEK HYDROLOGY 17

5.1 Flood Frequency Statistics 17
5.2 Flow Duration Statistics 17

6 HYDRAULICS OF DRY CREEK 19

7 DEMONSTRATION PROJECTS GOALS, OBJECTIVES AND DESIGN CRITERIA 28

8 DEMONSTRATION PROJECTS ENHANCEMENT DESIGN 31

8.1 Enhancement Approaches 31
8.2 Hydraulics of the 60% Complete Enhancement Design 36

9 ESTIMATED FUTURE HABITAT COMPOSITION AND ADDITIONAL REARING HABITAT 45

10 DEMONSTRATION PROJECT CONSTRUCTION CONSIDERATIONS 50

10.1 Access and Staging 50
10.2 Timing and Duration of Construction 50
10.3 Stream Diversion and Dewatering 50
10.4 Shoring of Excavations 52
10.5 Interaction with Existing Features 52
10.6 Right-of-Way Considerations 53
10.7 Fish Screening and Relocation 53
10.8 Working Hours 53

11 OPINIONS OF PROBABLE CONSTRUCTION COSTS 54

12 BIBLIOGRAPHY 57

13 APPENDIX A – 60% COMPLETE ENHANCEMENT DESIGN DRAWINGS 59

14 APPENDIX B – DRAFT GEOTECHNICAL REPORT 60

1 INTRODUCTION

Dry Creek flows 14 miles from the Warm Springs Dam (WSD) to the mouth of the Russian River in Sonoma County, California (*Figure 1*). WSD is operated by the Army Corps of Engineers to control floods, and by the Sonoma County Water Agency to supply potable water to 600,000 consumers in Sonoma and northern Marin Counties.

Dry Creek is home to native threatened and endangered fish, including coho salmon, Chinook salmon, and steelhead trout. The National Marine Fisheries Service has determined that the operation of Warm Springs Dam could threaten the survival of coho salmon and steelhead trout in Dry Creek, and in 2008 issued a Biological Opinion requiring improvements to their habitat. In particular, key goals identified for habitat enhancement in Dry Creek include development of rearing and refugia habitat for Central California Coast (CCC) coho salmon (*Onchorhynchus kisutch*) and CCC steelhead trout (*O. mykiss*).

Habitat enhancement in Dry Creek is seen as a significant opportunity for recovery of coho and steelhead in the region due to the relative abundance of cool water in the late summer months which is atypical of streams in the region. Late summer rearing conditions are considered a critical bottleneck for species recovery. Minimum habitat restoration goals are detailed more specifically in the Biological Opinion for Water Supply, Flood Control and Channel Maintenance Activities (RRBO: NMFS 2008).

The Biological Opinion lays out a timeline for the habitat work, which will ultimately result in over six miles of habitat enhancement in Dry Creek by 2020. A group of cooperating landowners in the Dry Creek Valley has come together with the Sonoma County Water Agency to begin planning the implementation of the first phase of these enhancements. This will be accomplished through a series of 'demonstration' projects within a 1.1 mile length of Dry Creek in the middle of the valley, extending from the mouth of Grape Creek to a point just downstream of the mouth of Crane Creek (Figure 1). Construction of the demonstration projects is scheduled to begin in 2012.

The following pages summarize the enhancement design development to date (60% Complete) for the 1.1 mile "Demonstration Reach" of Dry Creek.

2 SCOPE OF REPORT

The current report details design development to arrive at the present 60% Complete Enhancement Design. This draft design report is a 'living' document, which will be expanded as design development advances through the detailed design phase. As such, sections of the current report will be expanded with additional detail in future editions, and new sections will be added documenting further design development.

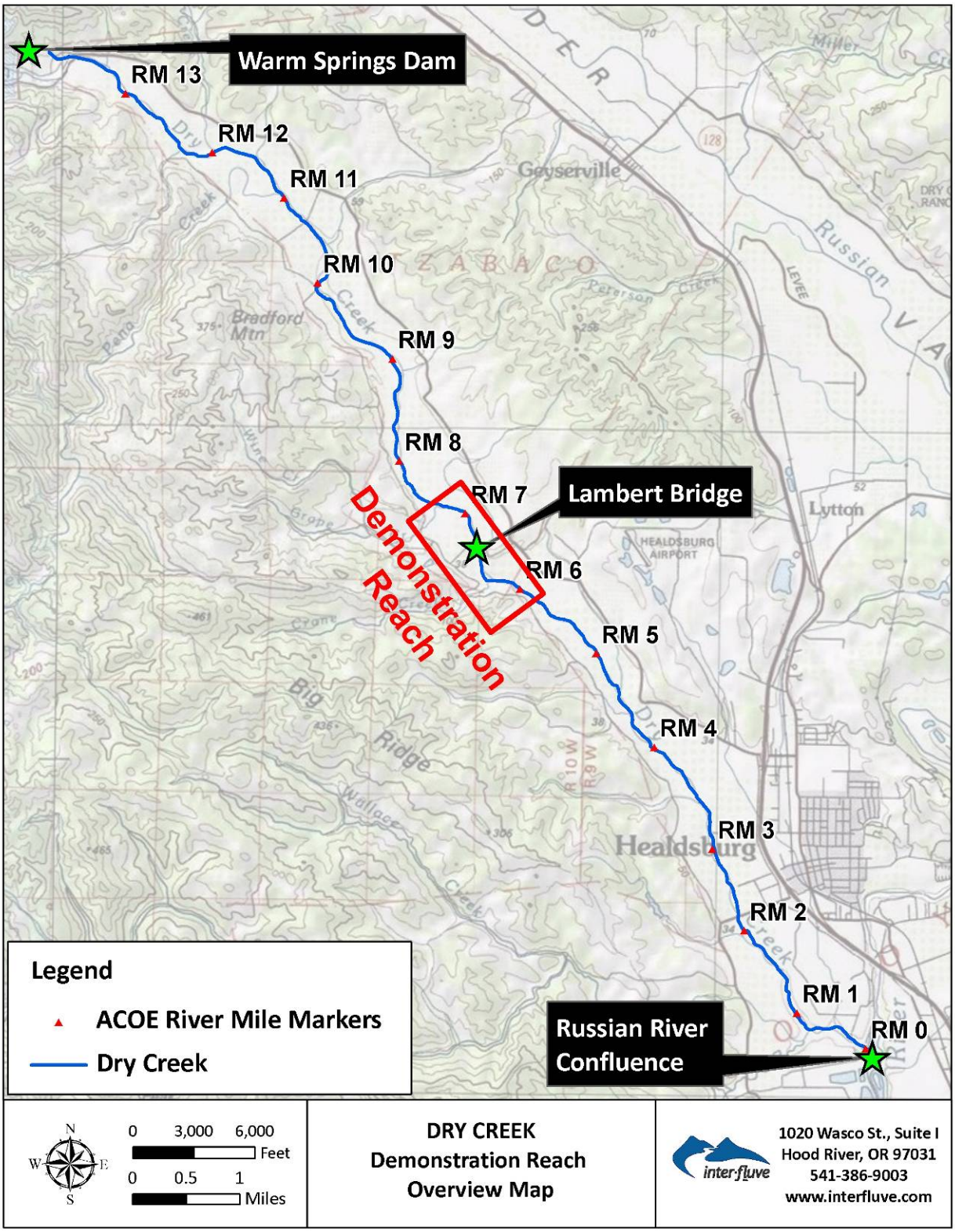


Figure 1: Map of Lower Dry Creek between Warm Springs Dam and the Russian River.

3 PREVIOUS STUDIES BY INTER-FLUVE

In addition to the detailed design of the Demonstration Projects, Inter-Fluve has been completing a feasibility study of fish habitat enhancement over the 13.9 mile length of Dry Creek between WSD and the Russian River. The feasibility study has resulted in two reports which provide a foundation for the demonstration project design. These reports are summarized below:

- *Final Current Conditions Report, Dry Creek from Warm Springs Dam to the Confluence with the Russian River* (Inter-Fluve 2010): This report includes a summary of watershed context and hydrology, an assessment of stream geomorphology based on available data and field observations, and a detailed summary of the fish habitat inventory completed in summer 2009.
- *Draft Habitat Enhancement Feasibility Study Report, Dry Creek from Warm Springs Dam to the Confluence with the Russian River* (Inter-Fluve 2011): This report includes additional quantitative assessment of stream geomorphology and trajectory, and assessment of the feasibility of fish habitat enhancement to meet the habitat goals of the RRBO on Dry Creek.

The following sections sample the key points from these studies as relevant to the demonstration project design. The reader is referred to the above reports for more detailed discussion.

4 DRY CREEK CURRENT CONDITIONS

4.1 Watershed Context

The Dry Creek watershed is located in the interior coast range of northern Sonoma and southern Mendocino counties, approximately 30 miles from the Pacific Ocean and 60 miles north of San Francisco Bay. Warm Springs Dam is located on Dry Creek at river mile 13.9, at the confluence of Dry and Warm Springs Creeks. The Dry Creek watershed lies within a region of Mediterranean climate, characterized by warm, dry summers and cool wet winters.

The characteristic pattern of the natural flow regime for Dry Creek prior to operation of the dam (before 1984) was seasonal with high flow events occurring in the winter and very low flow in the summer and early fall. Flow rates under natural conditions increased three orders of magnitude during the winter. After operation of the dam commenced in 1984, the flow regime changed to a perennial stream with much less variation in flow rates between summer and winter. Summers have consistent base flow while winter peak flows are reduced relative to natural flow conditions (Inter-Fluve 2010).

The present condition of lower Dry Creek expresses the legacy of management in the basin, which extends back to the settlement of the valley starting in the 1850s. Gravel mining began in the Russian River near Healdsburg about 1900, and continued in various locations within the mainstem until the late 1960s, and then shifted to the Russian River terraces below Healdsburg. The Potter Valley project was constructed in the early 1900s, which supplemented flow in the Russian River with water from the Eel River in northern California. Gravel mining also occurred along lower Dry Creek from the 1950s to the 1970s near the Mill Street bridge (approximately 2

miles above the creek mouth). In conjunction with the construction of Healdsburg (1952) and Coyote (1959) Dams on the Russian River which served to reduce downstream supplies of gravel, gravel mining and other activities resulted in a significant lowering of the base level for Dry Creek, which resulted in significant degradation in the main channel of lower Dry Creek, and subsequently in the tributaries (Army Corps of Engineers 1987).

4.2 Current Geomorphology of Dry Creek

The current geomorphology of lower Dry Creek is a result of the interaction of local geology, watershed characteristics, hydrology, and vegetative characteristics; the legacy of channel evolution and response to land management changes; and the ongoing influence of flow management. Lower Dry Creek is an incised, perennial, alluvial gravel bed stream that has responded to significant human induced hydrologic and geomorphic change over the past 150 years (Inter-Fluve 2010). The study reach is primarily composed of pool-riffle and plane-bed morphology (Montgomery and Buffington 1997) with an average channel gradient of 0.18%. The channel corridor is generally narrow relative to the active channel width, and relatively uniform in width over most of the study reach, with periodic wider reaches.

Widespread, systemic incision occurred historically in response to base-level lowering and other factors. Assessments completed in close proximity to the time of dam closure concluded that systemic degradation of lower Dry Creek had generally ceased by the time the dam came online (Harvey and Schumm 1985). The primary determinant of current geomorphic conditions is the influence of the dam, expressed through modified sediment supply, altered hydrology and the growth of riparian vegetation. Dam construction ceased delivery of bed material from the upper 60% of the watershed. The hydrologic regime has been converted from a seasonal runoff-based regime to a regime that combines moderate winter floods, year-round flows, and sustained, relatively high baseflow conditions. The change in hydrology has also resulted in increased growth of riparian trees that influence bank erosion rates (Inter-Fluve 2010, 2011)

The reduction in bedload supply is most noticeable in the reach between the dam and the confluence of Dutcher (RM 11.8) and Pena (RM 11) Creeks. The reduction in bed material supply is moderated by successive tributaries entering lower Dry Creek. The most significant of these in terms of bed material supply include Dutcher Creek (RM 11.8), Pena Creek (RM 11), Crane Creek (RM 6.3) and Mill Creek (RM 0.6). The reach between Pena Creek and Westside Bridge (RM 11 to RM 2) does not appear to be actively incising or aggrading, though there are selected areas of active channel adjustment. The reach between Westside Bridge and the confluence appeared to be the most alluvial reach, in which the channel position and shape are most readily shaped by fluvial forces (Inter-Fluve 2010, 2011)

Regulation has resulted in elevated summer baseflow conditions that when combined with the Mediterranean climate produces near ideal conditions for growth of riparian trees and shrubs. Regulation has also resulted in severe curtailment of major floods, which limits disturbance and removal of newly recruited and established vegetation. This combination of effects has resulted in extensive vegetative colonization of formerly active bar surfaces (Figure 2). Colonization of the bar surfaces serves to limit lateral migration of the active channel within the channel corridor, and has the effect of sequestering a reservoir of gravel within the system (Inter-Fluve 2010, 2011).

Vegetative colonization of bar surfaces has also led to an active channel that is efficient at moving gravel supplied to the stream despite the reduced flood flow hydrology. Mature vegetation and dense understory growth hydraulically roughen over bank areas and concentrate high flow velocities in the channel during high flow events. However, based on field observations, the combination of reduced bed material supply and reduced flood magnitudes and frequencies do not appear to have resulted in incremental systemic degradation or aggradation though areas of local adjustment and bed degradation are apparent, as observed by long-time Dry Creek landowners. Degradation is also kept in check by features which control the bed grade spaced periodically over the reach, such as bedrock exposures and grade control structures (Inter-Fluve 2010, 2011).

More detail regarding the current geomorphology of Dry Creek can be found in the Draft Feasibility Study Report (Inter-Fluve 2011).

Figure 2: Example of vegetative narrowing of channel corridor near Lambert Bridge (RM 6.6). Lambert Bridge is seen at lower right of each frame. Dry Creek flow is from top to bottom. Left frame is from 1976, right frame is from 2004. Light blue line is estimated limit of active fluvial features in 1976.

4.3 Fish Habitat in Dry Creek

A habitat inventory was conducted in 2009 to census aquatic habitat for coho salmon and steelhead trout in Dry Creek downstream of the Warm Springs Dam. Habitat conditions were documented at the summer steady-state operational discharge of approximately 100 cfs (Inter-Fluve 2010).

The inventory found that Dry Creek is composed of 26% riffles, 23% pools, 7% scour pools, 44% flatwaters and less than 1% cascades based on the relative frequency of mainstem habitats.

Pool depths generally decreased in the downstream direction, with a greater proportion of scour pools in the middle to upstream end of the survey area. Overall, there was far more flatwater than riffle habitat (44% of mainstem habitats by frequency versus 26% for riffles). Although Dry Creek is composed of 26% riffles by frequency, riffles represent only 12% of mainstem habitats by length. A total of 44 alcoves and 27 side channels were measured, with a relatively greater number of off-channel habitats in the lower half of the study reach (Inter-Fluve 2010).

Pebble counts were conducted at riffles in all surveyed reaches. The substrate sizes in these riffles meet coho and steelhead spawning requirements. The predominant substrate in riffles, flatwaters and pools was gravel. In side channel pools, dominant substrate was most often fine sediment, gravel, or sand. Instream woody debris (small, medium and large) totaled an average of 183 pieces of wood per mile in lower Dry Creek, with variability from reach to reach, ranging from 63 to 362 pieces per mile (Inter-Fluve 2010).

4.4 Habitat Enhancement Demonstration Reach Current Conditions

The Habitat Enhancement Demonstration Reach is located in survey reach 7 from the 2009 fish habitat and geomorphic inventory (Inter-Fluve 2010). Survey Reach 7 extends from below Crane Creek to about 1000 ft upstream of Grape Creek, while these important tributaries mark the upstream and downstream ends of the demonstration reach. These are deeply incised tributaries with exposed bedrock at their mouths. A mapped, unnamed tributary enters Dry Creek at river mile 6.6. A valley landmark, Lambert Bridge, crosses Dry Creek at river mile 6.6 (Figure 3).

Multiple bedrock outcrops are visible along the channel bed in this reach. Though the channel has narrowed as it has incised through this reach, there have been only minor amounts of channel migration since the 1940s (Figure 4). The channel is more sinuous than downstream, but the riparian corridor is narrow, and there is little room for substantial channel migration.

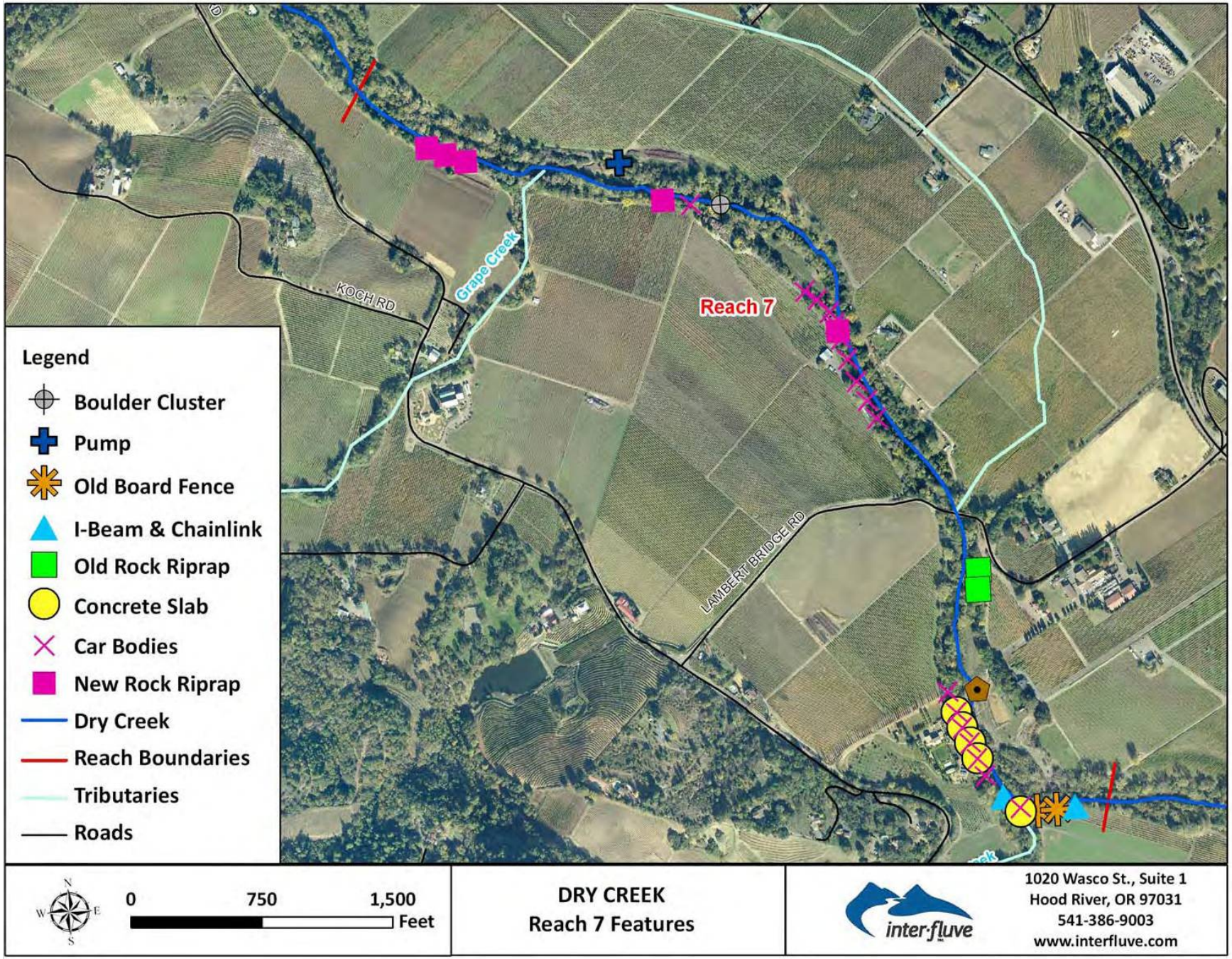


Figure 3: Existing features in Demonstration Reach (Inter-Fluve 2010).

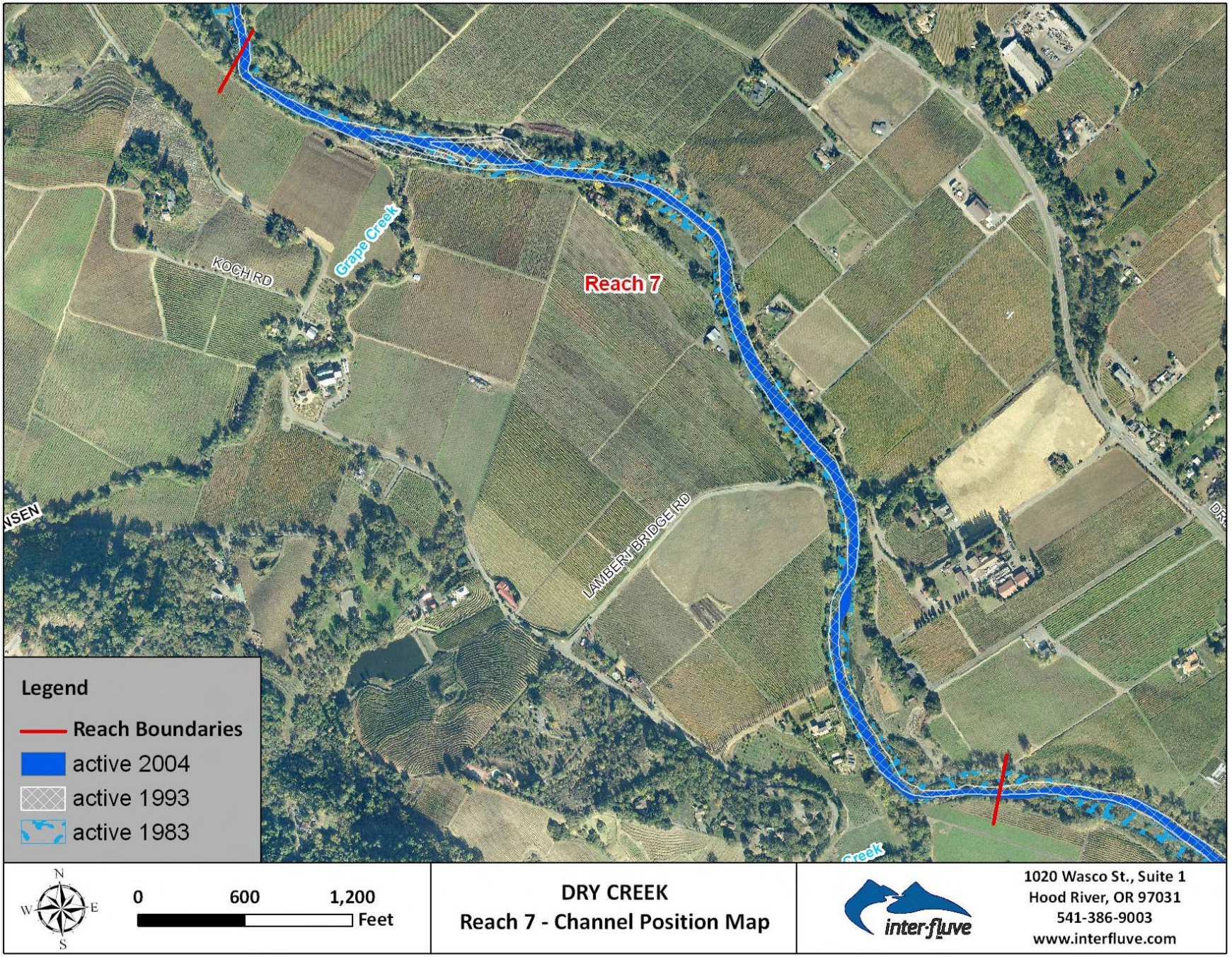


Figure 4: Channel position mapping for the post-dam period (Inter-Fluve 2010).

Figure 5: (upper left) cascade under Lambert Bridge, (upper right) mouth of Crane Creek, (lower left) bedrock outcrop, (lower right) riffle where Grape Creek enters Dry Creek.

Substantial incision has occurred through this reach, but the bedrock outcrops have limited further widespread degradation. The most apparent bedrock outcrop is the bedrock cascade under the Lambert Bridge, but there are also outcrops at river mile 6.4 between the unnamed tributary and Crane Creek, at the mouth of Grape Creek and upstream of Grape Creek. These occasional bedrock outcrops provide cover for fish, influence pool formation, and control stream gradient. Despite the bedrock outcrops, the dominant substrate is gravel, followed by sand. Existing bank stabilization efforts in the reach include boulder riprap, old cars on the banks, concrete slabs, I-beam and chain link fence, and old board fence protecting banks just downstream of Crane Creek on the right bank.

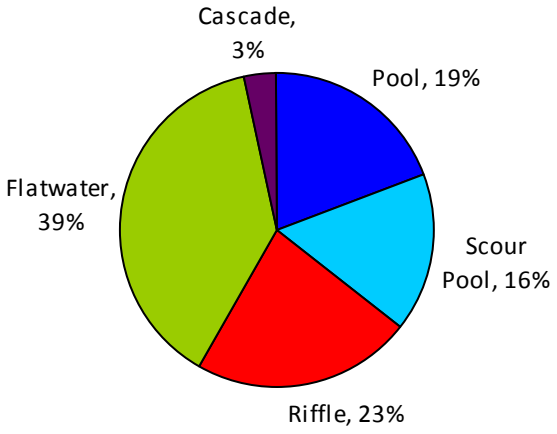
Figure 6: (upper left) Failed I-beam and chainlink fence stabilization efforts, (upper right) car bodies in the banks, (lower left) erosion along an outside bend, (lower right) a triangular boulder cluster in Dry Creek.

4.5 Demonstration Reach Habitat Classification

At the time of the habitat inventory (2009), survey reach 7 contained 35% pool habitat, 39% flatwater, 23% riffle, and 3% cascade (under Lambert Bridge) by relative frequency (*Figure 7*). Riffles represent only 10% of the 1.3 miles of main channel on a length basis. There are a few side channels and alcoves, one cascade and seven riffles ranging in length from 50 to 60 ft (Figure 8).

The average wetted width during the survey was 48 ft and the active channel and flood prone widths are 58.5 and 81 ft respectively. The average active channel depth was 2.5 ft. Adjacent terraces are about 10 ft above the channel bed.

Figure 7: Proportion of Habitat Types by Relative Frequency in Reach 7



Pebble counts were conducted in four riffles in Reach 7. The median grain size of four sampled riffles ranged from 16 to 30 mm (Figure 9). Most samples were medium gravels through very coarse gravels. 80% of all samples were within desirable coho/steelhead spawning sediment

sizes, and 36% was within juvenile rearing size classes. 5% of the samples were fine sediments or sand (<2mm).

There were a total of 287 pieces of wood in Reach 7, with 193 pieces per mile in the mainstem. The highest densities of wood were found in pools and riffles, followed by flatwaters, then side-channels and alcoves. 5 out of the 8 large wood pieces (>20” diameter) observed were found in pools. Cover was provided by overhanging vegetation, terrestrial vegetation growing in the water, and small woody debris, and also by boulders, bedrock, and root masses. Edge habitat was present in 44% of the habitat units.

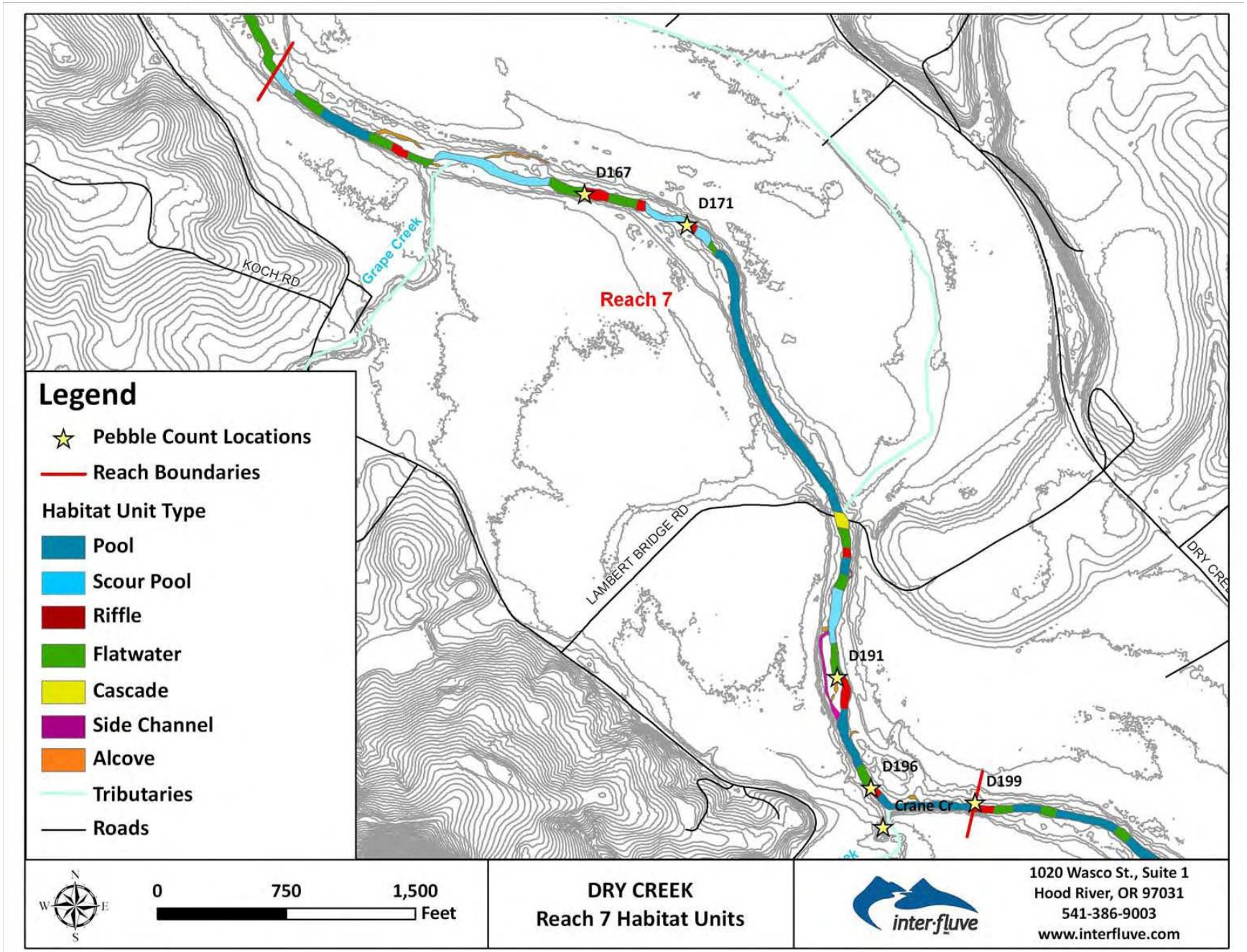
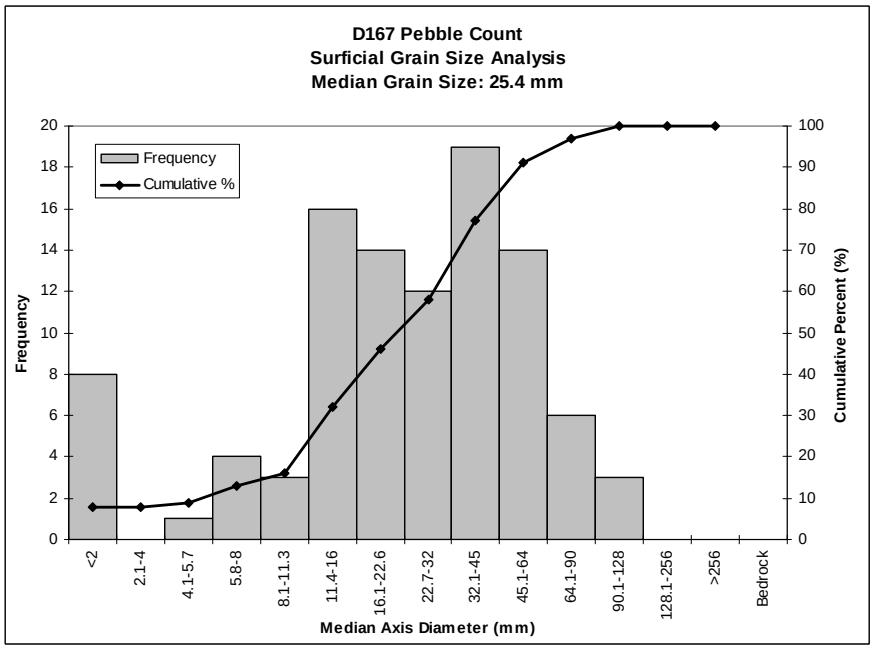


Figure 8: 2009 Habitat inventory results (Inter-Fluve 2010).

Figure 9: Grain size distribution for four riffles between Grape Creek and Crane Creek.D167 and D171 correspond to the habitat unit numbers in which the pebble counts were taken.



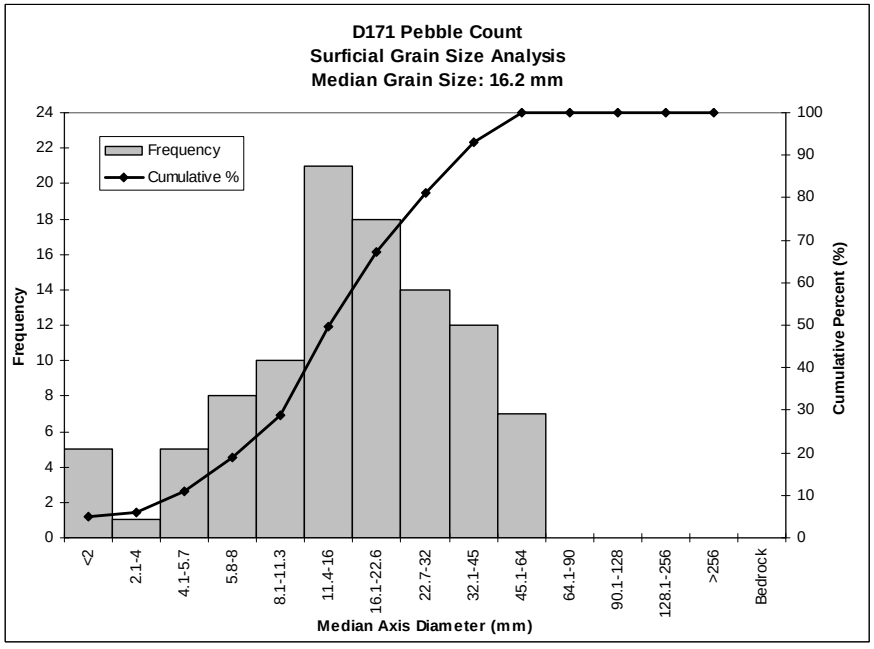
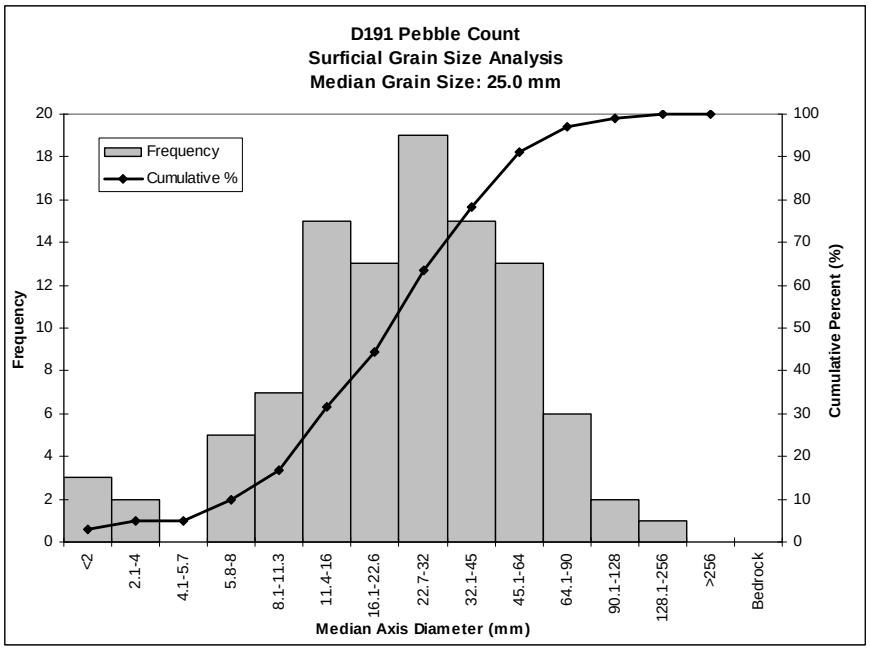
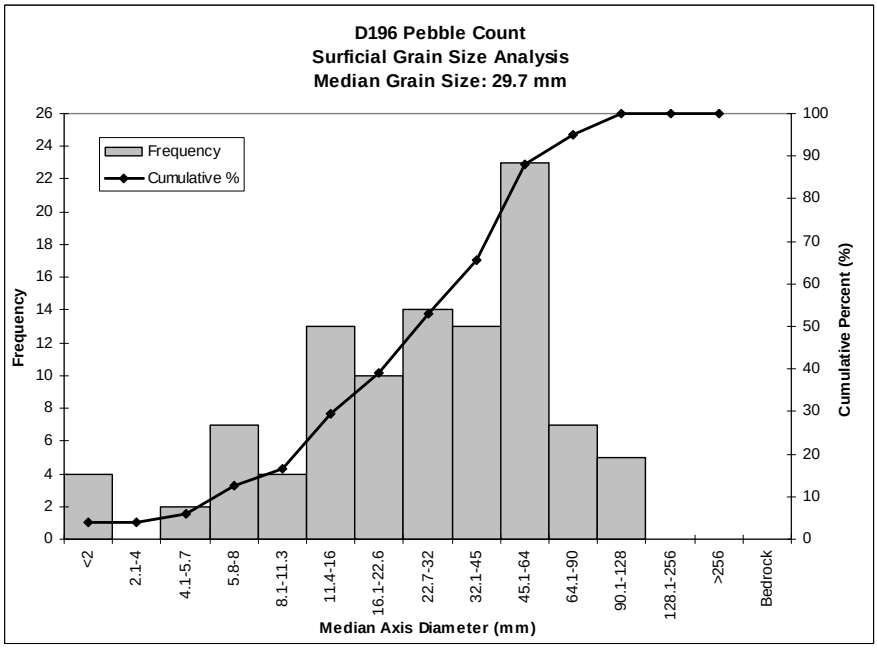


Figure 9, continued: Grain size distribution for four riffles between Grape Creek and Crane Creek. D191 and D196 correspond to the habitat unit numbers in which the pebble counts were taken.





5 DRY CREEK HYDROLOGY

Current hydrologic conditions in the project reach are regulated by WSD which became operational in 1984. Prior to dam construction and operation, Dry Creek had a natural flow regime typical of Mediterranean streams characterized by rapidly developing peak floods of relatively short duration occurring in conjunction with significant winter precipitation events, and very low summer period base flow. During major flood events, flow may have increased of 2-3 orders of magnitude over a short timeframe (Inter-Fluve 2010). The following section provides a summary of hydrologic characteristics germane to the enhancement design. More extensive discussion of Dry Creek hydrology is included in the Current Conditions and Feasibility Study Reports (Inter-Fluve 2010).

5.1 Flood Frequency Statistics

Peak flow hydrologic statistics (i.e., flood flows) were assessed for the project reach. Inter-Fluve (2011) reviewed the available data and estimated peak flows using corresponding methods. The available data consisted of peak flow estimates included in the Warm Springs Dam and Lake Sonoma Water Control Manual (WCM: Army Corps of Engineers 1984), and USGS gaging station data on Dry Creek (2 gages with 29 year records of relevant data) and Pena Creek (1 gage with a 12-year record). Table 1 reports the estimates derived from these two data sources. Because the estimates derived from the USGS streamflow data are based on observed streamflow conditions, those estimates have been accepted as the primary flood flow hydrology for the demonstration reach design.

Table 1: Peak discharge estimates for the Enhancement Demonstration Reach between Grape and Crane Creeks (Inter-Fluve 2011).

Flow Event	Discharge (cfs) Source: Extraploted from WCM	Discharge (cfs) Source: Estimated based on the available USGS gage data
1-year	2707	1392
2-year	4127	3795
5-year	6004	8444
10-year	7371	8743
25-year	9302	10152
50-year	10673	11127
100-year	12342	11214

5.2 Flow Duration Statistics

Flow duration statistics for Dry Creek were developed using daily average flow data from the USGS gaging station at Yoakim Bridge (USGS No. 11465200: (1) post-dam (1984-2008), and (2) pre-dam (1960-1983). The curves were developed for annual (January-December) and

winter-only (December-March) time periods. *Figure 10* presents flow-duration curves based on this analysis.

The magnitude and frequency of extreme high and low flows have shifted with regulation by Warm Springs Dam. Figure 10 shows that there were significantly more low flow days prior to construction of the dam. Post-dam flow duration curves for the two gages are similar with a majority of the flows in the 100 cfs range (80% of flows between 70 and 200 cfs below the dam) and no dry periods (Figure 10). The 50% excedence (median) flows at the dam outlet and at Yoakim Bridge for the post-dam period are 105 cfs and 110 cfs, respectively. This flow range corresponds closely with the steady state operational discharge maintained in Dry Creek in late spring, summer and fall.

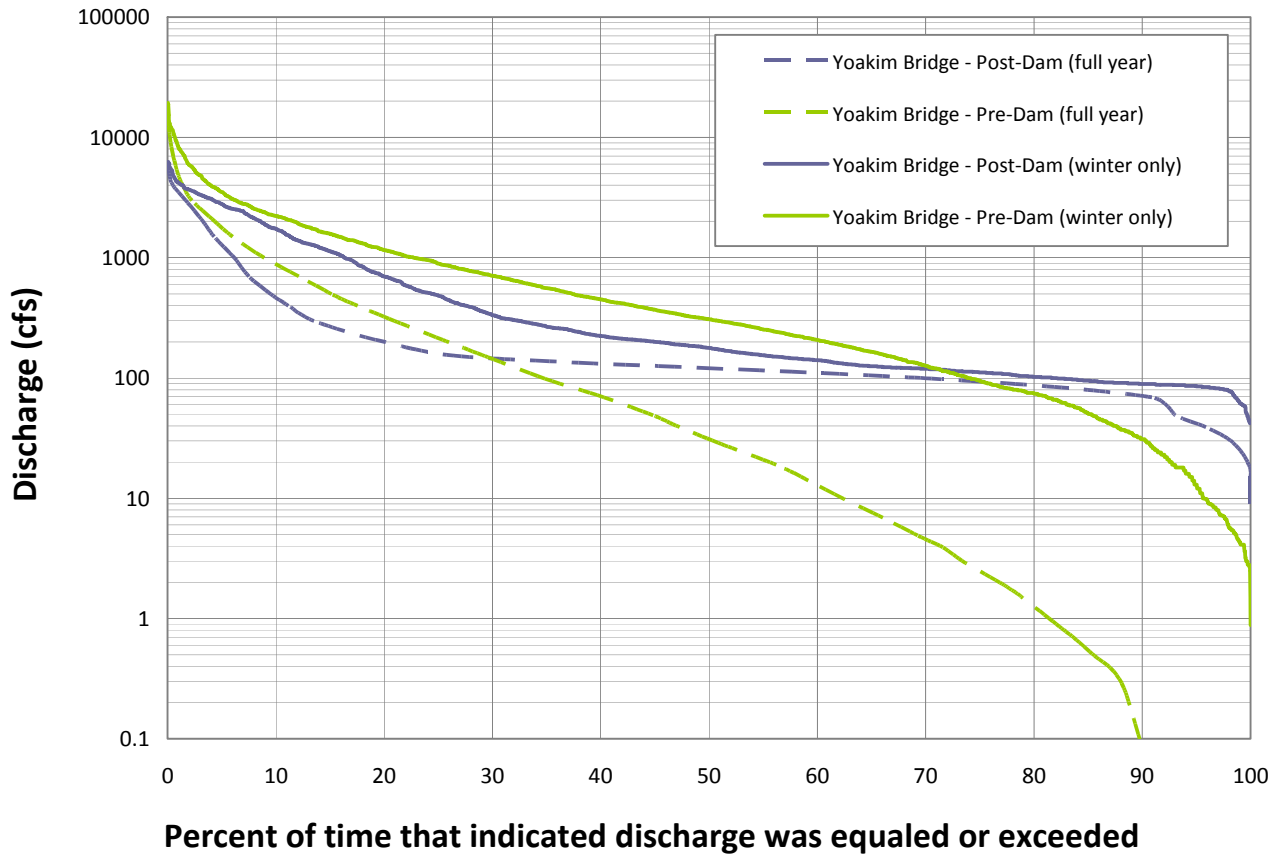


Figure 10: Flow duration curves for annual and winter (December-March) periods for Dry Creek at the USGS gage station at Yoakim Bridge (pre- and post-dam).

6 HYDRAULICS OF DRY CREEK

Existing hydraulic patterns were assessed to develop a baseline understanding of Dry Creek flow patterns through the study reach. The analysis was completed using the U.S. Army Corps of Engineers Hydraulic Engineering Center River Analysis System (HEC-RAS 4.1.0). HEC-RAS is a computer program that models the hydraulics of water flow through natural rivers and other channels. The program is one-dimensional, meaning that there is no direct modeling of the hydraulic effect of cross section shape changes, bends, and other two- and three-dimensional aspects of flow. The hydraulic model calculates channel and floodplain water velocities, depths and shear stresses for various input flows. The model geometry was developed using bathymetric, topographic and bridge data obtained as part of feasibility study and detailed design phases. The existing conditions model geometry includes 54 cross sections spaced over the 1.1 mile demonstration project reach.

Roughness coefficients (Manning's n values) applied at each model cross section were estimated from field observations, aerial photography and published methods (Arcement & Schneider 1989). Summarized in Table 2, the roughness values utilized fall within the range of values used in the 2006 FEMA study (Federal Emergency Management Agency 2006).

Table 2: Roughness coefficients used in the existing conditions model.

Description	Manning's n values
Channel, high roughness (bedrock, vegetation, LWD)	0.054 – 0.1
Channel, low roughness	0.03 – 0.04
Floodplain, heavily vegetated, LWD	0.12
Floodplain, mixed residential/lawns/landscape trees/minor structures	0.1
Floodplain, cleared surfaces and roads	0.04-0.09

The flood events utilized in the model include the 1.01-, 2-, 5-, 10-, 50- and 100-year estimates described above. Also simulated were the approximate steady state operational discharge (105 cfs) and the approximate flow (218 cfs) occurring during the original survey effort (May 2010) for comparison to observed water surface elevations. The simulations were executed for steady state flow conditions.

Model input parameters were adjusted so that simulated water surface elevations within the reach approximately match (+/- 0.04 to 0.7 ft, mean = 0.19 ft) observed water surface elevations measured during the May 2010 survey. Figure 11 shows the simulated water surface profiles under existing conditions for the range of simulated flows.

To examine the spatial patterns of surface water distribution in Dry Creek during the simulated flows for existing conditions, the ArcGIS extension HEC GeoRAS was utilized to prepare inundation maps for selected flow events (Figures 12-17). As can be seen, flow begins to spill out of the existing active channel at roughly the 2-year return period flood. The 100-year return period flow is contained within the creek corridor.

In addition, Inter-Fluve (2011) assessed select sediment transport characteristics of the demonstration reach. The analysis suggests that Dry Creek is capable of mobilizing the surface substrate on riffles in 2-year and 10-year return period floods. In many locations the surface substrate is also marginally mobile in the flow that is exceeded 20% of the time based on the winter flow duration curve, which is a flow that is exceeded relatively frequently and may occur for sustained duration. At the locations where subsurface substrate data were available, the analysis suggests that this material (which is assumed to approximate the actual bed material load during bedload transport events) can be transported at the three flow levels described above. Finally, based on evaluation of three locations within and immediately upstream of the demonstration reach, the effective discharge was estimated to occur in the range of 1000 to 3000 cfs, which is in the approximate 1-year to 2-year return period flood range. See Inter-Fluve 2011 for more detailed discussion.

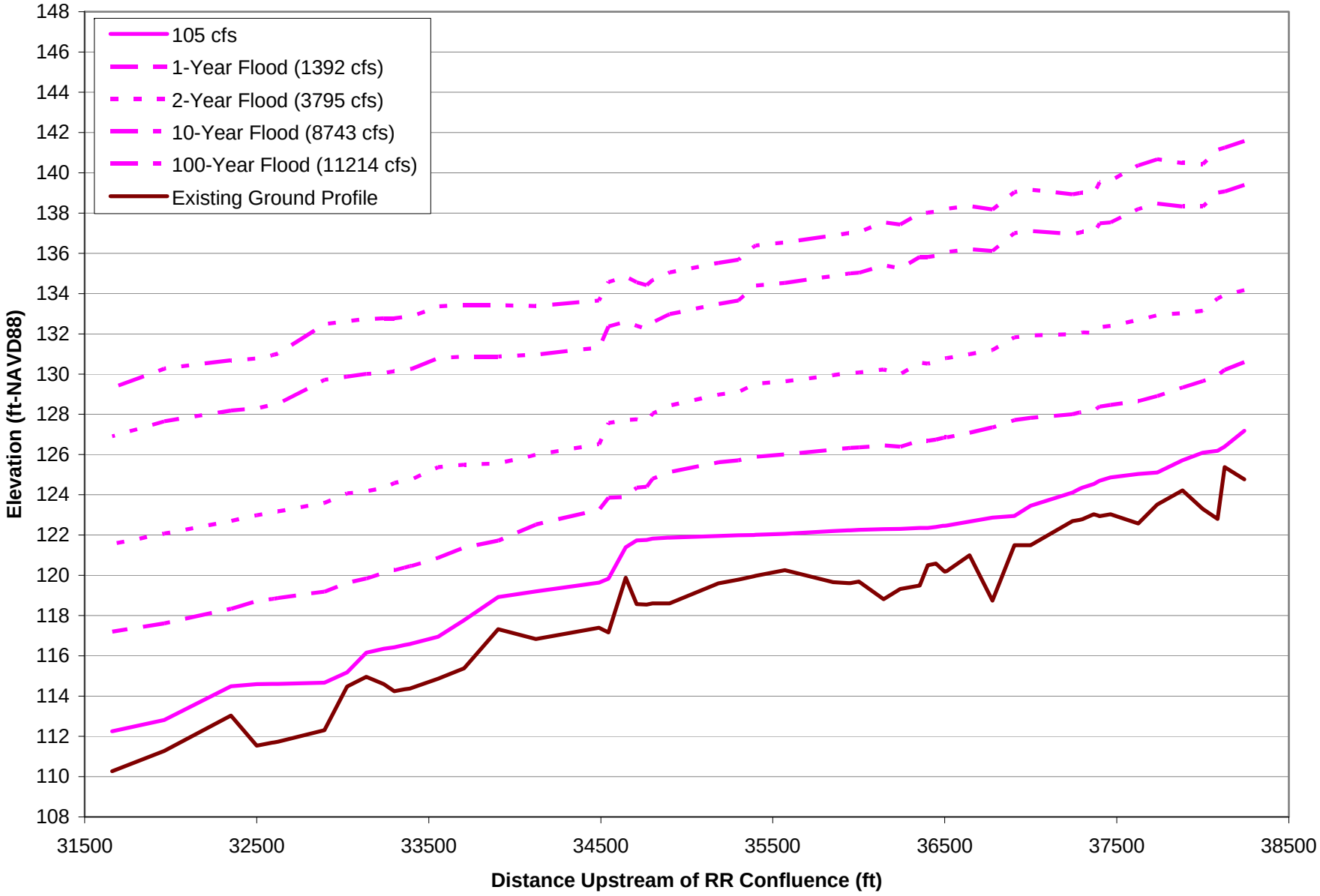


Figure 11. Simulated water surface profiles for existing conditions at base flow and a range of high flow events.

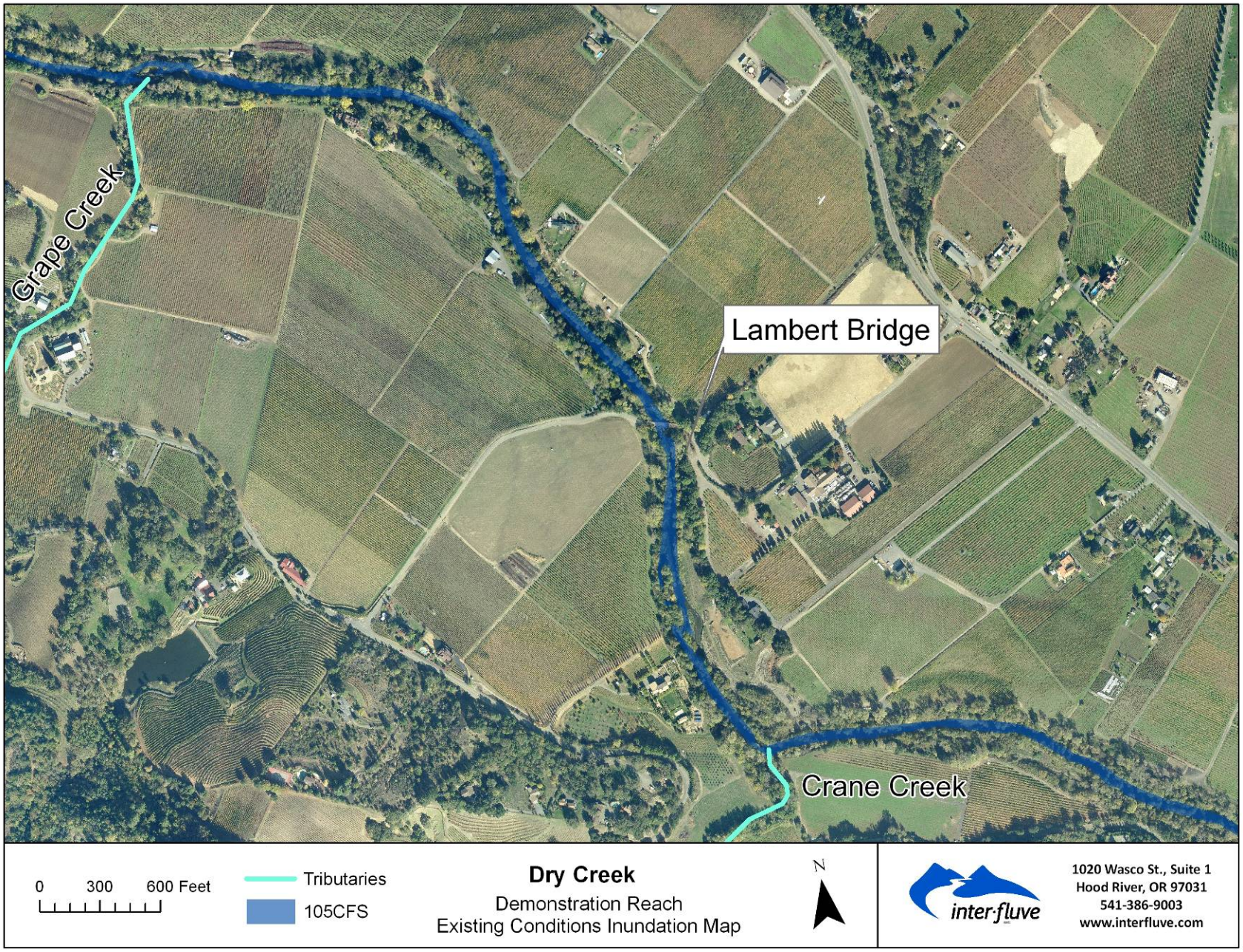


Figure 12. Inundation map based on existing conditions at 105 cfs.

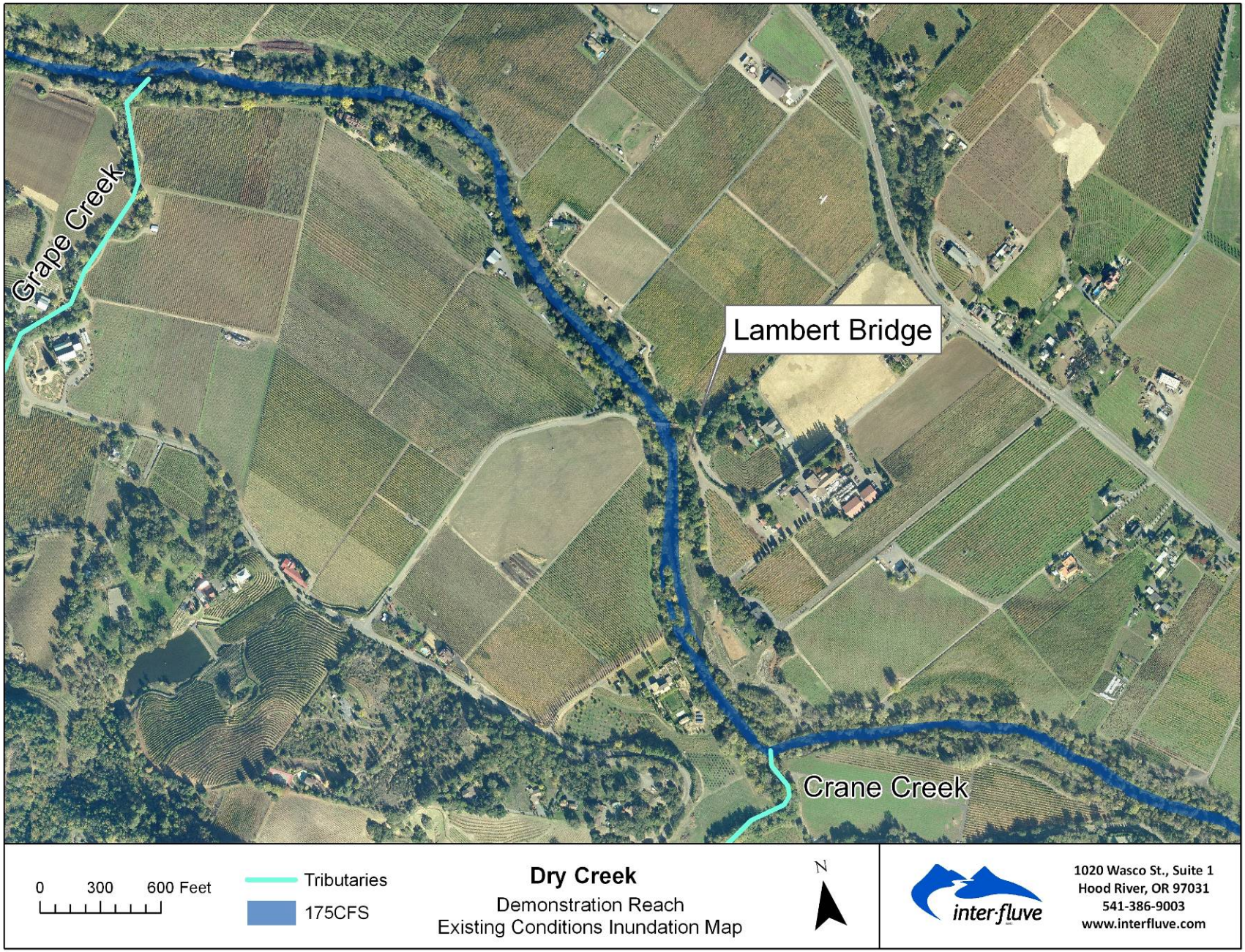


Figure 13. Inundation map based on existing conditions at 175 cfs.

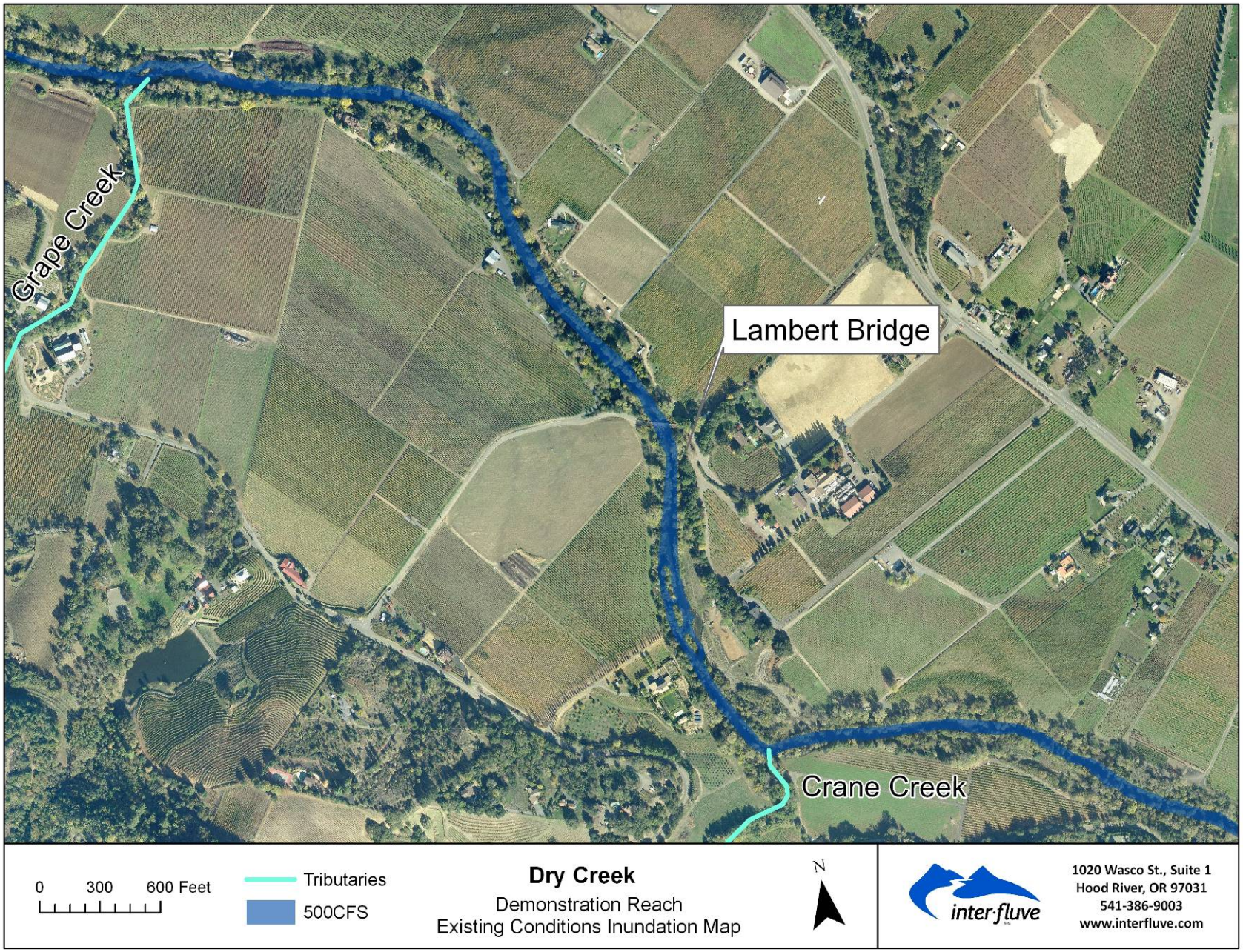


Figure 14. Inundation map based on existing conditions at 500 cfs.

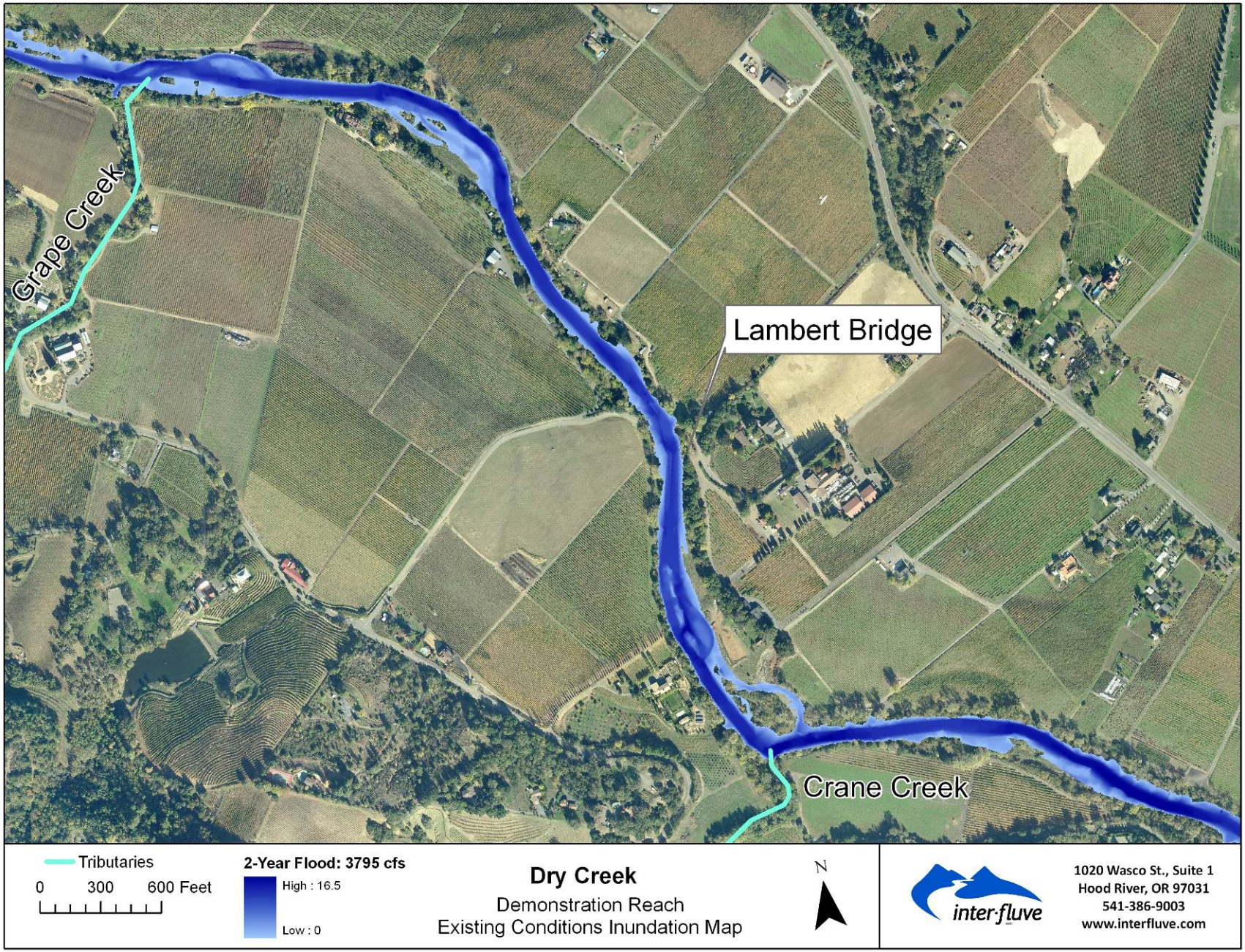


Figure 15. Inundation map based on existing conditions for 2-year return period flood (3795 cfs).

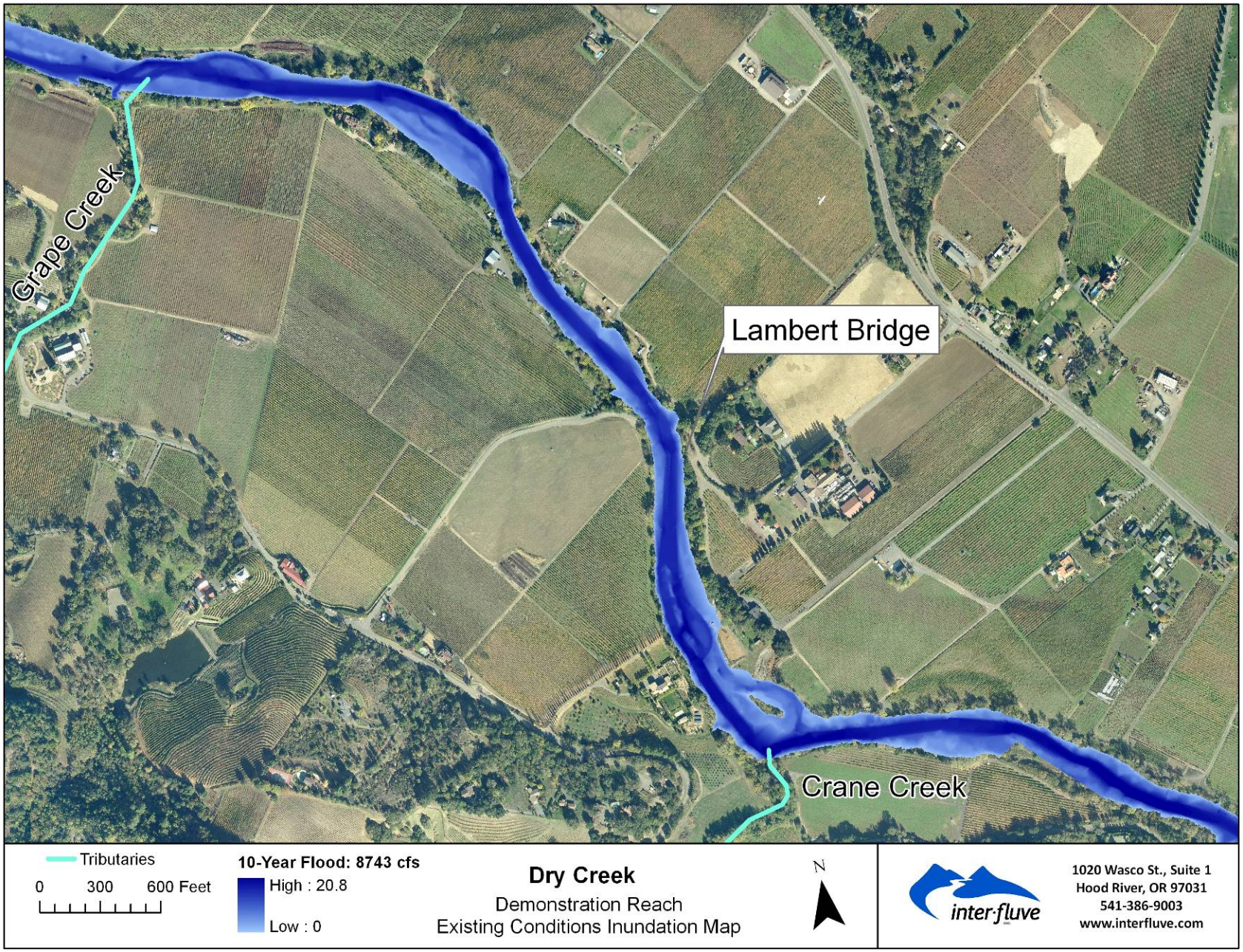


Figure 16. Inundation map based on existing conditions for 10-year return period flood (8743 cfs).

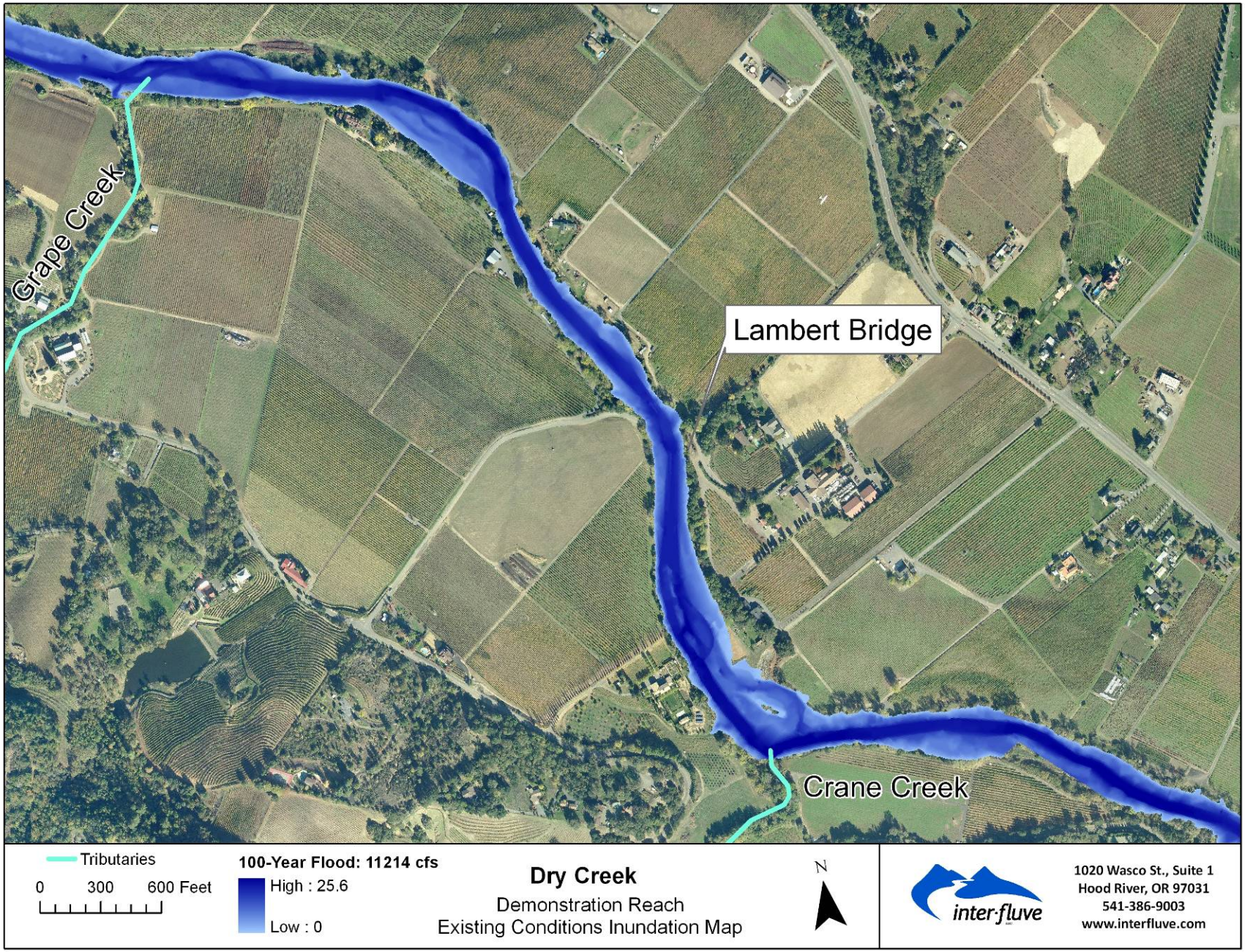


Figure 17. Inundation map based on existing conditions for 100-year return period flood (11214 cfs).

7 DEMONSTRATION PROJECTS GOALS, OBJECTIVES AND DESIGN CRITERIA

The goals and objectives for the Demonstration Reach enhancements include the following:

- Maximize the general ecological lift to the reach to the extent practicable within the current geomorphic and hydraulic function of the stream,
- Increase the availability of high quality summer rearing and winter refugia habitat for salmonids (specifically Coho and steelhead), given the current physical function of the system,
- Stabilize areas of problem erosion using techniques that also enhance habitat conditions for fish, and
- Demonstrate enhancement techniques that may be utilized elsewhere in Dry Creek in order to meet the habitat requirements of the Biological Opinion.

The RRBO lays out criteria which define high quality rearing habitat conditions for coho salmon and steelhead trout. These criteria were combined with additional considerations to constitute the design criteria for the project, summarized in Table 3. Although the RRBO is a 15 year guiding document, NMFS and CDFG will likely require the Water Agency to maintain functioning coho and steelhead habitat beyond this time frame. It is anticipated that the habitat enhancements will continue to provide habitat benefits and be maintained in approximately similar quantities for 25 years. The Water Agency, NMFS, and CDFG are engaged in an adaptive management planning process that will specify goals, objectives, and monitoring methods to verify the effectiveness and longevity of habitat enhancements (Wieckowski et al. 2010).

Table 3. Demonstration Project Design Criteria

Feature/Issue	Criteria	Remarks/Reference
Fish Habitat Design Criteria		
a. Target flow range	• 110 to 175 cfs	• Flow range outlined in RRBO
b. Pool Abundance	• 33% to 67% of all habitats	• RRBO
c. Pool:riffle ratio	• 1:2 to 2:1	• RRBO
d. Water depth	• 2 to 4 feet in pools	• RRBO
e. Velocity in rearing habitat	• < 0.2 ft/s • Reduced from present conditions to extent practicable	• RRBO • Primarily able to be met in off-channel habitats and shelter habitats associated with large woody debris • Local velocities in mainstem pool habitat
f. Cover	• >30% of habitat bottom obscured by cover	• RRBO • due to depth, surface turbulence, or presence of structures such as logs, debris piles, boulders, or overhanging banks and vegetation
g. Refugia habitat	• Should provide high quality shelter during high flow releases	• RRBO
h. Longevity of habitat	• 25 years in approximately similar quantities though adjustments will occur	• Water Agency
Large Woody Debris Stability		
i. Mobility of LWD	• 25 year event	• In most cases, stability requirements similar between Q2 and Q100-year events.
j. LWD Decay	• 15-25 year period	• Typical decay rates for coniferous species
Vertical Stability		
k. Design stability for riffles	• 25 year event	• In most cases, design substrate sizing is similar

Table 3. Demonstration Project Design Criteria

Feature/Issue	Criteria	Remarks/Reference
		between Q2 and Q100 events
Lateral Stability		
l. Stream boundaries constructed inside the channel corridor	• 5 year event	• Relatively deformable boundary construction
m. Stream boundaries constructed along margin of the channel corridor	• 50-year event	• Less deformable boundary construction
n. Stream boundary construction techniques	• Employ techniques that also provide margin shelter and riparian habitat	• Biotechnical techniques
Planform Stability		
o. Avulsion into off-channel habitat	• None within first 5 years following construction, notwithstanding extraordinary hydrologic events • Future avulsion is acceptable provided habitat criteria continue to be met	• Address risk of avulsion through design overbank roughness created with LWD
Riparian Vegetation		
p. Invasive species	• Endeavor to eliminate invasive vegetation	
q. Native revegetation	• Encourage diverse, less dense native community	
Construction Period		
r. Impacts to existing resources	• Minimal	
s. Impacts to adjacent operations	• Minimal	
t. Impacts to infrastructure	• None	

8 DEMONSTRATION PROJECTS ENHANCEMENT DESIGN

8.1 Enhancement Approaches

Enhancements in the Demonstration Reach will emphasize natural stream characteristics, or those which evolve through a given stream's geomorphology. By using enhancement practices that emulate natural geomorphic effects, the benefits provided to juvenile coho and steelhead will be optimized by increasing the amount of high quality rearing habitat. Because these approaches occur within a dynamic system, they should not be expected to be static through time. However, they should provide approximately similar quantities of habitat through time within the project reach, and the planned adaptive management approach will assist with this. The following paragraphs describe the primary enhancement approaches planned for the Demonstration Reach. Drawings representing each of these approaches are included in the 60% complete construction drawings included in Appendix A.

Backwater Channels & Ponds

Backwater channels, alcoves and ponds are areas off to the side of the stream that in summer connect to the main stream only at their downstream end. During this time, water backs into these areas, and has very low or no current. In addition to still water, logs that protrude into or float on the water, floating and submerged vegetation, and surrounding tall vegetation make these areas very attractive to juvenile fish. They use these areas to search for food, rest and to avoid predators. During winter periods, these areas will continue to have quiet water despite occasional high flows moving through them. This type of habitat provides the greatest opportunity in the Demonstration Reach to meet the target velocity criteria specified in the RRBO (Inter-Fluve 2011).

In the Demonstration Reach, this type of habitat is proposed in four areas, two each upstream and downstream of Lambert Bridge (Sheet 4 in Appendix A). Construction of these areas will entail excavation to achieve desired grades relative to the summer water surface elevation, and include placement of logs at appropriate locations, planting of aquatic vegetation and management of surrounding vegetation. The initial bottom grades for these areas have been set at 4 feet below the summer water surface elevation for the 60% design.

Based on repeat observations of backwater habitats in Dry Creek and assessment of the response of these habitats to high flow events, and monitoring of constructed side channels on other streams, Inter-Fluve (2011) developed guidelines to inform design of this habitat type on Dry Creek (Table 4). The primary challenges to the longevity of constructed backwater habitats are nuisance sedimentation and downstream changes in the main channel affecting the hydraulic control for the backwater habitat. Of the backwater channels reviewed on Dry Creek to date, those whose upstream ends were located a moderate distance from the active channel, and/or with a section of hydraulically rough floodplain between the upstream channel and the habitat were substantially less affected. These considerations will promote the longevity of the constructed habitat. Nevertheless, some degree of sedimentation in these areas may be unavoidable, and this issue should be tracked through the adaptive management program.

Table 4. Considerations for design of backwater channels on Dry Creek, based on field observations of similar habitats on Dry Creek, and observations of constructed side channel evolution on other project sites.

Consideration	Relevant Failure Mode
Outlets should not be located in depositional zones (e.g., riffles)	Nuisance sedimentation
Moderate distance from the active channel at the upstream end, and/or	Nuisance sedimentation
Hydraulically rough zone between active channel and upstream end	Nuisance sedimentation
A robust control on channel grade should be located downstream of the outlet (e.g., riffle)	Abandonment by loss of hydraulic control.

Substantial volumes of large woody debris will be installed in the backwater habitats. These installations will be overtopped by the full range of flood flows. In order to remain in the demonstration reach over a prolonged period to continue to provide habitat value, the large woody debris must either be large enough that it cannot be transported by the stream, or be ballasted to prevent its mobilization. Because it is not realistic to supply the size of large woody debris that would be self-stable in the reach (i.e., old growth logs), the large woody debris installed in Dry Creek will be ballasted to emulate the stability characteristics of much larger logs. Large woody debris will be ballasted through a range of techniques which will include partial burial, and cabling to other logs, existing mature trees, timber piles, snags, and/or boulders. Typical sections and details are included on the drawings (Sheets 35 to 40 in Appendix A), though it will be necessary to conform these typical approaches to the specifics of each installation location in real time during construction.

Riffle Construction

Riffles are areas where the streambed is steeper and the current is swift. Riffles play a key role in controlling the elevation of the streambed and releasing the stream's energy so that the current flowing through adjoining pools is slower during the summer period. They are also important for food production. Riffle habitat was found to be relatively lacking during the 2009 habitat inventory, which leads to long flatwater and pool habitat units with swifter than desired velocities and that lack complexity (Inter-Fluve 2010). Riffle habitat is lacking because Dry Creek has evolved to a condition where it is very efficient at transporting the sediment that is supplied to the stream downstream of WSD (Inter-Fluve 2011).

Construction of riffles in the Demonstration Reach is proposed in seven locations to provide key grade control for constructed backwater habitats and to improve the quality of the adjoining pools for fish (Sheet 4 in Appendix A). The riffles are designed to backwater the adjacent upstream pool in the summer operational discharge range, which will flatten the water surface through the pool and lead to reduced stream velocity. Although the riffles will reduce stream velocity through the existing pools, the primary locations in these habitats where the target velocity criteria specified in the RRBO will be met will be in shelter habitats associated with large woody debris and along the channel margins.

Riffles are constructed with a well-mixed layer of small boulders, cobbles, gravel and sand across the stream, and will entail excavation of portions of the existing streambed to prepare suitable subgrade conditions. The seven riffles planned for construction fall into two groups based on the anticipated hydraulic stresses applied to them following construction. Two of the

riffles (stations 32+590 and 34+990) are located in relatively more confined locations upstream of grade breaks in the stream, and consequently are estimated to be subjected to higher shear stresses during floods than the other five locations. Therefore, two riffle substrate gradations have been designed, with Type A applied to the higher shear stress locations and Type B applied to the remaining locations (Table 5). Riffle construction will include measures to prevent flanking.

Table 5: Constructed riffle substrate gradations.

Riffle Substrate Type	**A**		**B**	
Riffle Locations	**32+590, 34+990**		**All other locations**	
% Passing	**Median Diameter (in)**		**Median Diameter (in)**	
Weight Basis	**Min**	**Max**	**Min**	**Max**
100	14	16	6	8
84	11	13	5	7
50	9	10	4	5
16	1.8	2.0	0.8	0.9
5	0.3	0.4	0.1	0.2

Pool Enhancement

Pools are deeper areas of the stream which in a healthy stream provide key habitat for young fish because currents are slow, the flow patterns are diverse, and fish can hide beneath logs that project into the water. Proposed pool enhancement in the Demonstration Reach will act to increase the complexity and diversity of habitat for young fish, and create areas that have sheltered currents that young fish prefer. This will be accomplished with selected grading of existing pool features and the installation of large woody debris along the pool margins. Additionally, as described above, pool velocities will be reduced due to riffle construction.

Many of the pool enhancement locations are in relatively confined stream segments or next to tall banks leading from the stream up to the vineyard grade. In these locations, the large woody debris installations will be constructed tight to the banks to limit potential for flanking around the installations and damaging the banks. These installations will be overtopped by the full range of flood flows. Similar to the description above for large woody debris in backwater habitats, large woody debris will be ballasted through a range of techniques to enhance its longevity in the reach. Typical sections and details are included on the drawings (Sheets 35 to 40 in Appendix A), though it will be necessary to conform these typical approaches to the specifics of each installation location in real time during construction.

Log Jams

A log jam is an accumulation of logs that may be constructed in an area where it would be beneficial to initiate or stabilize the planform of the channel. The log jam serves to anchor the planform by being an immobile object along the streambank, acting similar to a bridge abutment or a natural bedrock outcrop. Deep pools may form next to the log jams through the interaction of the logs and flowing water, creating excellent fish habitat. To create a log jam, the area is excavated and then logs are stacked and knit together with boulders and “snags” (emulating

trunks of dead trees that remain standing vertical to the horizon). This combination stabilizes the log jam during large floods.

Similar to the descriptions above for large woody debris in backwater and pool habitats, large woody debris in log jams will be ballasted through a range of techniques to enhance its longevity in the reach. Typical sections and details are included on the drawings (Sheets 37 to 39 in Appendix A), though it will be necessary to conform these typical approaches to the specifics of each installation location in real time during construction.

Streambank Construction

Streambank Construction is proposed in multiple locations for varying objectives. Based on these characteristics, streambank construction techniques are divided into four categories. These are described below:

- Type 1 Bank – This bank construction technique is planned in multiple locations throughout the reach (Sheets 19 to 21 in Appendix A). These locations are characterized by low shear stress, but bank side slope that is steeper than 3 horizontal to 1 vertical. The construction technique includes grading, surface preparation, seeding, installation of coir biodegradable fabrics, and planting with riparian species. This approach will guard against erosion from streamflow and rill erosion due to direct rainfall,
- Type 2 Bank – This bank construction technique is planned at one location in the demonstration reach (Stations 334+25 to 336+30; Sheet 19 in Appendix A) where the planform will be adjusted within the larger channel corridor. This is a deformable bank boundary construction approach that consists of two or more layers of fabric encapsulated soil (FES) lifts. This technique involves wrapping soil and gravel materials in a double layer of biodegradable coir fabric, with live cuttings placed between the FES lifts. Over time, the fabric will degrade and established vegetation will provide the primary strength to the streambank.
- Type 3 Bank - This technique is planned at one location (Stations 333+50 to 337+25; Sheets 19 in Appendix A) to limit the creek from migrating into a high terrace along the channel corridor margin. With this approach, eroding materials will be excavated and the streambank will be rebuilt with a combination of logs, boulders, cobbles and soil. The area is then planted with native riparian vegetation. This forms a less deformable streambank which still provides habitat value. Large woody debris and rootwads protrude from the bank at elevations that are underwater during the summer period, providing shelter locations along the bank.
- Type 4 Bank - This technique is planned at one location (Stations 360+00 to 365+75; Sheets 21 in Appendix A) to limit the creek from migrating into a high terrace along the channel corridor margin and to stabilize a high eroding bank. Similar to the Type 3 approach, the eroding materials will be excavated and the streambank will be rebuilt with a combination of logs, boulders, cobbles and soil. The area is then planted with native riparian vegetation. The base of the streambank will be rebuilt using a log crib technique up to an elevation that matches the overbank elevation on the opposite side of the stream. The upper part of the streambank will be rebuilt with FES lifts as described for Type 2 Bank above. Native plants are seeded and planted in the upper bank. Large woody debris and rootwads protrude from the bank at elevations that are underwater during the summer period, providing shelter locations along the bank.

Riparian Vegetation Management

In general, the vegetation within the project area does not display the range of different successional classes indicative of a dynamic, properly functioning riparian system. Plant communities within intact riparian systems typically consist of a variety of vegetation communities that represent a range of different age classes and structural types. This pattern is largely a function of active floodplain evolution which is currently suppressed in the project reach.

Although there are small swaths of emergent wetland and shrub/scrub habitats within the project reach, the majority of the riparian community is comprised of mixed hardwood forest with differing levels of canopy closure and understory diversity. These hardwood forests are interspersed with areas that have been heavily impacted by human disturbance and are dominated by invasive species. Invasive species are found throughout the project area in varying densities. Dominant invasive species include Himalayan blackberry, English Ivy, thistle, periwinkle, and domestic grapes. Invasive densities range from small patches of individual species to large swaths of riparian area dominated solely by a single invasive species, typically Himalayan blackberry.

In order to increase plant species diversity, structural complexity, and overall habitat values, the riparian vegetation management plan will include the suppression and eradication of invasive species and planting of native vegetation. The area planned for riparian vegetation management is shown on Sheets 41 to 44 in Appendix A. A preliminary palette of native plants to be used in revegetation activities has been developed in consultation with the Sonoma County Stream Maintenance Program Manual (Horizon Water and Environment 2009), and is included on Sheet 45 in Appendix A.

When practicable, the proposed backwater habitats have been designed to support a wide range of plant species that vary along an elevation and hydrologic regime gradient. The goal for these areas is to maximize plant species diversity and provide vegetation and habitat types that are currently lacking in the project reach. The backwatered areas will support a vegetation gradient that transitions from emergent wetland aquatics and herbaceous wetland plants to a shrub/scrub plant community that will vegetate the interface between the wet and dry areas. The upper drier slopes will be planted with species that will mature into a multi-tiered, open canopy riparian forest.

Invasive species control methods will be further refined as the design progresses. The primary treatment focus will likely be restoration of areas that are so dominated by invasive species that almost all native species have been displaced and will not be able to re-colonize within the near future unless remedial actions are taken. Himalayan blackberry is the primary species responsible for this condition. In these areas, intensive chemical and mechanical land clearing treatments will be undertaken prior to the installation of a native plant community. Plant community types to be installed within these areas will depend on the existing communities adjacent to the treatment areas. A secondary, more labor intensive strategy will be the selected removal of invasive species from the understory. This type of invasive control is often more labor intensive due to hand removal methods that must be used in order to prevent damage to existing native plants.

Irrigation has been proven to increase the survival rates of newly planted vegetation and increase project success. The most cost effective method to irrigate enhancement areas is the installation of a temporary, above-ground irrigation system in locations where these provisions are unlikely to be destroyed by flood flows. These systems consist of PVC pipe laid in a grid throughout the enhancement area with simple impact sprinklers mounted on 3'-4' high risers. These systems can run on battery operated solenoid timers when plugged into an existing pressurized water source or from a single pump for well or direct withdrawal from surface waters. Alternate methods may be required in locations with frequent, swift overbank flows. Plants would be watered a total of 1" per week, preferably in a single watering depending on slope and soil characteristics. Irrigation would occur between the months of June and September for the first two years following plant installation.

8.2 Hydraulics of the 60% Complete Enhancement Design

The existing conditions HEC-RAS model (Section 6) was modified to simulate the future hydraulic conditions in the enhanced channel based on the 60% complete design. The 'design' hydraulic model was utilized to provide input into the preliminary design of stream channel bed and bank designs, to estimate the increased area of rearing habitat, and for assessment of the impact of the project on flood water surface profile elevations through the project reach. As with the existing conditions model, water surface profiles and inundation maps were produced for selected flows for the proposed enhancement design. It should be noted that the model results reported below are based on the 60% complete design. Predicted hydraulic conditions can be expected to be revised with ongoing design development in the coming months.

Figure 19 compares the predicted water surface profiles for selected flows for both existing and proposed conditions. At 105 and 175 cfs, the addition of rifles to the reach appears to achieve the goal of flattening the water surface (thereby reducing velocities) in the reach immediately upstream. Flood water surface profiles are similar between existing and proposed conditions, though slight increases are predicted in select locations, primarily in areas adjacent to proposed riffle construction. For the 100-year return period flood, increases in the water surface profile range from 0 to 1.0 feet, though the flood waters are still predicted to be contained in the creek corridor and within the project footprint. Though the design will be refined further in the coming months, Sonoma County requirements for documentation of predicted increases in the FEMA base flood profile should be reviewed at this time.

Simulated channel shear stresses through the project reach range from 0.2 to 2.0 lb/ft^2 at the 2-year return period flood discharge and from 0.3 to 2.9 lb/ft^2 at the 100-year discharge. The highest predicted values of shear stress are in the area of Lambert Bridge, where the flow is constricted and the channel bed drops over a bedrock outcrop. In general, predicted shear stresses are lower for the proposed case than the existing case, except in the vicinity of the proposed riffles, where increases are predicted.

Simulated flood inundation based on the proposed design are shown (Figures 20 to 25) to illustrate the effect of the project on the spatial pattern of surface water connection in Dry Creek following implementation. As compared to existing conditions, the area of inundation increases substantially at low to moderate discharge events (105 cfs up to the 2-year event), but is comparable at and above the 10-year flood event.

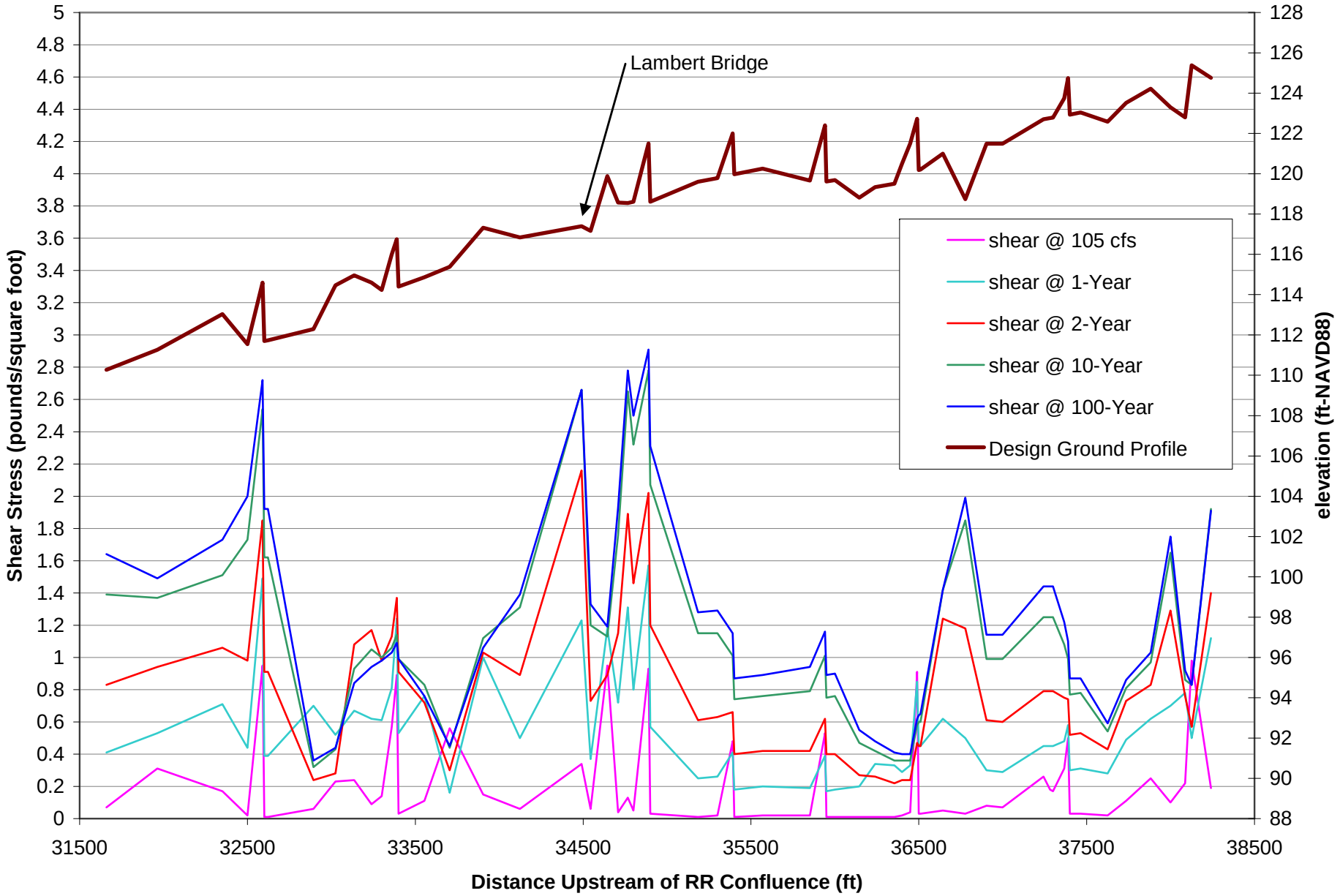


Figure 18. Simulated shear stress values associated with the proposed design for the Demonstration Reach.

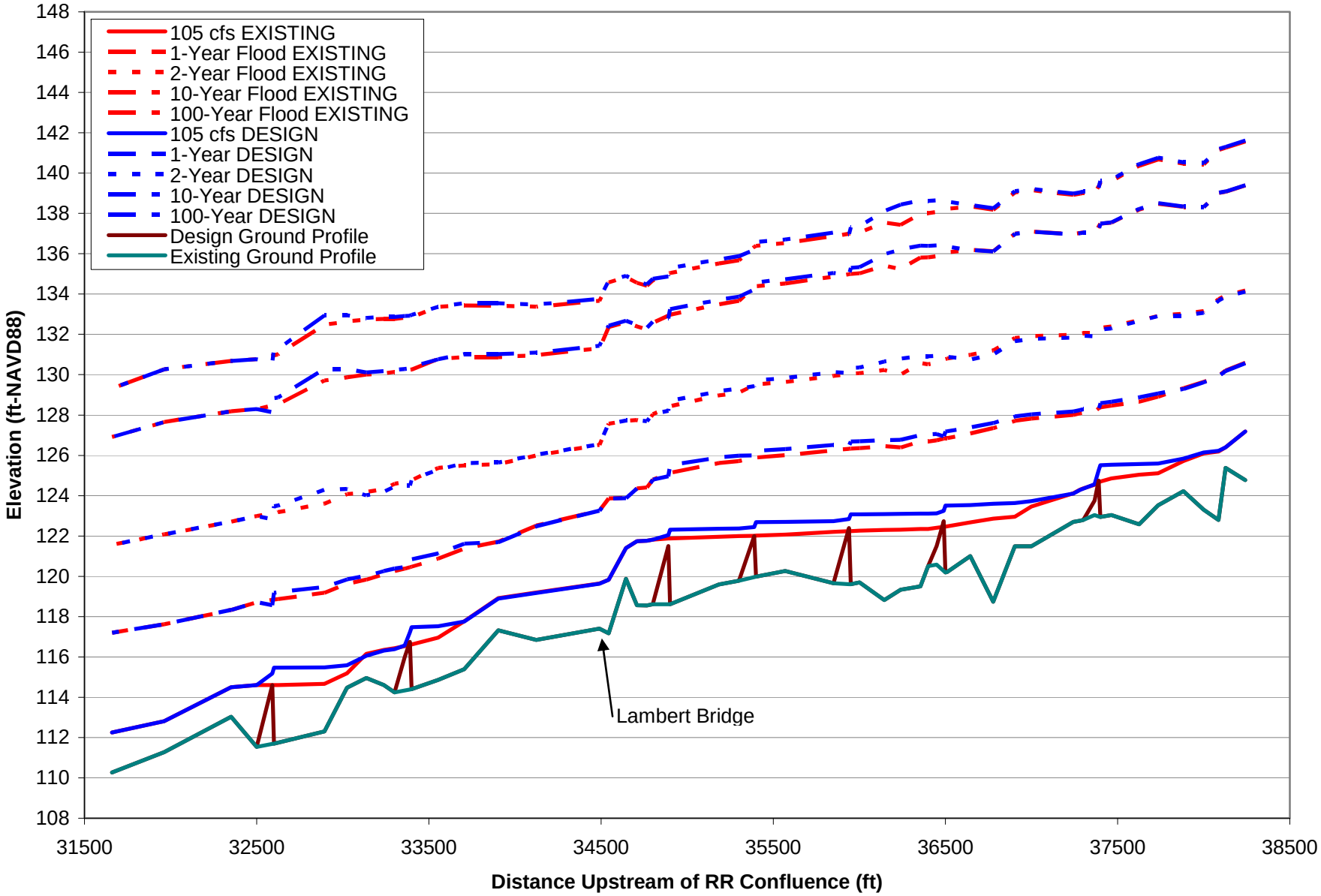


Figure 19. Simulated flood water surface profiles for existing conditions (red) and proposed conditions (blue) associated with the proposed design for the Demonstration Reach.

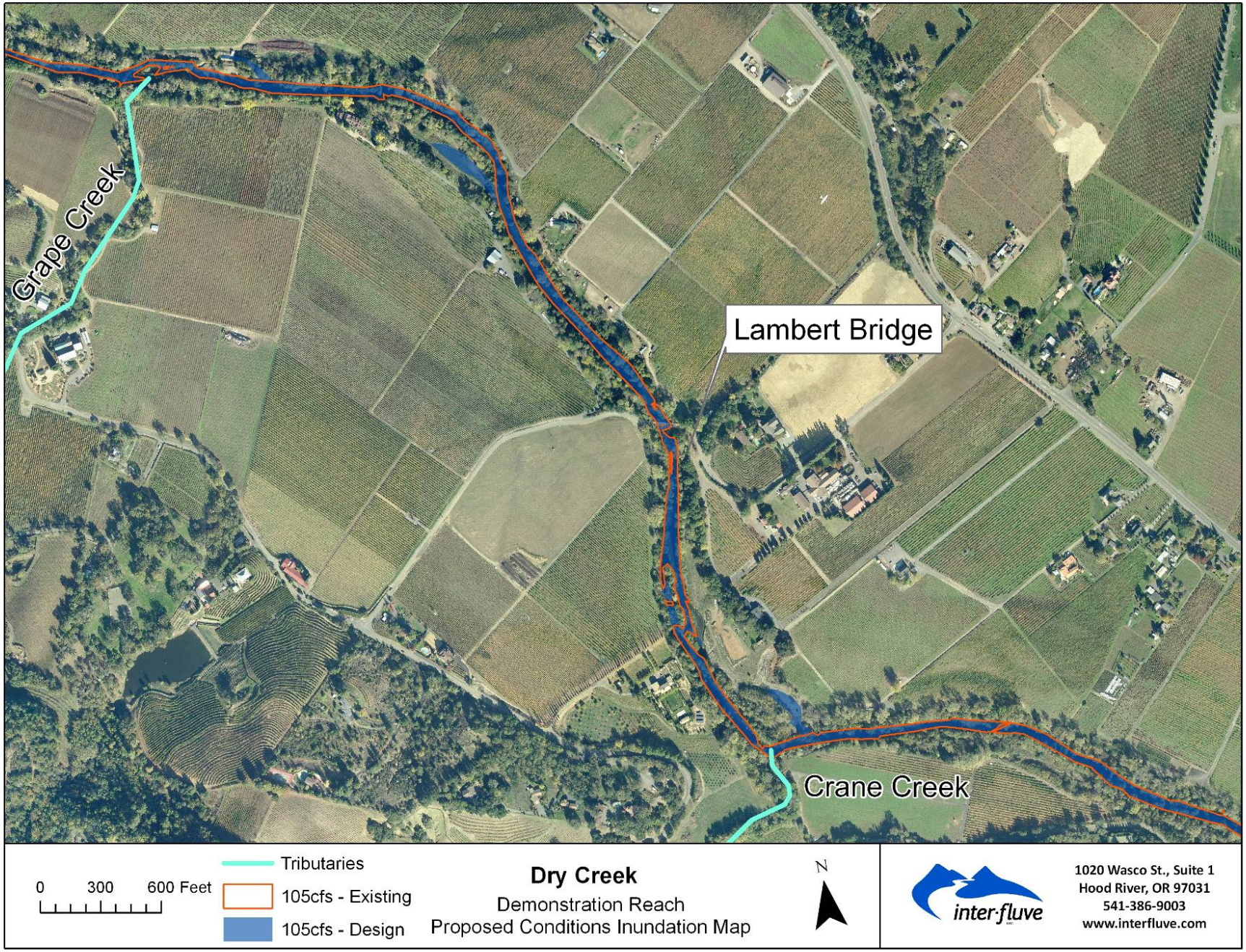


Figure 20. Inundation map based on design conditions at 105 cfs.

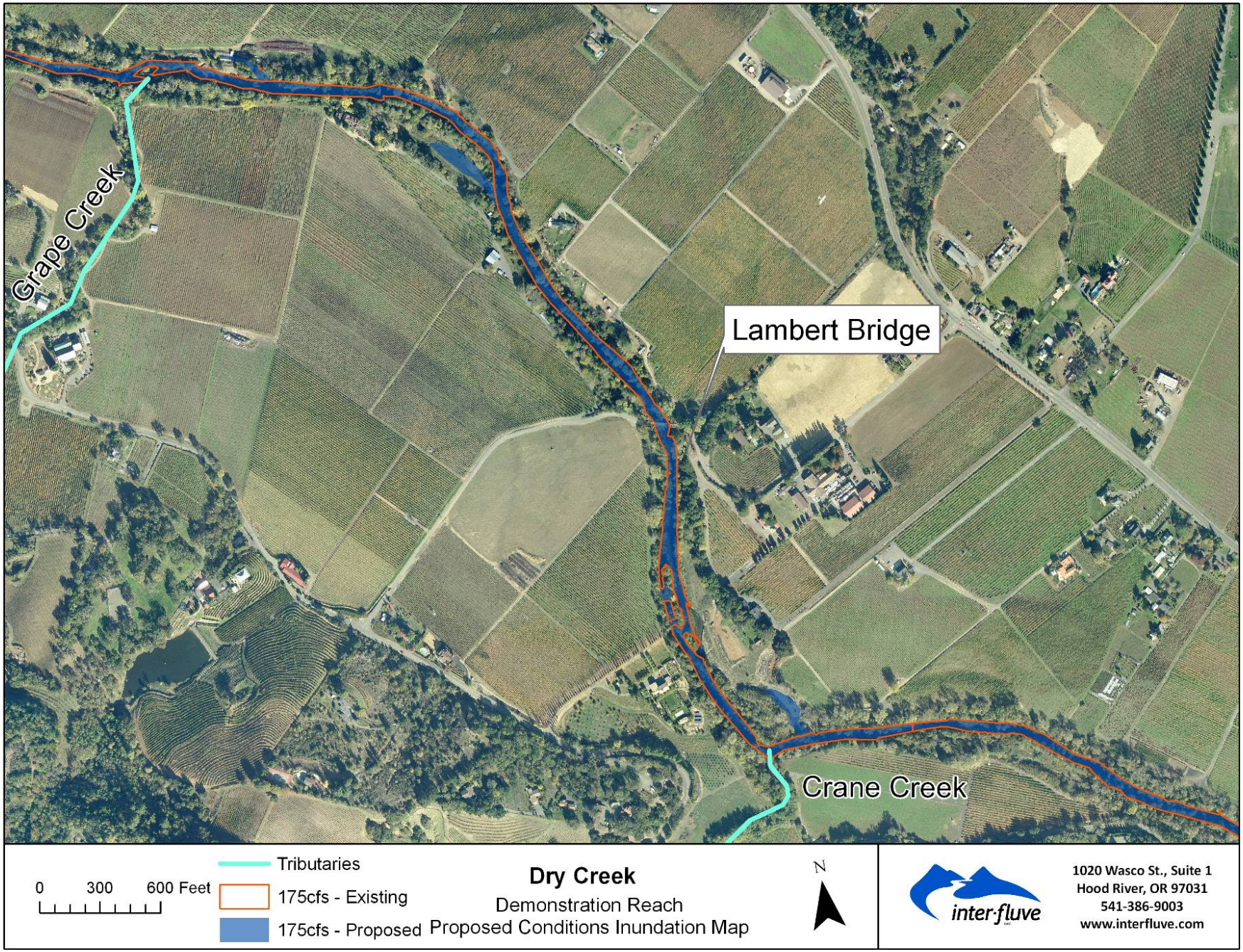


Figure 21. Inundation map based on design conditions at 175 cfs.

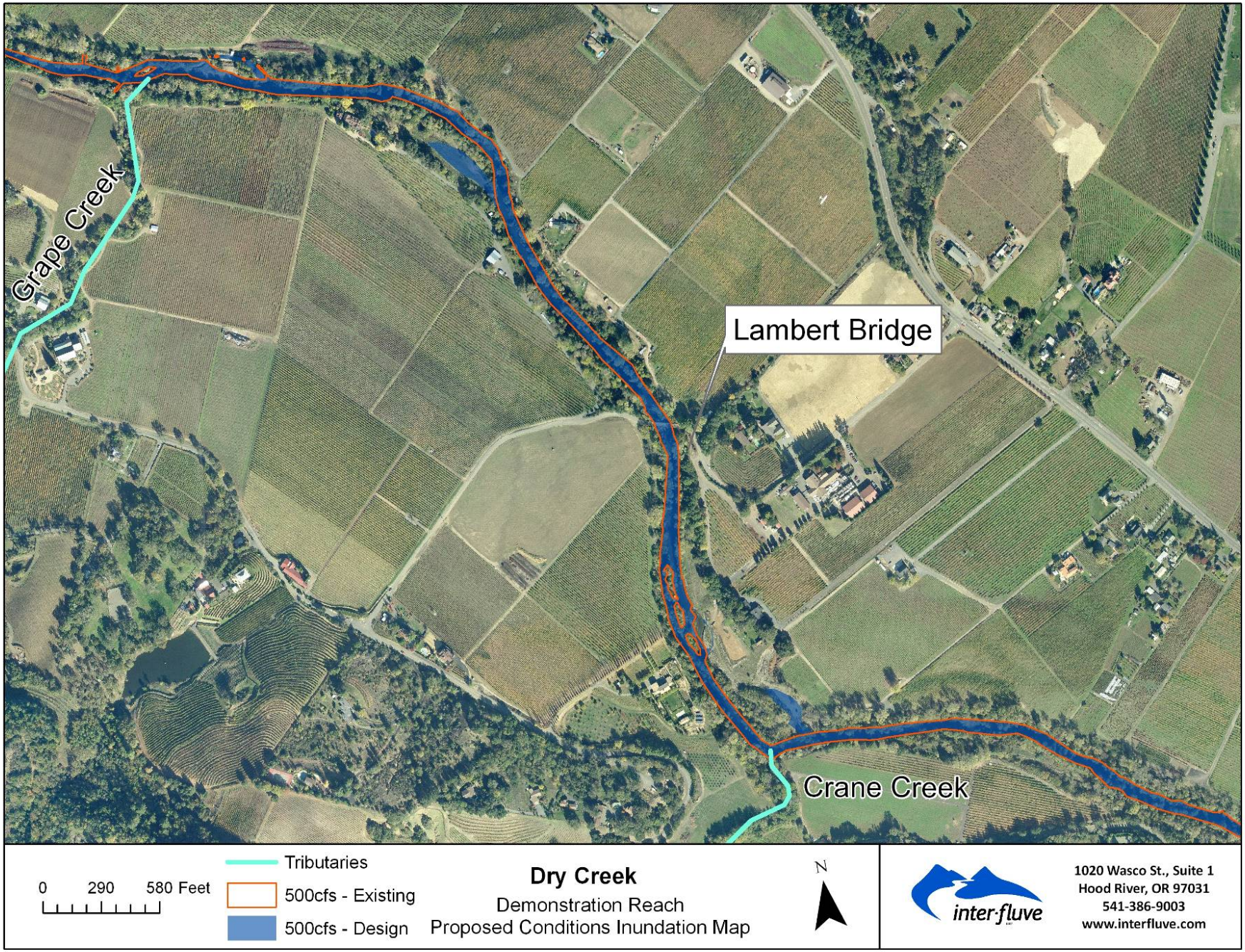


Figure 22. Inundation map based on design conditions at 500 cfs.

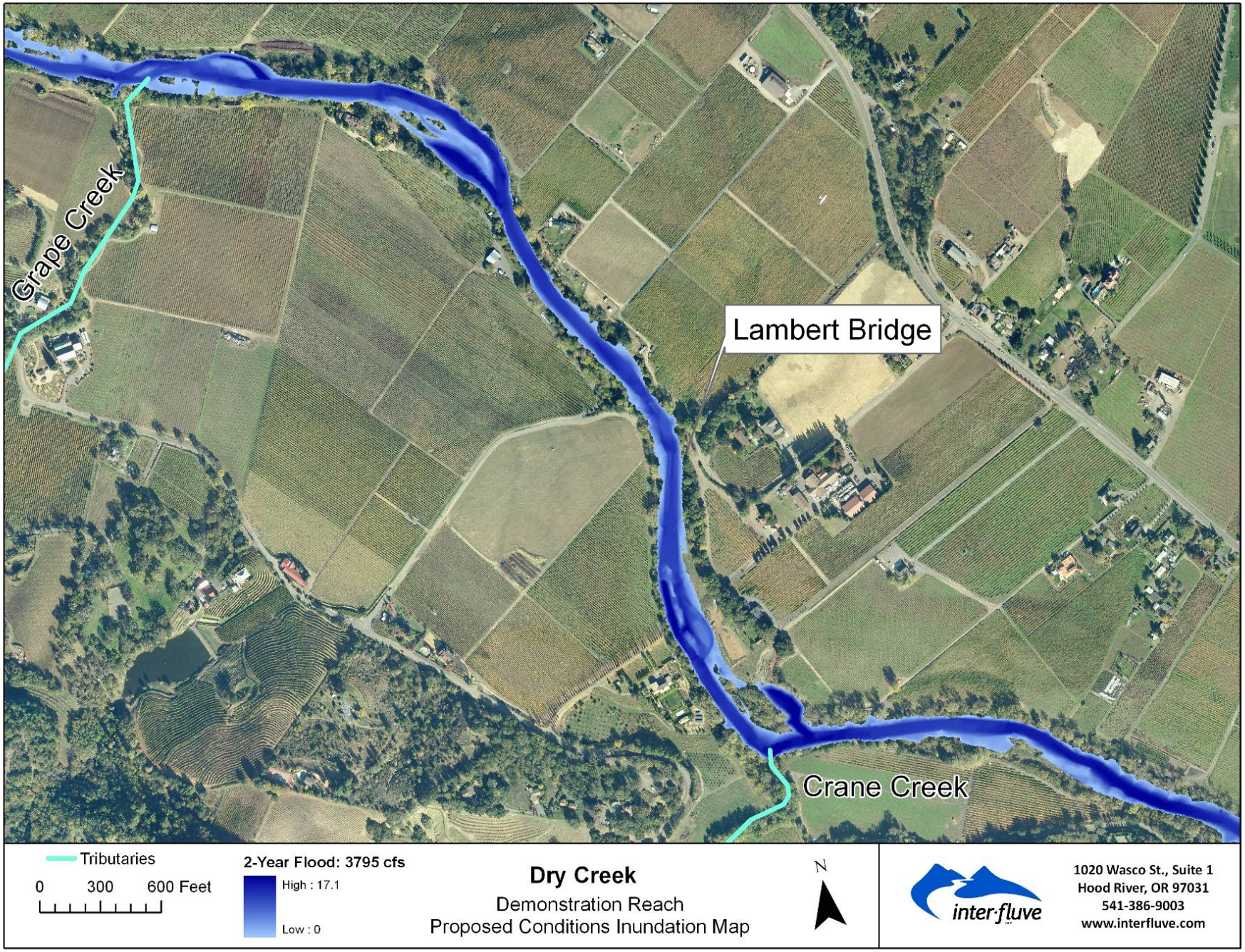


Figure 23. Inundation map based on design conditions for 2-year return period flood (3795 cfs).

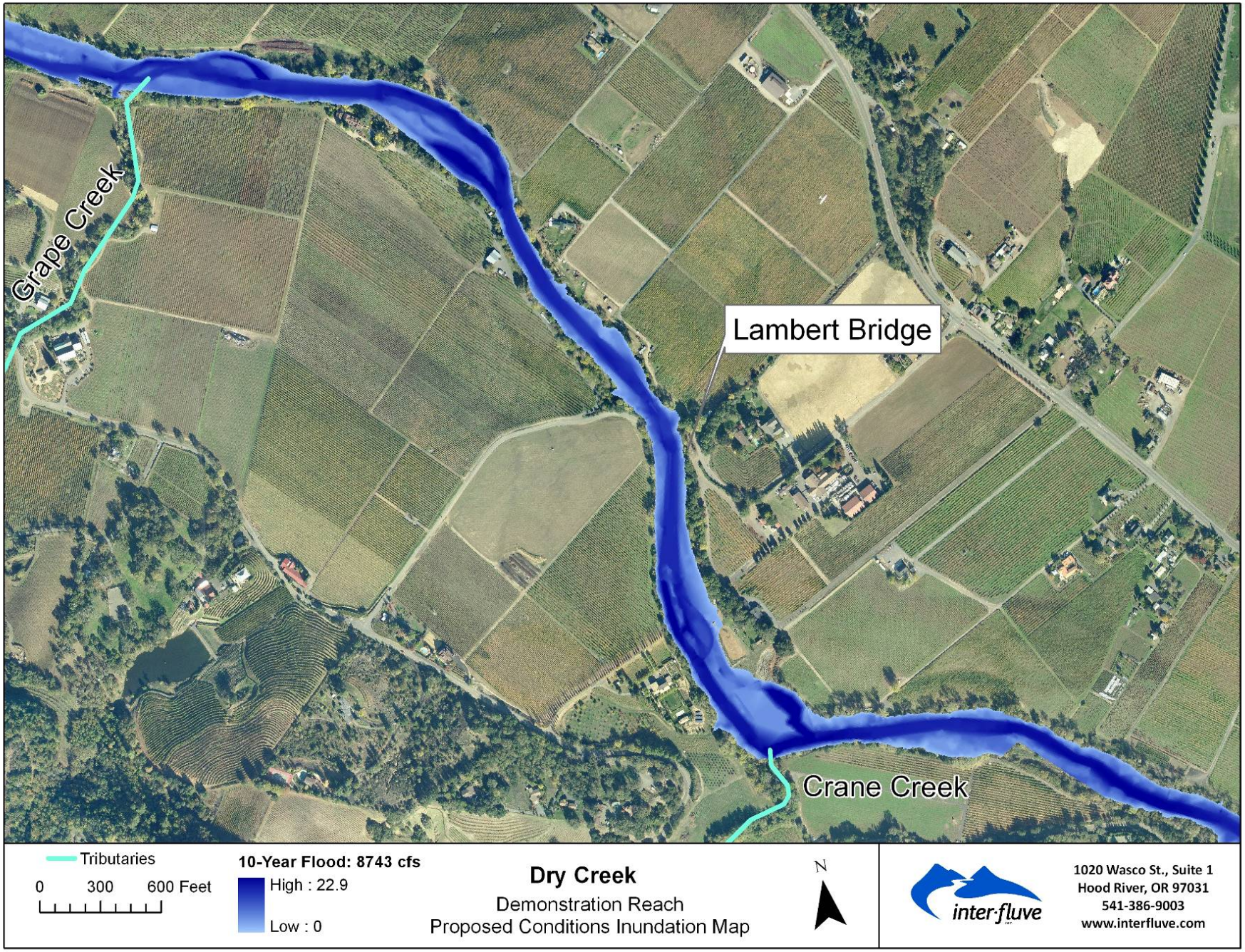


Figure 24. Inundation map based on design conditions for 10-year return period flood (8743 cfs).

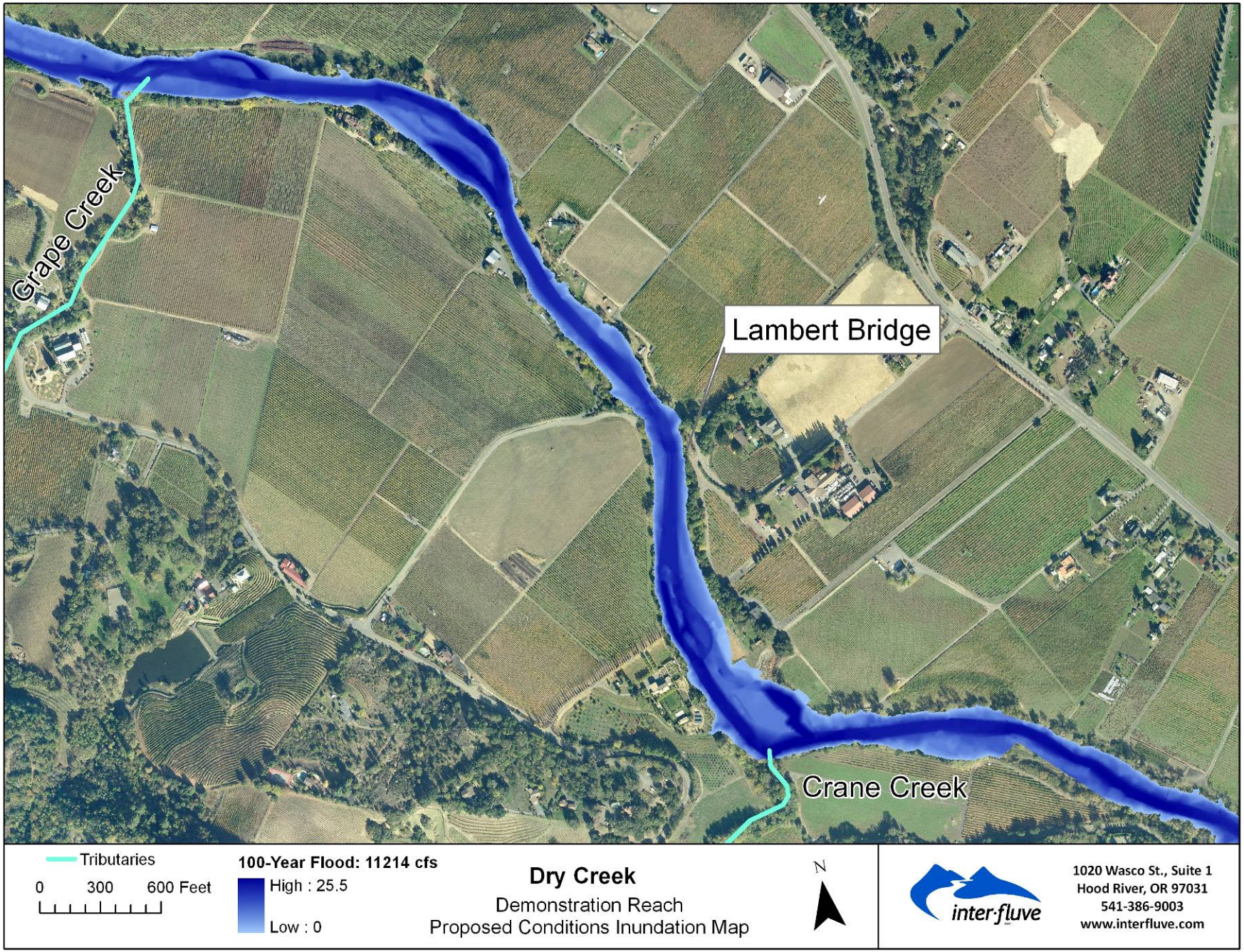


Figure 25. Inundation map based on design conditions for 100-year return period flood (11214 cfs).

9 ESTIMATED FUTURE HABITAT COMPOSITION AND ADDITIONAL REARING HABITAT

Included is a comparison of current and proposed stream habitat units for the Dry Creek Habitat Enhancement Demonstration Project. The baseline data source for this comparative assessment is the Summer 2009 habitat survey, which has been described in detail in the Draft Dry Creek Current Conditions Report (March 2010). The proposed habitat unit distribution is compiled from changes to stream features as provided in the 60% demonstration reach design. In addition, an analysis was performed to predict the additional potential juvenile coho rearing habitat resulting from the project. Figures 26-27 reflect habitat distribution by area and Figures 28-29 reflect habitat distribution by frequency, respectively. Figure 30a-b shows the spatial distribution of habitat units for existing and proposed conditions, while Table 6 summarizes habitat area by unit type for existing and proposed conditions.

The preliminary estimate of additional coho rearing habitat provided by the improvements to habitat outlined in the 60% design was calculated based on the area of proposed alcoves and also anticipated velocity refuge provided by large woody debris (LWD) placements. LWD placements will typically extend 2 to 4 feet into the channel (3 feet on average), with some protruding further and others flush with the bank. As a means of estimating this influence on increased juvenile coho rearing habitat area, we have assumed that the LWD features will provide a band of velocity refuge 3 feet wide over the length of the LWD placement. Adding together the area of created alcove with the area of LWD velocity refuge, our estimate results in an increase in potential coho rearing habitat of 84,406 ft^2 (7842 m^2, or 1.94 acres; Table 7). The spatial distribution of this additional coho rearing habitat is shown in Figure 30c. It should be noted that additional LWD placements are not included in the 60% design downstream of Lambert Bridge as a component of habitat enhancement, as existing margin and pool habitat was assessed to be sufficient. No instream improvements are currently proposed here except for the riffle construction depicted in Figures 30a and 30b.

It should also be noted that for this preliminary estimate of additional coho rearing area, we have elected to limit the estimate of additional rearing habitat to those areas with high predictability, i.e., area associated with alcoves and LWD placements only. Since the usability of the incremental pool margin areas is difficult to predict at the current stage of design development, (our modeling suggests that average pool velocity may be reduced by up to half) we have elected to not include them in the current analysis. For these reasons, the current preliminary estimate should be considered conservative. Additionally, the predicted composition of habitat units and additional rearing area may change with future design development and as feedback from stakeholders (such as landowners) is incorporated.

Table 6: Habitat area by unit type for existing and proposed conditions.

	Existing Habitat		Proposed Habitat	
	Area (ft^2)	**#**	**Area (ft^2)**	**#**
Alcove	7969	6	67047	9
Cascade	6552	1	6552	1
Flatwater	62044	10	44082	8
Pool	211622	9	184956	13
Riffle	30075	6	65500	12

Table 7. Additional coho rearing habitat provided by new alcoves and LWD placements.

Habitat Type	**(ft^2)**	**(m^2)**
Alcove	63118	5864
LWD-Margin Habitat	21288	1978
Total	**84406**	**7842**

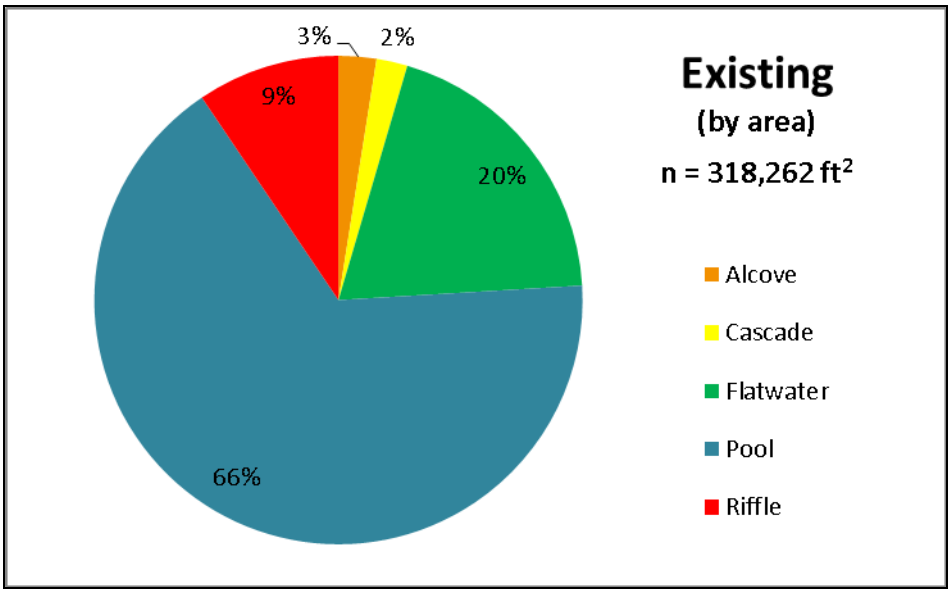


Figure 26. Existing habitat units in the Demonstration Reach, by area.

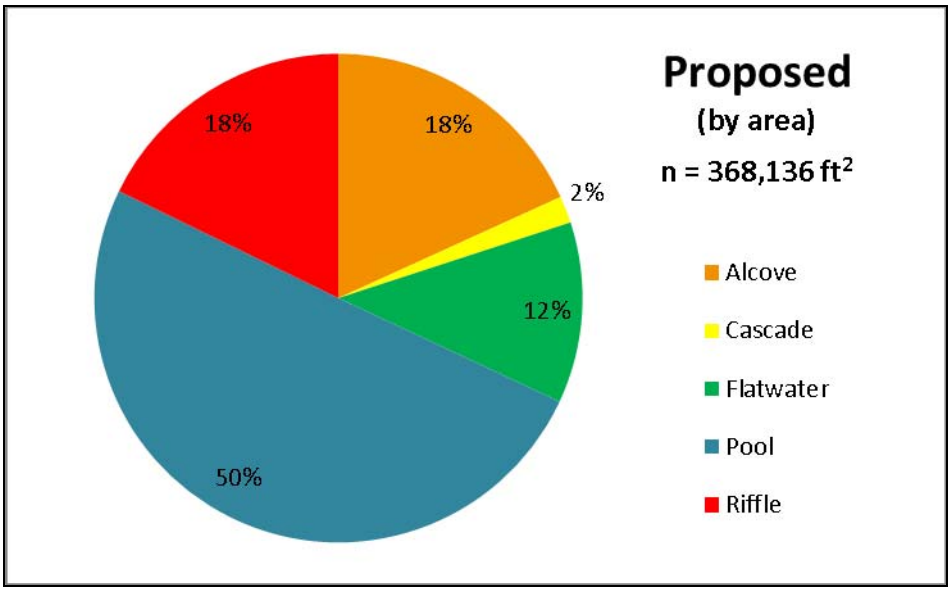


Figure 27. Future habitat units in the Demonstration Reach based on the 60% design, by area.

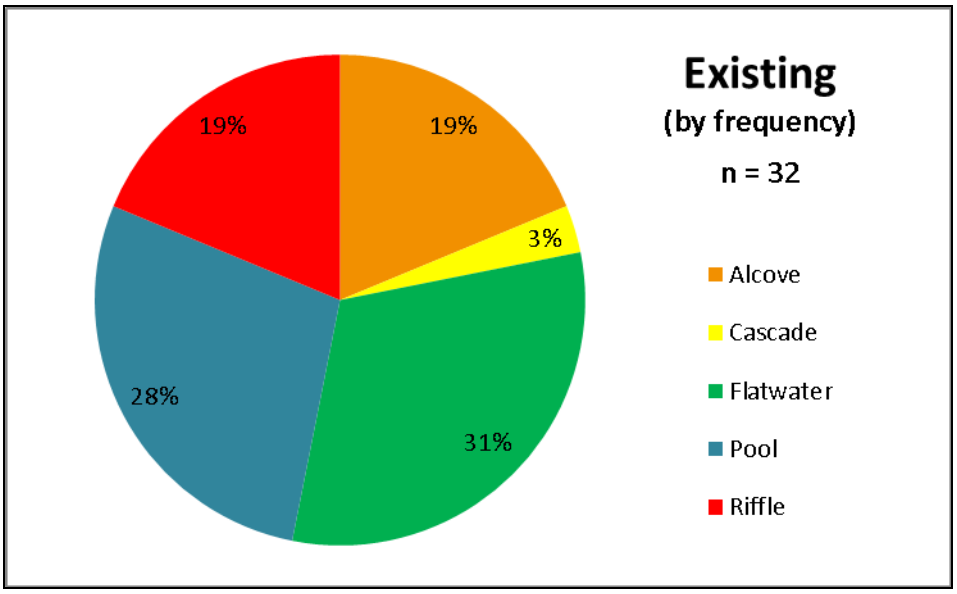


Figure 28. Existing habitat units in the Demonstration Reach, by frequency.

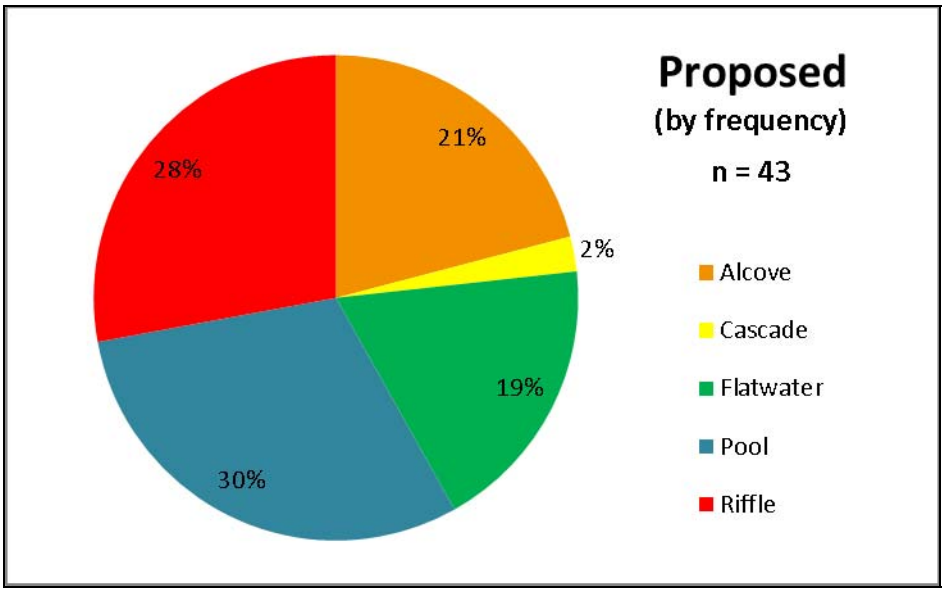


Figure 29. Future habitat units in the Demonstration Reach based on the 60% design, by frequency.

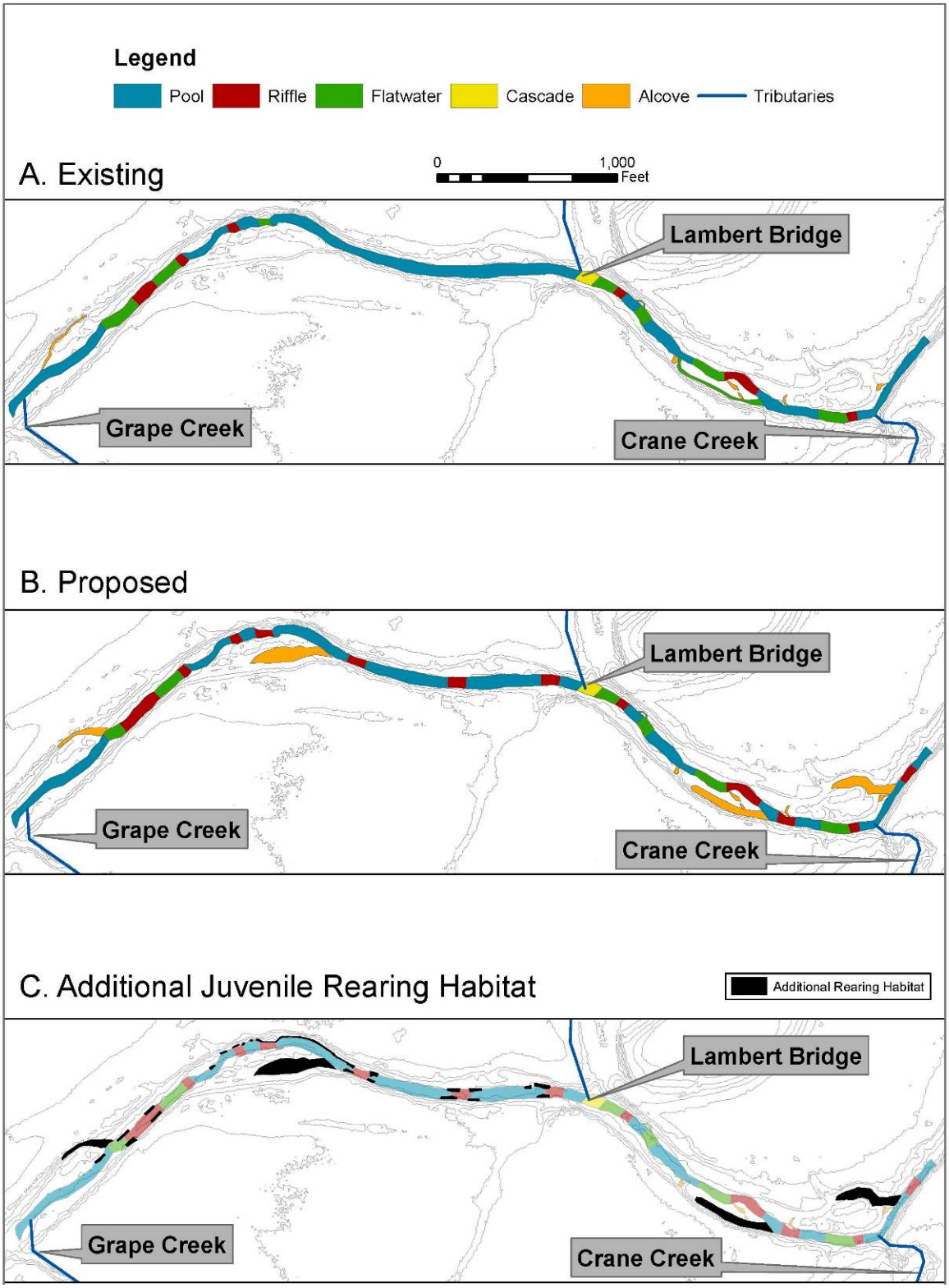


Figure 30. Existing (a) and proposed (b) spatial distribution of habitat units for the Dry Creek Demonstration Reach. Additional juvenile rearing habitat is shown in (c), associated with LWD placement, LWD protruding from bank stabilization, and new alcove habitats.

10 DEMONSTRATION PROJECT CONSTRUCTION CONSIDERATIONS

The nature of land use and infrastructure constraints in the Demonstration Reach present logistical challenges for constructing the enhancements, discussed below.

10.1 Access and Staging

The narrow, incised creek corridor and proximity to vineyard operations limit available access corridors and staging areas. Proposed alignments of ingress/egress, access corridors and staging areas are shown on the 60% complete drawings. These proposed corridors will need to be reviewed by the Agency and the landowners to verify consistency with vineyard operations. In select locations, it may be necessary to clear vegetation and grade access ramps down to the stream corridor in order to construct the work. These areas will need to be restored following construction.

10.2 Timing and Duration of Construction

The in-water work period for Dry Creek is typically June 15 to October 15. If necessary, this period could be potentially extended for two weeks on either end, dependent on year and circumstances of the work. In order to maximize the available construction window within the in-water work period, mobilization and site preparation efforts may commence around or before June 1. Following review of the 60% complete design, it will be necessary to identify whether there are periods between May and October during which construction work would adversely impact vineyard operations, such as the autumn crush period. If necessary, the available work window will be further constrained to accommodate vineyard operations. The anticipated total duration of construction ranges from 3 to 4 months, but could be shortened through mobilization of multiple work crews and expanded working hours (see below).

10.3 Stream Diversion and Dewatering

The steady state operational discharge maintained by the Water Agency during the allowable in-water work period is typically 105 cfs but may be as high as 140 cfs for multiple periods of several days if the work is constructed during a dry hydrologic year.. In order to satisfactorily construct the enhancements and prevent excessive turbidity to the active flowing stream, it will be necessary to divert the stream around active work zones and dewater active work areas. Based on test pit sampling conducted as part of the geotechnical subsurface exploration program (Appendix B), the subsurface materials become compromised quickly during excavation under water, leading to caving of excavation zones and limited control on excavation precision.

105 to 140 cfs is a substantial volume of water to divert in a stream with the physical characteristics such as Dry Creek, including relatively narrow and deeply incised stream corridor, high value adjacent land use and a primary traffic corridor (Lambert Bridge Road) bisecting the work zone. Stream diversion options include gravity-driven and pumped systems. Two alternative approaches have been developed for consideration and discussion with regulatory entities, and are reflected in the drawings (Appendix A). Additionally, alternate

project cost opinions based on utilization of each of these alternatives are included in Section 11 below.

Following review of these alternatives, the preferred general approach will be selected and reflected in the construction drawings, though it will presented as a non-binding approach. Ultimately, the construction contractor will be responsible for final design and implementation of stream diversion and dewatering, constrained by the requirements set forth by the project permits and other limitations described in the project construction specifications. The construction contractor will submit their design for diversion and dewatering for review and concurrence by the Project Engineer. The two alternative approaches are described below:

Pumped Diversion Alternative (Sheets 8 to 10 in Appendix A)

A pumped diversion system provides the benefits of moving the water out of the creek corridor, and maximizes the available work space in the corridor, which will facilitate efficient and competent completion of the work, including concurrent completion of work at multiple sites within the reach. Due to the logistics of installing a pumped system to convey 105-140 cfs, it is most practical to bypass the entire project reach with a single system.

The preliminary design of the system includes six to eight 250 horsepower electric pumps, conveying bypass flows through four to five 24-inch discharge lines running in parallel. A preliminary alignment for the temporary bypass system is shown in the plans on the east side of the creek. The discharge lines would be typically placed on the existing ground surface, but the alignment will require the discharge lines to be either temporarily trenched through Lambert Bridge Road, or passed beneath the east end of Lambert Bridge. A variation on the potential alignment is shown on the Rued property. The feasibility of these alternate routes will need to be verified with the landowner.

Electric pumps may be more economical in terms of energy costs and rental fees than diesel pumps, and may provide a quieter environment while the work is being constructed. To power an electrical system, a temporary extension of the existing electrical system in the area would be considered. Alternatively, power could be supplied by diesel generator sets equipped with sound muffling equipment.

The primary limitations to the pumped diversion alternative include high cost, potential interaction with vineyard operations at select locations, relatively inflexibility once installed, substantial fish relocation effort, and temporary impacts to biota associated with drying up the entire project reach over the complete project construction period.

Gravity Diversion Alternative (Sheets 11 to 14 in Appendix A)

The gravity diversion alternative provides a more surgical approach to stream diversion. Due to the high transmissivity of the alluvium that comprises the substrate materials in Dry Creek, a gravity-driven system will require containing the flow in either pipes or a lined open bypass channel, supplemented with well points to draw down the local water table in excavation zones. Either piped or open-channel gravity systems require space within the channel corridor to convey the bypass flows, which is only available in a subset of the project reach.

This alternative includes two separate gravity diversion zones, each approximately 1300 feet in length. The first (Sheet 12) would enable sequenced construction of off-channel enhancement areas A and B, in addition to the associated riffles, bank construction and log jams in this zone. The second bypass zone (Sheet 13) would enable construction of off channel enhancement area C, the Type 4 Bank, and associated riffles and log jams. These gravity bypass systems would be supplemented with a network of well points used at critical sequencing junctures to complete the work. The remainder of the work included in the demonstration reach would be constructed using a variety of local coffer dam, well point and other dewatering approaches (Sheets 12 to 14 in Appendix A).

Because this alternative relies more heavily on local dewatering from well points and open excavations, it will be necessary to handle substantial volumes of water to ensure that water is not discharged back to Dry Creek in a sediment-laden condition, and within acceptable water quality standards. Water pumped from the subsurface from well points should be clean once the well points are in place because it is the same water as is flowing down Dry Creek. However, some minimal treatment may be necessary including running the water through sedimentation facilities (Baker tanks, filter bags, or settling basins) and periodic testing of water quality. This will require space in order to be accomplished. In addition to small areas within the creek corridor itself, currently fallow vineyard lands on the Seghesio, Dry Creek Vineyard, and Farrow properties may provide opportunities to handle this water.

The primary benefits associated with the gravity diversion relative to the pumped diversion include lower cost, greater flexibility in sequencing work between different areas of the project reach, reduced fish relocation requirements, reduced impact to areas not being enhanced by the project, and limited interaction with vineyard operations. The primary drawbacks to this approach include increased need to work in the active flowing stream while the system is installed in each location, more day to day management of the system, greater complexity, greater need to manage local dewatering outflow, and more disturbance of non-enahacement areas and areas within the enhancement zones which will require reconstruction to a condition at least as sound as the pre-project condition.

10.4 Shoring of Excavations

Based on the results of the subsurface geotechnical exploration (Appendix B), it is estimated that excavation shoring may be required along select portions of the excavation required to construct the Type 4 Bank (Stations 360+00 to 365+75) in order to avoid impacting the adjacent vineyard rows. Shoring is not anticipated to be required for other enhancement areas.Determination of the need for, design of and installation of shoring measures will ultimately be the responsibility of the construction contractor through a performance-based specification.

10.5 Interaction with Existing Features

The design endeavors to avoid interactions with existing features to the extent possible. However, iteractions were unavoidable in select locations. At the Type 4 Bank Construction (Stations 360+00 to 365+75), a fenced horse paddock and a fenced sheep pen are within the limits of the construction footprint as currently drawn at the upstream and downstream ends,

respectively. Additionally, the vineyard road adjacent to the the streambank at this location is within the construction footprint. These features will need to be modified to complete the work, but can be replaced following construction.

In addition, a pump intake and a storm drain outflow fall within the construction footprint at off-channel enhancement areas A (Sheet 19 in Appendix A) and D (Sheet 22 in Appendix A), respectively. It is proposed that these features will be modified at the time of construction. For the pump intake, it is proposed to convert the surface intake to a subsurface Ranney collector-type intake buried in the streambed. At the storm drain outfall, measures will be installed to limit potential for underming and dissipate enrgey from the outfall.

10.6 Right-of-Way Considerations

For purposes of determining limits for right-of-way determinations, in areas where off-channel enhancement is planned, it is recommended to include the full width of the channel corridor in order to anticipate potential future channel adjustments. For isolated riffles and logs jams enhancement, a margin of 50 feet upstream and downstream and 20 feet on each side of the planned enhancements is recommended. It should be noted that the locations of enhancement features may be adjusted to fit field conditions at the time of construction, thus flexibility in determining final right-of-way boundaries is recommended is this can be accommodated within necessary protocol.

10.7 Fish Screening and Relocation

If selected, a pumped diversion system will require screening to prevent aquatic life from entering the system. It is anticipated that a large perimeter screen will enclose the pump intake zone to allow approach water velocities to be within criteria established by the National Marine Fisheries Service. Screen mesh will meet established criteria.

Once the stream diversion commences in each work zone, it will be necessary to relocate aquatic life from the project reach to adjacent reaches, in particular ESA-listed salmonids. Fish relocation will require a significant effort, accomplished through a combination of methods using nets and electrofishing techniques.

10.8 Working Hours

The Water Agency and landowners may wish to consider extended working hours to maximize the daily rate of production, to minimize the overall duration of construction and project cost. If feasible, expanded working hours that allow two shifts per day during the extended summer daylight hours will reduce overall project cost and impact. The available working hours are also likely to be constrained by local ordinances.

11 Opinions of Probable Construction Costs

Two alternate Opinions of Probable Construction Costs (OPC) based on the 60% complete design are found in Table 8a-b below. The first OPC (Table 8a) assumes pumped diversion of the stream around the full project reach. The second OPC (Table 8b) assumes gravity diversion and the site specific approaches discusses above. The cost opinions have been developed based on review of construction costs for similar items in past projects, consultation with construction contractors and material suppliers, and applicable reference cost data. The actual cost of implementation of the project may vary from the cost opinions due to heavy construction market and other unforeseen factors. To account in part for this, a 15% construction cost contingency has been included in the cost opinions.

Table 8a. Engineer's Opinion of Probable Construction Costs - 60% Complete Submittal. Alternative A. Pumped Diversion

No.	Bid Item	Unit	Unit Price	Quantity	Subtotal	design and quantity assumptions
General - Project Initiation						
1	Mobilization	LS	$336,361	1	$336,361	5% of Items 2-20
2	Temporary Access Road Improvements	LS	$100,000	1	$100,000	Temporary ditch crossings, misc road upgrades
3	Temporary Traffic Control & Flagging	LS	$75,000	1	$75,000	misc
4	Dust Control	LS	$100,000	1	$100,000	16 weeks x 5 days x 8 hours x $150
Erosion Prevention, Environmental Protection and Sediment Control						
5	Fish Relocation	LS	$20,000	1	$20,000	Placeholder estimate
6	Stream Diversion					100 cfs system - six electric/diesel pumps, 4 24" HDPE discharge lines, 3 diesel backup
a.	fixed startup and teardown costs	LS	$800,000	1	$800,000	freight, assembly, power delivery improvements, diversion dam
b.	monthly cost	EA	$380,000	3	$1,140,000	equipment rental, power
7	Dewatering	LS	$50,000	1	$50,000	local dewatering
8	Erosion Control BMPs	LS	$200,000	1	$200,000	placeholder estimate
Earthwork						
9	Clearing and Grubbing	LS	$25,000	1	$25,000	limited
10	Common Excavation					
a.	Off Channel Area A: Wallace-Farrow	CY	$20	12,000	$240,000	Based on 041511 volume estimate
b.	Off Channel Area B: Wallace-Lipton	CY	$20	1,600	$32,000	Based on 041511 volume estimate
c.	Off Channel Area C: Van Alyea	CY	$20	11,500	$230,000	Based on 041511 volume estimate
d.	Off Channel Area D: Seghesio	CY	$20	1,500	$30,000	Based on 041511 volume estimate
Large Woody Debris Installation						
11	Floodplain Roughness Logs					
a.	logs	EA	$1,000	72	$72,000	furnish and install
b.	logs with rootwads	EA	$1,500	48	$72,000	furnish and install
c.	boulders	TN	$100	120	$12,000	estimate 1 ton per log
12	Backwater Habitat Logs					
a.	logs	EA	$1,000	117	$117,000	furnish and install
b.	logs with rootwads	EA	$1,500	78	$117,000	furnish and install
c.	boulders	TN	$100	195	$19,500	estimate 1 ton per log
12	Pool Enhancment Logs					
a.	logs	EA	$1,000	71	$71,000	furnish and install
b.	logs with rootwads	EA	$1,500	46	$69,000	furnish and install
c.	boulders	TN	$100	117	$11,700	estimate 1 ton per log
13	Log Jams & Misc Placements					
a.	logs	EA	$1,000	420	$420,000	furnish and install
b.	logs with rootwads	EA	$1,500	260	$390,000	furnish and install
c.	boulders	TN	$100	680	$68,000	estimate 1 ton per log
Bank stabilization						
14	Type 1 Bank - Farrow & Van Alyea	SY	$15	3,400	$51,000	fabric treatment on slope, includes stakes, seed and wastage
15	Type 2 Bank - Wallace	Face Foot	$32	900	$28,800	ps
16	Type 3 Bank - Wallace					
a.	Logs	EA	$1,000	180	$180,000	furnish and install
b.	Logs with Rootwads	EA	$1,500	80	$120,000	furnish and install
c.	Riprap Scour Protection and Granular Backfill	CY	$70	550	$38,500	18"-0
d.	Fabric Encapsulated Lift	Face Foot	$32	425	$13,600	includes stakes, seed and wastage
17	Type 4 Bank - Mascherini					Upstream and Downstream Locations Combined
a.	Logs	EA	$1,000	162	$162,000	furnish and install
b.	Logs with Rootwads	EA	$1,500	54	$81,000	furnish and install
c.	Earthwork	CY	$18	12,690	$228,420	subgrade cut / crib & lift common backfill, disposal of excess
d.	Riprap Scour Protection and Granular Backfill	CY	$70	2,565	$179,550	18"-0
e.	Aggregate Filter Material	CY	$50	338	$16,875	
f.	Geotextile Fabric	SY	$9	2,430	$21,870	
g.	Fabric Encapsulated Lift	Face Foot	$32	6,075	$194,400	includes stakes, seed and wastage
Riffle Installation						
18	Riffle Material	CY	$120	3,900	$468,000	Assume imported river material, assumes subgrade cut, reuse and disposal of excess
Vegetation Management						
19	Clearing of Invasive Vegetation and Selected Revegetation	AC	$20,000	15.5	$310,000	
Site Restoration						
20	Misc Restoration	LS	$100,000	1.0	$100,000	
21	2" A.C. Overlay	SY	$20	2,600	$52,000	Post Construction, Van Alyea Driveway
	Construction Subtotal				$7,063,576	
	15% Contingency				$1,059,536	
	Project Total				$8,123,112	

Additive Items

No.	Bid Item	Unit	Unit Price	Quantity	Subtotal	design and quantity assumptions
A1	Increase Diversion Capacity from 105 to 140 cfs	LS	$776,000	1	$776,000	increase pumped diversion system capacity from 105 to 140 cfs for dry year conditions

Table 8b. Engineer's Opinion of Probable Construction Costs - 60% Complete Submittal. Alternative B. Gravity Diversion

No.	Bid Item	Unit	Unit Price	Quantity	Subtotal	design and quantity assumptions
General - Project Initiation						
1	Mobilization	LS	$298,361	1	$298,361	5% of Items 2-20
2	Temporary Access Road Improvements	LS	$100,000	1	$100,000	Temporary ditch crossings, misc road upgrades
3	Temporary Traffic Control & Flagging	LS	$75,000	1	$75,000	misc
4	Dust Control	LS	$100,000	1	$100,000	16 weeks x 5 days x 8 hours x $150
Erosion Prevention, Environmental Protection and Sediment Control						
5	Fish Relocation	LS	$20,000	1	$20,000	Placeholder estimate
6	Stream Diversion					Systems capable of handling 140 cfs. 2 large gravity bypass locations (60" pipe), site specific treatments including coffer damming and dewatering wells
a.	gravity bypass system	EA	$325,000	2	$650,000	2 sites @ ~ 1400 LF persite. 60" dia HDPE (not welded), excavation, decomission, coffer dams, misc restoration
b.	isolated riffle/LWD sites	EA	$100,000	3	$300,000	per detail on plans
c.	dewatering wells	EA	$3,500	30	$105,000	misc placements sitewide, 24" casing, 4" pump, 2 weeks operation
	Misc coffer dams	EA	$25,000	5	$125,000	Assume steel sheet piling, 70 LF each @350LF
7	Dewatering	LS	$50,000	1	$50,000	local dewatering
8	Erosion Control BMPs	LS	$200,000	1	$200,000	placeholder estimate
Earthwork						
9	Clearing and Grubbing	LS	$25,000	1	$25,000	limited
10	Common Excavation					
a.	Off Channel Area A: Wallace-Farrow	CY	$20	12,000	$240,000	Based on 041511 volume estimate
b.	Off Channel Area B: Wallace-Lipton	CY	$20	1,600	$32,000	Based on 041511 volume estimate
c.	Off Channel Area C: Van Alyea	CY	$20	11,500	$230,000	Based on 041511 volume estimate
d.	Off Channel Area D: Seghesio	CY	$20	1,500	$30,000	Based on 041511 volume estimate
Large Woody Debris Installation						
11	Floodplain Roughness Logs					
a.	logs	EA	$1,000	72	$72,000	furnish and install
b.	logs with rootwads	EA	$1,500	48	$72,000	furnish and install
c.	boulders	TN	$100	120	$12,000	estimate 1 ton per log
12	Backwater Habitat Logs					
a.	logs	EA	$1,000	117	$117,000	furnish and install
b.	logs with rootwads	EA	$1,500	78	$117,000	furnish and install
c.	boulders	TN	$100	195	$19,500	estimate 1 ton per log
12	Pool Enhancment Logs					
a.	logs	EA	$1,000	71	$71,000	furnish and install
b.	logs with rootwads	EA	$1,500	46	$69,000	furnish and install
c.	boulders	TN	$100	117	$11,700	estimate 1 ton per log
13	Log Jams & Misc Placements					
a.	logs	EA	$1,000	420	$420,000	furnish and install
b.	logs with rootwads	EA	$1,500	260	$390,000	furnish and install
c.	boulders	TN	$100	680	$68,000	estimate 1 ton per log
Bank stabilization						
14	Type 1 Bank - Farrow & Van Alyea	SY	$15	3,400	$51,000	fabric treatment on slope, includes stakes, seed and wastage
15	Type 2 Bank - Wallace	Face Foot	$32	900	$28,800	ps
16	Type 3 Bank - Wallace					
a.	Logs	EA	$1,000	180	$180,000	furnish and install
b.	Logs with Rootwads	EA	$1,500	80	$120,000	furnish and install
c.	Riprap Scour Protection and Granular Backfill	CY	$70	550	$38,500	18"-0
d.	Fabric Encapsulated Lift	Face Foot	$32	425	$13,600	includes stakes, seed and wastage
17	Type 4 Bank - Mascherini					Upstream and Downstream Locations Combined
a.	Logs	EA	$1,000	162	$162,000	furnish and install
b.	Logs with Rootwads	EA	$1,500	54	$81,000	furnish and install
c.	Earthwork	CY	$18	12,690	$228,420	subgrade cut / crib & lift common backfill, disposal of excess
d.	Riprap Scour Protection and Granular Backfill	CY	$70	2,565	$179,550	18"-0
e.	Aggregate Filter Material	CY	$50	338	$16,875	
f.	Geotextile Fabric	SY	$9	2,430	$21,870	
g.	Fabric Encapsulated Lift	Face Foot	$32	6,075	$194,400	includes stakes, seed and wastage
Riffle Installation						
18	Riffle Material	CY	$120	3,900	$468,000	Assume imported river material, assumes subgrade cut, reuse and disposal of excess
Vegetation Management						
19	Clearing of Invasive Vegetation and Selected Revegetation	AC	$20,000	15.5	$310,000	
Site Restoration						
20	Misc Restoration	LS	$100,000	1.0	$100,000	
21	2" A.C. Overlay	SY	$20	2,600	$52,000	Post Construction, Van Alyea Driveway

Construction Subtotal	$6,265,576
15% Contingency	$939,836
Project Total	$7,205,412

12 BIBLIOGRAPHY

Arcement, G.J. Jr., V.R. Schneider. 1989. Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains. US Geological Survey Water Supply Paper 2339.

Army Corps of Engineers, 1984. Warm Springs Dam and Lake Sonoma, Dry Creek, California, Water Control Manual Appendix II to Master Water Control Manual Russian River Basin, California. ACOE, Sacramento District, CA. 141.

Army Corps of Engineers, 1987a. Dry Creek Sediment Engineering Investigation, Sediment Transport Studies. ACOE, Sacramento District, CA. 156 p.

Entrix, Inc. 2004. Russian River Biological Assessment. Prepared for ACOE and SCWA. September 29, 2004. Walnut Creek, CA.

Federal Emergency Management Agency (FEMA). 2006. Flood Insurance Study (FIS) for Sonoma County, California, Unincorporated Areas. Volume 1 of 3. FIS Number 060375V001A. Revised: September 6, 2006.

Harvey, M.D. and Schumm, S.A. 1985. Geomorphic Analysis of Dry Creek, Sonoma County, California from Warm Springs Dam to Russian River Confluence. For ACOE, Sacramento District, CA. 134 p.

Harvey, M.D. and Schumm, S.A. 1987. Response of Dry Creek, California, to Land Use Change, Gravel Mining and Dam Closure. *Erosion and Sedimentation in the Pacific Rim* (Proceedings of the Corvallis Symposium, August, 1987). IAHS Publication No. 165, 451-460.

Horizon Water and Environment. 2009. Draft - Stream Maintenance Program Manual. Prepared.for Sonoma County Water Agency. January.

Inter-Fluve 2010. Final Current Conditions Report, Dry Creek from Warm Springs Dam to the Confluence with the Russian River. Prepared for the Sonoma County Water Agency. December.

Inter-Fluve 2011. Draft Habitat Enhancement Feasibility Study Report, Dry Creek from Warm Springs Dam to the Confluence with the Russian River. Prepared for the Sonoma County Water Agency. March.

Montgomery, D.R., and Buffington, J.M., 1997, Channel-reach morphology in mountain drainage basins: Geological Society of America Bulletin v. 109, no 5, p. 596-611.

NMFS 2008. Biological Opinion for Water Supply, Flood Control Operations, and Channel Maintenance conducted by the U.S. Army Corps Of Engineers, the Sonoma County Water Agency, and the Mendocino County Russian River Flood Control

and Water Conservation Improvement District in the Russian River watershed. Southwest Region. September 24.

Wieckowski, K., M. Porter, D. Pickard, and D. Marmorek. 2010. Draft - Dry Creek Adaptive Management Framework (AMF). Report prepared by ESSA Technologies Ltd., Vancouver, BC. for Sonoma Water County Agency, Santa Rosa CA.

13 APPENDIX A – 60% COMPLETE ENHANCEMENT DESIGN DRAWINGS

14 APPENDIX B – DRAFT GEOTECHNICAL REPORT

SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING
SAGE
INTEGRATING EARTH & STRUCTURE

DRAFT

Geotechnical Investigation Report

Dry Creek Habitat Enhancement Demonstration Projects - Phase 3

Sonoma County, California

SAGE Project No. 07-082.02

Prepared for:

Inter-fluve Inc.
1020 Wasco Street
Suite 1
Hood River, OR 97031

March 11, 2011

4180 Douglas Blvd., Ste. 100
Granite Bay, CA 95746
P (916) 729-8050
F (916) 729-7706

www.sandersgeo.com

SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING

SAGE

INTEGRATING EARTH & STRUCTURE

March 11, 2011
Project No. 07-082.02 3.02

Mr. Michael Burke
Inter-Fluve, Inc.
1020 Wasco St., Ste. 1
Hood River, OR 97031

RE: Revised Draft Geotechnical Investigation Report
Dry Creek Habitat Enhancement Demonstration Projects
Station 325+00 to 383+00
Sonoma County, California

Dear Mr. Burke:

Sanders & Associates Geostructural Engineering, Inc. (SAGE) is pleased to submit this revised draft report presenting the results of our geotechnical investigation for the proposed habitat enhancements in Dry Creek, a major tributary to the Russian River in Sonoma County, California. Specifically, this investigation was focused on the first phase of enhancements along an approximately 1.1 mile length of Dry Creek, referred to as the Demonstration Reach, which extends from the mouth of Grape Creek downstream to the mouth of Crane Creek (station 325+00 to 383+00). We are submitting one (1) copy of this draft report for your review.

We explored the subsurface conditions at selected off channel enhancement sites and a bank stabilization site by excavating eight (8) test pits and drilling two (2) small-diameter borings (Figure 2). In addition, NORCAL Geophysical Consultants performed a geophysical survey at an off channel enhancement site which could not be accessed by conventional mechanized equipment.

In general, we encountered alluvial soils consisting of mixtures of gravel and sand with interbedded layers of finer material. The material ranged from loose to dense, with the least dense materials generally near the ground surface. Saturated materials were very loose upon excavation and could not maintain excavation cuts or slopes.

Based on the results of the geophysical survey, the depth to bedrock at Off-Channel Enhancement Area D is estimated between 2 and 9 feet on the northwest and southeast ends of a seismic refraction line performed at this site, respectively. The recorded velocities suggest the rock is rippable to moderately rippable with a CAT 9L bulldozer. Bedrock was not encountered in any of the test pits excavated at the site.

The report submitted herewith contains recommendations regarding site grading, temporary and permanent slopes, slope stability, and bearing capacity. These recommendations are based on limited subsurface exploration and laboratory testing. Consequently, variations between expected and actual soil conditions may be found during construction. SAGE should be retained to observe the earthwork to evaluate actual conditions encountered for conformance with the geotechnical aspects of the plans and specifications.

Please call us should you have questions.

Sincerely yours,
Sanders & Associates Geostructural Engineering, Inc.

Darren A. Mack
Geotechnical Engineer

Drew G. Kennedy
Engineering Geologist

TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 SCOPE OF SERVICES 2
3.0 SITE CONDITIONS 2
4.0 GEOLOGIC CONDITIONS 2
4.1 Regional Geologic Setting 2
4.2 Site Geology 3
5.0 SUBSURFACE CONDITIONS 3
6.0 SEISMICITY 5
6.1 Regional Seismicity 5
6.2 Seismic Hazards 6
6.3 Fault Rupture 6
7.0 RECOMMENDATIONS 6
7.1 Demolition & Clearing 6
7.2 Fill Material and Compaction Requirements 7
7.3 Aeration 7
7.4 Excavatability 8
7.5 Temporary Slopes 8
7.6 Permanent Slopes 9
7.7 Slope Stability and Bearing Capacity 9
8.0 SERVICES DURING CONSTRUCTION 10
9.0 LIMITATIONS 10
10.0 REFERENCES 12

FIGURES

Figure 1 Site Location Map
Figure 2 Subsurface Exploration Map

APPENDICES

Appendix A – Field Exploration Program

Figure A-1 Soil Classification Chart

Figures A-2 through A-3 Logs of Soil Borings B1 and B2

Figure A-4 Logs of Test Pits TP1 through TP8

Appendix B – Laboratory Test Results

Appendix C – Geophysical Survey Report

SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING

SAGE

INTEGRATING EARTH & STRUCTURE

REVISED DRAFTGEOTECHNICAL INVESTIGATION REPORT
Dry Creek Habitat Enhancement Demonstration Projects
Station 325+00 to 385+00
Sonoma County, California

1.0 INTRODUCTION

Sanders & Associates Geostructural Engineering, Inc. (SAGE) is pleased to submit this revised draft report presenting the results of our geotechnical investigation for habitat enhancements in Dry Creek, a major tributary to the Russian River in Sonoma County, California. Specifically, this investigation was focused on the first phase of enhancements along an approximately 1.1 mile length of Dry Creek, referred to as the Demonstration Reach, which extends from the mouth of Grape Creek downstream to the mouth of Crane Creek (STA 325+00 to 383+00).[1]

The purpose of the proposed habitat enhancements is to develop summer rearing and winter refugia habitat for local fish species, specifically coho salmon and steelhead trout. Based on our review of the 30% Dry Creek Habitat Enhancement Demonstration Projects plans, we understand this will be achieved using a combination of enhancement approaches, including backwater ponds and channels for the fish to inhabit. The backwater ponds and channels will require excavation in stream terraces adjacent to the active stream channel. Slope inclinations for channel regarding are expected to be on the order of 2H:1V or flatter, with cuts up to 15 feet. In channel enhancement measures will include new riffle areas, deepening of existing pools, and construction of artificial log jams.

In addition, stabilization of the creek banks will be locally required to retain property and to enhance the habitat characteristics along the edge of Dry Creek. Anticipated bank stabilization measures will include: (1) flattening the existing slopes and covering with biodegradable fabrics; (2) bank reconstruction using log cribs with live willow cuttings; and (3) bank reconstruction using fabric encapsulated soil with live willow cuttings. The log cribs will have nominal widths (perpendicular to slope) of 20 to 25 feet, and will be underlain at the toe by 3- to 4-foot-wide by 5- to 8-foot-deep pads of 18-inch-minus rock. Backcuts for taller stabilization efforts are expected to consist of temporary slopes, although shoring may be required locally where layback space is limited by the presence of existing vineyards.

The approximate project location is shown on the Site Location Map (Figure 1). The important project features are shown on the Subsurface Exploration Map (Figure 2).

[1] Project stations (STA) are based on the 30% Dry Creek Habitat Enhancement Demonstration Projects plans prepared by Inter-Fluve, dated October 1, 2010.

2.0 SCOPE OF SERVICES

We performed a subsurface investigation in support of the proposed habitat enhancements for the Demonstration Reach. We have summarized the observations and results of our investigation in this geotechnical report, which provides recommendations and conclusions for developing the habitat enhancement design. Specifically, our investigation consisted of:

- Conducting a site reconnaissance to review selected locations for subsurface exploration;
- Obtaining the necessary drilling permits and coordinating our subsurface exploration program;
- Retaining the services of a private utility locator to clear investigation locations for possible underground utilities and/or buried objects;
- Performing a subsurface exploration program including eight (8) test pits and two (2) soil borings;
- Performing a geophysical survey at an off channel enhancement site which could not be accessed by conventional mechanized equipment;
- Collecting representative samples of the soil encountered in the test pits and soil borings;
- Performing laboratory testing on selected soil samples; and
- Preparing this geotechnical report.

3.0 SITE CONDITIONS

Dry Creek is an incised stream with flows regulated by the upstream Warm Springs Dam. Flow regulation has reduced the frequency and severity of major floods while providing a continuous baseflow during the summer months. This has resulted in the rapid growth of dense riparian vegetation and shrubs along the channel banks and formerly active bar surfaces since the dam was put into service in 1984. Where visible through the dense vegetation, the channel banks are generally steep to very steep and locally subject to erosion. Alluvial terraces are locally preserved along the Demonstration Reach, and are positioned above the active stream channel. These terrace surfaces, including a prominent terrace at Off Channel Enhancement Area C (Figure 2), are relatively flat benches with areas of dense vegetation to open grassy meadows.

4.0 GEOLOGIC CONDITIONS

4.1 Regional Geologic Setting

The Demonstration Reach is located in the Dry Creek drainage valley within the Coast Ranges geomorphic province of California. The Coast Ranges province is generally characterized by northwest-trending mountain ranges and intervening valleys that are controlled by right-lateral strike-slip faulting along the San Andreas fault system.

Review of available geologic mapping and literature sources indicate that the Dry Creek drainage valley is a structurally-controlled valley that generally lies on the boundary between sedimentary units

of the Great Valley Complex to the east and various fault bounded lenses of the Coast Range ophiolite and metamorphic rock units of the Franciscan Complex to the west (Blake, Graymer, and Stamski, 2002). However, sandstone, siltstone, and shale units belonging to the Great Valley Complex are also mapped along the western margin of the valley adjacent to the Demonstration Reach. The valley is filled with stream channel and floodplain deposits associated with Dry Creek and include up to three terrace deposits, the oldest of which appears to be approximately 1,000 years old (Harvey and Schumm, 1985).

4.2 Site Geology

Geologic conditions at the site are generally similar to those depicted by Huffman and Armstrong (1980) and Blake, Graymer, and Stamski (2002). In general, the Demonstration Reach is underlain by alluvial deposits of varying age. The deposits are comprised of clay, silt, sand, gravel, and cobble mixtures of varying rock types derived from tributaries extending into the adjacent Coast Range ophiolite, Great Valley Complex, and Franciscan Complex. The youngest alluvium is found within the active stream channel and low-lying gravel bars that are seasonally inundated.

Alluvial terraces are preserved along the length of the Demonstration Reach, and are comprised of older alluvial deposits. The position of these terraces relative to the active stream channel varies along the reach. In general, terraces positioned higher than the active stream channel are well vegetated, particularly the prominent terrace at Off Channel Enhancement Area C (Figure 2). Shallow slope failures are locally present along the active channel and terraces banks in areas where the banks are actively being undercut.

Bedrock outcrops observed along the active stream channel are generally limited to Grape and Crane Creeks near the confluence with Dry Creek, and within the Dry Creek channel below and immediately downstream of Lambert Bridge. The exposures are comprised of interbedded layers of weak siltstone and somewhat stronger, thicker beds of sandstone that appear to be consistent with descriptions of the siltstone, sandstone, and shale units of the Great Valley Complex. In general, the siltstone and sandstone exposures can easily be broken with a rock hammer, and are expected to be excavatable using conventional grading equipment. At Grape Creek, the bedrock is locally folded along a west-southwest plunging axis approximately parallel to the apparent syncline evident in the mapped Great Valley Complex units exposed on the western flank of the valley.

5.0 SUBSURFACE CONDITIONS

We explored the subsurface conditions at selected off channel enhancement sites and bank stabilization site by excavating eight (8) test pits and drilling two (2) small-diameter borings (Figure 2). In addition, NORCAL Geophysical Consultants (NORCAL) performed a geophysical survey at an off channel enhancement site which could not be accessed by conventional mechanized equipment. Table 1 summarizes the subsurface exploration performed. A description of our field exploration program, as well as the test pit and borings logs, is presented in Appendix A. The results of laboratory testing are presented in Appendix B.

TABLE 1
SUMMARY OF EXPLORATION LOCATIONS

Enhancement Site*	Property Owner(s)	Subsurface Exploration
Off Channel Enhancement Area A Bank Stabilization (STA 334+00 – 337+70)	Wallace & Farrow	Test pits (TP5 to TP8)
Off Channel Enhancement Area C	Van Alyea	Test pits (TP1 thru TP4)
Bank Stabilization (STA 360+00 – 363+55, STA 365+10 – 365+80)	Mascherini	Soil borings (B1, B2)
Off Channel Enhancement Area D	Seghesio	Geophysical survey

TP1 through TP4 were excavated at Off Channel Enhancement Area C. The upper 6 to 12 inches of TP1 through TP3 were composed of loose to medium dense gravelly silt and silty gravel with organic material. TP4 exposed four feet of medium stiff gravelly clay at the surface of the excavation. Below the surficial layer, we encountered easily excavatable loose to medium dense sand and gravel mixtures. Groundwater was encountered around Elevation 122 feet in each test pit.

Soils encountered in TP5 through TP9 generally comprised sandy gravel with trace fines and cobbles up to 10 inches. Localized layers of sand and clayey sand were also encountered. The subsurface material was loose to medium dense and could be easily excavated. Groundwater was encountered between Elevation 115 and 118 feet.

The soils encountered in B1 and B2 indicate that the upper 13 to 15 feet of the creek bank is variable. In B1, we encountered loose to medium dense silty sand and sand. In B2, we encountered medium stiff to stiff clay with some silty sand. Below 15 feet, we encountered sand and gravel with varying silt and clay content. Groundwater was between 21 and 23 feet below existing grade, which corresponds to between Elevation 121 and 122 feet.

The water level in Dry Creek was measured adjacent to TP-1 and TP-5. At these two locations, the measured groundwater elevations in the test pits were approximately the same as the adjacent water surface elevation in Dry Creek. Although not measured in the field, we would expect similar results for the remaining test pits.

The test pit side slopes were marginally stable in dry to moist conditions. However, rapid caving or sloughing generally occurred below the water table, particularly where active seepage was encountered, which limited the depth of the test pits.

Although bedrock of the Great Valley Complex is visible in Grape and Crane Creeks near the confluence with Dry Creek, and within Dry Creek below and immediately downstream of Lambert Bridge, bedrock was not encountered in the test pits and borings. At Off Channel Enhancement Area D, the results of the NORCAL survey suggest the depth to sedimentary bedrock is between 2 and 9 feet below existing grades on the northwest and southeast ends of the seismic refraction line,

respectively. The recorded velocities suggest the rock is rippable to moderately rippable with a CAT 9L bulldozer. The approximate location of the seismic line is shown on Figure 2, and the full geophysical report is presented in Appendix C.

6.0 SEISMICITY

6.1 Regional Seismicity

Seismicity is defined as the geographical and historical distribution of earthquakes, or more simply, earthquake activity. The potential for ground shaking at the site is related to earthquake activity that might occur along nearby or distant faults. Based on historical earthquake activity and fault hazard mapping, the Sonoma County region is considered to have a relatively high potential for seismic activity related to the San Andreas fault system.

The 2002 Working Group on California Earthquake Probabilities (WGCEP) suggests the overall probability of one or more $M_W \geq 6.7$ earthquakes occurring in the San Francisco Bay region during the period from 2002 to 2032 is 62 percent (WGCEP, 2003). The highest probability of 27 percent was assigned to the Hayward/Rodgers Creek fault zone.

The closest active faults in this system are the Maacama and Rodgers Creek faults, which are mapped approximately 6 miles northeast and 8 miles southeast of the site, respectively. The San Andreas fault is mapped approximately 20 miles southwest of the site.

Regional fault maps and databases (Jennings et al., 2010; USGS, 2010) and a fault evaluation report (Bryant, 1982) show several strands of the Healdsburg fault within and adjacent to the Dry Creek drainage valley. No strands are mapped as crossing or projecting towards the Demonstration Reach. Seismically, the Healdsburg fault comprises an approximately one mile wide system of northwest trending, right-lateral strike-slip fault strands. These strands appear to be a northwest extension of the Rodgers Creek fault and define part of a complex seismic stepover with the Maacama fault to the north (McLaughlin and Sarna-Wojcicki, 2003). Both the Rodgers Creek and Maacama fault systems are zoned as active[2] under the State of California Alquist-Priolo (AP) Earthquake Fault Zoning Act (Bryant and Hart, 2007).

Although not currently zoned as active under the AP Act, workers mapping in the surrounding region considered some traces of the Healdsburg fault to be "recently active" (Huffman and Armstrong, 1980) or "Quaternary active" (Blake, Graymer, and Stamski, 2002). Based on available paleoseismic studies for the region and the structural relationship of the Healdsburg fault with the active Rodgers Creek and Maacama fault systems, the Healdsburg fault should be considered potentially active[3].

---

2 Active faults are defined as those exhibiting either surface ruptures, topographic features created by faulting, surface displacements of Holocene (younger than about 11,000 years old) deposits, tectonic creep along fault lines, and/or close proximity to linear concentrations or trends of earthquake epicenters.

3 Potentially active faults displace geologic deposits of Pleistocene age (about 2 million to 11,000 years old).

6.2 Seismic Hazards

Based on the close proximity of the site to the Maacama, Rodgers Creek, and other major active faults in the area, there is a high potential for the site to experience moderate to very strong ground shaking during a major earthquake on one of these faults. The intensity of earthquake ground motion at the site will depend on the characteristics of the generating fault, the distance to the earthquake epicenter, the magnitude and duration of the earthquake, and specific site geologic conditions.

In addition, given the sandy nature of the materials and high elevation of the groundwater table encountered during the subsurface excavation, liquefaction may occur. It is possible that liquefaction or ground shaking may damage the bank stabilization structures due to lateral spreading. However, damage caused by lateral spreading should not cause a safety hazard for the local population since the improvements are for the remediation of an existing habitat and are not infrastructure related. Therefore, recommendations regarding liquefaction and liquefaction mitigation were not included in our scope of work.

6.3 Fault Rupture

Given the structural relationship of the Healdsburg fault with the active Rodgers Creek and Maacama faults, there is a reasonable chance of ground surface rupture along traces of the Healdsburg fault during a major earthquake on either of the active faults. Stereoscopic analysis of aerial photos and digital imagery suggests that one or more low sinuosity reaches of Dry Creek upstream/downstream of the Demonstration Reach may be structurally controlled along unmapped traces of the Healdsburg fault or other lineaments that may be associated with the fault. However, the Demonstration Reach is a higher sinuosity reach that does appear to be structural controlled. In addition, given the nature of the proposed habitat enhancements, any potential fault offset would be unlikely to have any significant impacts to the long term performance.

7.0 RECOMMENDATIONS

We believe the proposed construction is feasible from a geotechnical standpoint provided our geotechnical recommendations are incorporated into project design and construction. The primary geotechnical considerations for the site are the excavatability of the native subsurface material and stability of temporary and permanent slopes. In accordance with our scope of services, the following subsections present our recommendations for site grading, temporary and permanent slopes, and excavations.

7.1 Demolition & Clearing

Site demolition is expected to be minimal, but could include the removal of existing below-grade improvements, if any, that will interfere with the proposed construction. These could include utilities, culverts, and abandoned auto bodies.

Where utilities are to be abandoned and removed, they should be capped or plugged with grout at the Right-of-Way (ROW). Where it is feasible to abandon utilities in-place, utilities greater than three inches in diameter should be completely filled with flowable cement grout over their entire length. Where abandoned utilities are perpendicular to an excavation, they should be filled with grout to the nearest manhole or valve. It may be necessary to pothole utilities in several locations to facilitate and/or verify grouting. Utilities less than or equal to three inches in diameter can be plugged with concrete at the sides of the excavation. Existing utility lines, where encountered, should be addressed on a case-by-case basis.

Any demolition requiring excavation should be properly backfilled with engineered fill according to the recommendations provided later in this section.

7.2 Fill Material and Compaction Requirements

On-site soil will be acceptable for use as general site fill provided it is free of organic material and contains no rocks or lumps larger than four inches in greatest dimension. Rock fragments larger than four inches can be reused in the fill provided they are broken down to less than four inches in diameter.

If imported fill is required, it should be free of organic matter or other deleterious material, contain no rocks or lumps larger than four inches in greatest dimension, and have a relatively low expansion potential (defined by liquid limit less than 40 and a plasticity index lower than 15).

All fill material, including on-site fill, should be submitted to the Geotechnical Engineer for approval at least 72 hours before it is to be used on site. Where imported fill is required, the grading subcontractor should provide analytical test results or other suitable environmental documentation at least three days before use at the site indicating the proposed fill material is free of hazardous materials.

Where fill is required, the exposed subgrade should be scarified to a depth of eight inches, moisture-conditioned to at least two percent above optimum moisture content, and compacted to at least 90 percent relative compaction.[4] However, 85 percent relative compaction is acceptable where vegetation or replanting is planned. Where the thickness of the fill layer will be five feet or greater, the soil should be placed in eight-inch loose lifts and compacted to above optimum moisture content.

7.3 Aeration

If wet subgrade conditions are encountered at the site, or the base of excavations or backfill areas become soft, unstable and/or disturbed by construction equipment, it may be necessary to stabilize the base of the excavation prior to fill placement. For granular soils, particularly gravels, installation

[4] Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, as determined by ASTM D1557-00 laboratory compaction procedure.

of sumps to locally lower the water level will likely be sufficient to stabilize the material provided the pumps are large enough to keep up with infiltration. For clayey soils, the least costly stabilization measure typically consists of aeration (drying) of the wet soil to reduce its moisture content to a compactable level. However, depending on climatic conditions, several days to several weeks of relatively warm, dry weather may be required to dry the soil to an acceptable level. In addition, it is often necessary to turn the material several times a day to promote uniform drying. The soil will be deemed sufficiently aerated when the required degree of compaction can be achieved and/or the resulting subgrade surface is firm and unyielding.

7.4 Excavatability

Based on the results of our borings and test pits, we believe standard construction equipment, such as a hydraulic excavator, should be able to complete the excavations required for the proposed habitat improvements. The encountered materials were generally loose to medium dense and were easily excavated. No cemented soils or bedrock was encountered in our borings or test pits.

Based on the preliminary results of the seismic refraction line performed at Area D, bedrock appears to be about 2 to 9 feet below existing grade. The reported seismic velocities range from about 1,000 feet per second in overburden materials to over 6,800 feet per second in bedrock, which suggests the bedrock is rippable to marginally rippable using a CAT D9L bulldozer. We expect bedrock encountered at Crane Creek, Grape Creek, and Lambert Bridge will be similar.

7.5 Temporary Slopes

Temporary slopes are expected to be cut for bank stability construction in areas B and C. All temporary slopes should be excavated in accordance with the latest edition of the CAL-OSHA excavation and trench safety standards as a minimum (CCR, 2005). We understand some top-of-cut setback limitations may exist in these areas due to the proximity of an existing vineyard.

Test borings B1 and B2 were drilled through the proposed backslope materials for Area C. In boring B1, the upper 20 feet of the materials encountered consist of loose to medium dense sand, silty sand, and silty sandy gravel. Because this is a layered system, the maximum slope inclination is controlled by the least stable layer, in this case, the sand. At this location, it is our opinion that the soil should be preliminarily classified as Type C according to the CAL-OSHA classification system. The maximum allowable slope for Type C soil is 1.5H:1V. Vertical benches should not be cut into the base of temporary excavations.Type C should also be assumed for Areas B, where access limitations did not allow for site specific exploration to be performed.

At the location of boring B2, however, the upper 11 feet of the embankment consists of medium stiff to stiff sandy clay, which in our opinion can be preliminarily classified as a Type B soil. The maximum allowable slope for Type B soil is 1H:1V. Below this depth, the soil is classified as silty sand and gravel, and a direct shear test in the silty gravel indicates the material has some apparent cohesion. The silty sand and gravel is transitional between Type B and C soil and will require on-site classification during excavation to determine the CAL-OSHA soil type. Because OSHA does not

allow layered systems with upper slopes steeper than lower slopes, we recommend cuts taller than 11 feet in the vicinity of boring B2 have an assumed inclination of 1.5H:1V for preliminary planning purposes.

The contractor should be responsible for all temporary slopes excavated at the site, and should designate one of their on-site employees as a "competent person" who is responsible for trench and excavation safety. The competent person should be responsible for determination of the correct CAL-OSHA soil type and should direct the excavation crews to use shallower slopes than presented above if appropriate. The competent person should also be prepared to flatten slopes if seepage is observed within the excavation.

If there is insufficient space to construct temporary slopes, temporary shoring may be required. Given the medium dense nature of the sands and gravels encountered at the site, we anticipate steel sheet piles, installed using a vibratory hammer mounted to a hydraulic excavator, are the most likely method of shoring to be used at the site. For design of temporary shoring, and assuming granular slope deposits, we recommend using active pressures of 35 and 65 pounds per cubic foot (pcf) for level backslope conditions and a maximum backslope of 1.5H:1V, respectively. Passive resistance should be computed using allowable passive pressures of 300 and 145 pcf above and below the groundwater table, respectively. These passive pressures include a factor of safety of 1.5 to limit sheet pile deflections.

7.6 Permanent Slopes

Permanent slopes are expected to be cut for channel regarding. They will generally be excavated in gravelly sands and sandy gravels with no appreciable cohesion. All permanent slopes should have a maximum finished slope of 2H:1V. Permanent slopes should be revegetated and/or be covered in biodegradable fabrics as shown in the final construction plan set.

7.7 Slope Stability and Bearing Capacity

We understand bank stabilization will be performed at Off Channel Enhancement Area B and C. For evaluation of slope stability at these locations, a cohesion of 250 psf and a friction angle of 24 degrees can be used for native soils to remain or recompacted native soil. If imported soil meeting the requirements presented in section 7.2 is used, a friction angle of 32 degrees (no cohesion) can be used.

The proposed log crib structures may bear on underlying soils at two points. An average bearing pressure may be imposed over the width of the overall crib structure, which is estimated to be on the order of 20 to 25 feet. However, pressures may be imposed locally on the 18-inch-minus rock streambed substrate (toe rock) buried beneath the toe of the wall. If it is necessary to evaluate the bearing capacity at these two points, we recommend using the allowable dead load bearing capacities presented in Table 2.

TABLE 2
ALLOWABLE DEAD LOAD BEARING CAPACITY

Structure	Min. Width, ft	Min. Embedment*, ft	Allowable Dead Load Bearing Pressure, psf
Log crib (overall structure)	20	None required	4,000
Toe Rock	3	5	3,000

*Measured vertically from creek bed to bottom of improvement

These values assume fully saturated (submerged) soil conditions and a factor of safety of at least 3 for dead load conditions. The toe pressures are provided as a check to ensure that excessive toe pressures at not imposed, which could cause the bank stabilization system to settle and/or rotate toward the channel.

8.0 SERVICES DURING CONSTRUCTION

The recommendations provided in this report are based on the assumption that SAGE will be retained to provide plan review and observation and testing services during construction in order to evaluate compliance with our recommendations. Prior to construction, we should review the excavation and/or shoring plans prepared by the contractor. During construction, we should periodically check the materials exposed due to excavation of temporary and permanent slopes. These observations will allow us compare the subsurface conditions observed during construction with those encountered during our investigation and allow us to assess the contractor's work with respect to the project plans and specifications and the recommendations presented herein. If SAGE is not retained for these services, we cannot assume responsibility for any and all potential claims that may arise during or after construction as a result of misuse or misinterpretation of SAGE's report by others.

9.0 LIMITATIONS

This report has been prepared for the sole use of Sonoma County Water Agency and their agents specifically for the design of the Dry Creek Habitat Enhancement Demonstration Projects described herein. The opinions, conclusions, and recommendations contained in this report are based upon the information obtained from our site subsurface exploration, our engineering studies, experience, and engineering judgment, and have been formulated in accordance with generally accepted geotechnical engineering practices that exist at the time this report was prepared. No other warranty, expressed or implied, is made or should be inferred. In addition, the recommendations presented in this report are based on the subsurface conditions encountered in a limited number of test pits and borings. Actual conditions may vary. If subsurface conditions encountered in the field differ from those described in this report, we should be consulted to determine if changes to our conclusions or supplemental recommendations are required.

The opinions presented in this report are valid as of the date of this report for the property being evaluated. Changes in the condition of a property can occur with the passage of time, whether due to natural processes or the works of man. If site conditions vary from those described herein, we should be consulted to evaluate the impact of the changes, if any. In addition, changes in applicable standard of practice can occur, whether from legislation or the broadening of knowledge. Accordingly, the opinions presented in this report may be invalidated, wholly or partially, by changes outside of SAGE's control. In any case, this report should not be relied upon after a period of three years without prior review and approval by SAGE.

10.0 REFERENCES

Blake, M.C., Graymer, R.W., and Stamski, R.E., 2002, *Geologic Map and Map Database of Western Sonoma, Northwestern Marin, and Southernmost Mendocino Counties, California*: U.S. Geological Survey Miscellaneous Field Studies Map MF-2402, Version 1, 1 sheet, scale 1:100,000.

Bryant, W.A., 1982, *Chianti, Healdsburg, Alexander, Maacama and related faults, Sonoma County*: California Division of Mines and Geology Fault Evaluation Report 135, 18 p., scale 1:24,000, parts of 5 quadrangles, scale 1:24,000.

Bryant, W.A., and Hart, E.W., 2007, *Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps*: California Geological Survey, Special Publication 42, Interim Revision 2007.

California Code of Regulations (CCR), 2005, *Register 2005, No. 17, Title 8, Division 1 – Department of Industrial Relations, Chapter 4 – Division of Industrial Safety, Subchapter 4 – Construction Safety Orders, Article 6 – Excavations, Sections 1539 through 1547*, April 29.

Harvey, H.D., and Schumm, S.A., 1985, *Geomorphic Analysis of Dry Creek, Sonoma County, California from Warm Springs Dam to Russian River Confluence*: Department of the Army Sacramento District Corps of Engineers, Contract No. DACW05-85-P-0064

Huffman, M.E., and Armstrong, C.F., 1980, *Geology for planning in Sonoma County:* California Division of Mines and Geology Special Report 120, 31 p., 5 pls., scale 1:62,500.

Inter-Fluve, Inc., 2010a, *30% Complete Design Report, Dry Creek Habitat Enhancement Demonstration Projects: River Miles 6.2 to 7.3,* October 1, 2010.

Inter-Fluve, Inc., 2010b, *30% Dry Creek Habitat Enhacement Demonstration Projects Plan Set,* October 1, 2010.

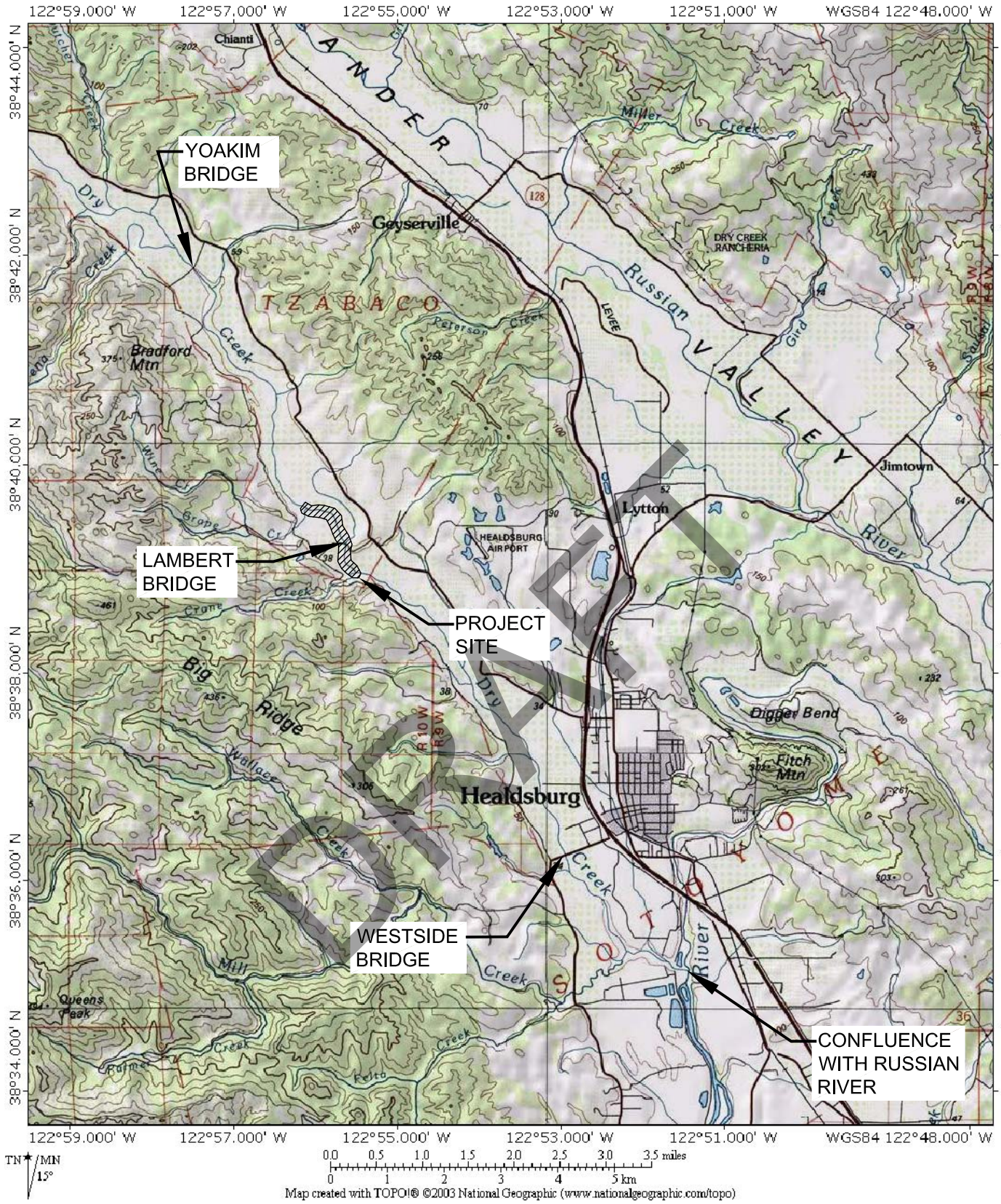
Jennings, C.W., Bryant, W.A., and Saucedo, G.J., 2010, *Fault Activity Map of California*: California Geological Survey, California Geologic Data Map Series, Map No. 6, scale 1:750,000.

McLaughlin, R.J., and Sarna-Wojcicki, A., 2003, *Geology of the Right Stepover Region between the Rodgers Creek, Healdsburg, and Maacama Faults, Northern San Francisco Bay Region – A Contribution to Northern California Geological Society Field Trip Guide, June 6-8, 2003:* U.S. Geological Survey Open-File Report 03-502.

U.S. Geological Survey (USGS) and California Geological Survey, 2010, *Quaternary fault and fold database for the United States,* accessed October 2010, from USGS web site: http//earthquakes.usgs.gov/regional/qfaults/

Working Group on California Earthquake Probabilities, 2003, *Earthquake Probabilities in the San Francisco Bay Region: 2002 to 2031*: U.S. Geological Survey Open-File Report 03-214.

FIGURES



DRAFT

SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING
sage
INTEGRATING EARTH & STRUCTURE
4180 Douglas Blvd., Ste. 100
Granite Bay, CA 95746
P (916) 729-8050
F (916) 729-7706

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECTS

SONOMA COUNTY — SITE LOCATION MAP — CALIFORNIA

FIG 1

DATE: 03/11/11	FILE: 07-082.02	SCALE: NONE	JOB NO.: 07-082.02

KEY

B1 BORING COMPLETED BY SAGE ON 8/20/10

TP1 TEST PIT COMPLETED BY SAGE ON 8/18/10 AND 8/19/10

0 150' 300' 600'

1" = 300'

SEGHESIO

SEGHESIO

MASCHERINI

MASCHERINI

RUED

RUED

RUED

BANK STABILIZATION (STA 360+00 - 363+55 AND STA 365+10 - 365+80)

OFF CHANNEL ENHANCEMENT AREA D

B2

B1

TP1

TP2

TP3

TP4

OFF CHANNEL ENHANCEMENT AREA C

SEISMIC LINE

PASSALAGQUA

KIGHT

VAN ALYEA

DRY CREEK

LAMBERT BRIDGE ROAD

DRY CREEK VINEYARD

BANK STABILIZATION (STA 334+00 - 337+70)

DRY CREEK VINEYARD

FARROW

WALLACE

OFF CHANNEL ENHANCEMENT AREA A

TP5

TP6

TP7

TP8

REFERENCE: 30% DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECTS PLAN SET

DRAFT

4180 Douglas Blvd., Ste. 100
Granite Bay, CA 95746
P (916) 729-9050
F (916) 729-7706

SAGE
SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING
INTEGRATING EARTH & STRUCTURE

SUBSURFACE EXPLORATION MAP

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECTS

COUNTY OF SONOMA CALIFORNIA

REV	BY	DATE	DESCRIPTION
1	-	-	-

DATE: 03/11/11
SCALE: 1" = 300'
DESIGNED BY: RMA
DRAFTED BY: RMA
CHECKED BY: DGK
JOB NO.: 07-082.02
FILE: 07-082.00

FIG 2

APPENDIX A
Field Exploration Program

A.1 Field Exploration Program

Our field exploration program consisted of excavating eight (8) test pits and drilling two (2) small-diameter soil borings. The approximate test pit and boring locations, designated TP1 through TP8 and B1 through B2, respectively, are presented on Figure 2.

Prior to the start of drilling, SAGE obtained a drilling permit from the Sonoma County Permit and Resource Management Department (PRMD) and notified Underground Service Alert (USA) at least 48 hours prior to the start of work. Furthermore, all borings and test pits were cleared by a private utility locator.

The test pits were excavated by Luce Backhoe Excavation of Santa Rosa, California. Test pits TP1 through TP4 were excavated on August 18, 2010 using a CAT 416C rubber-tire backhoe equipped with a 24-inch bucket. Test pits TP5 through TP8 were excavated on August 19, 2010 using a CAT 315L track-mounted excavator equipped with a 42-inch bucket. The test pit depths were limited to 13.5 feet or less due to caving conditions below groundwater.

Borings B1 and B2 were drilled on August 20, 2010 by Clear Heart Drilling of Santa Rosa, California. The borings were drilled using a truck-mounted DR5K1 drill rig equipped with seven-inch-diameter hollow stem augers. B1 and B2 were advanced to a depth of 41.5 feet below the existing ground surface, which corresponds to 21.3 and 23.2 feet below the existing channel bed invert, respectively.

During excavation of the test pits and drilling of the borings, our geologist logged the materials encountered and obtained representative samples for visual classification and laboratory testing. The materials encountered were classified in general accordance with the Unified Soil Classification System (USCS) as summarized on Figure A-1. Logs of the borings and test pits are presented as Figures A-2 through A-3 and Figure A-4, respectively.

Representative soil samples were recovered during drilling using the following sampler types:

- Modified California (MCA) split-barrel sampler with a 3.0-inch-outside diameter fitted with 2.43-inch-inside-diameter, six-inch-long brass or stainless steel liners;
- Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch-outside diameter, without liners; and

Both split-barrel samplers were driven with a 140-pound, safety (rope and cathead) hammer falling 30 inches. The blow counts required to drive the samplers over a standard 18-inch-drive were recorded in six-inch increments in the field. Where refusal was encountered, defined as greater than 50 blows over any six-inch increment, drive lengths less than 12 inches were also recorded. The final 12-inches of the drive (less in the case of refusal) were added to develop the reported blow count. The blow counts for the MCA sampler were corrected for the effects of sampler size and converted to SPT N-values using a conversion factor of 0.6. The final, corrected values for each drive are presented on the boring logs and represent N_{60} values.

Due to the proximity of the borings to Dry Creek, grout migration through the coarse grained alluvial deposits and into the creek was a concern. To mitigate this, our geologist obtained verbal

approval from the on-site Sonoma County PRMD inspector to backfill the borings with soil cuttings to 15 feet, and top off with neat cement grout. The remaining cuttings were spread out on the ground surface adjacent to the boring.

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than holf of soil > No. 200 sieve size)	Gravels (More than half of coarse fraction > No. 4 sieve size)	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction > No. 4 sieve size)	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils (more than holf of soil < No. 200 sieve size)	Silts and Clays LL = < 50	ML	Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays LL = > 50	MH	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic silts and clays of high plasticity
Highly Organic Soils		PT	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel coarse fine	3" to No.4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
Sand coarse medium fine	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

TYPES OF STRENGTH TESTS

PP	Pocket Penetrometer
TV	Field Torvane
LVS	Laboratory Vane Shear
UC	Unconfined Compression
TXUU	Triaxial, unconsolidated, undrained
DS	Direct Shear

Unstabilized (initial) groundwater level

Stabilized groundwater level

SAMPLER TYPE

C — Core barrel

O — Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube

PT — Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube

ST — Shelby tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

BULK — Disturbed grab sample

CA — California split-barrel sampler with 2.5-inch outside diameter and 1.93-inch inside diameter

MCA — Modified California split-barrel sampler with 3.0-inch outside diameter and 2.5-inch inside diameter

SPT — Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter

Sampling attempted without recovery

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECTS

Sonoma County California

SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING
sage
INTEGRATING EARTH & STRUCTURE

4180 Douglas Blvd., Ste. 100
Granite Bay, CA 95746
P (916) 729-8050
F (916) 729-7706

SOIL CLASSIFICATION CHART

Project No. 07-082.02

Date 10/29/10 Figure A-1

PROJECT: Dry Creek Demonstration Reach, Sonoma County, CA

LOG OF BORING B1

BORING LOCATION: See Figure 2	**DRILLING SUBCONTRACTOR:** Clear Heart Drilling
DATE STARTED: 8/20/2010 **DATE FINISHED:** 8/20/2010	**DRILL RIG:** DR5KI Truck Mounted
LOGGED BY: D. Kennedy	**DRILLING METHOD:** 7-inch hollow stem auger
ELEVATION (FT): 144.2 **DATUM:** NAVD 88	
GW DEPTH (FT): 22.7 **GW DATE:** 8/20/2010	**HAMMER TYPE:** Rope and cathead (safety)
CASING NOTES: N/A	**HAMMER WT (LBS):** 140 **HAMMER DROP (IN):** 30
BACKFILL MATERIAL: Soil cuttings & neat cement	**SAMPLERS:** MCA, SPT

DEPTH (FT)	ELEV. (FT)	SAMPLE TYPE	SAMPLE	SPT N60 VALUE	LITHOLOGY	DESCRIPTION	LABORATORY TEST DATA: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	FINES (%)	TYPE of TEST	UNCONFINED STRENGTH (tsf)	SHEAR STRENGTH (ksf)	PLASTICITY: LL	PI
1	143				SM	SILTY SAND (SM) yellow brown, loose, moist, fine grained sand								
2	142													
3	141	MCA		7										
4	140													
5	139													
6	138	MCA		12		SAND (SP) brown, medium dense, moist, fine grained sand, trace silt, locally grades to medium grained sand								
7	137													
8	136	MCA		8	SP	loose, with SILTY SAND (SM) interbeds								
9	135													
10	134													
11	133	MCA		12										
12	132				SM	SILTY SAND (SM) brown, medium dense, moist, fine grained sand, approximately 25% fines								
13	131					gravel at 13.5 based on change in drilling								
14	130					SILTY SANDY GRAVEL (GM) brown, medium dense, moist, fine gravel with some coarse gravel, medium to coarse sand, trace fines								
15	129													
16	128	SPT		25	GM									
17	127													
18	126													
19	125					GRAVEL WITH SILT AND SAND (GW-GM)								

DRAFT

MCA and SPT blow counts converted to SPT N60 values using conversion factors of 0.6 and 1.0, respectively.

SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING
sage
INTEGRATING EARTH & STRUCTURE

Project No: 07-082.02

Figure: A-2

LOG OF BORING 07-082 GINT BORING LOGS.GPJ SAGE.GDT 3/10/11

PROJECT: Dry Creek Demonstration Reach, Sonoma County, CA

LOG OF BORING B1

DEPTH (FT)	ELEV. (FT)	SAMPLE TYPE	SAMPLE	SPT N60 VALUE	LITHOLOGY	DESCRIPTION	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	FINES (%)	TYPE of TEST	UNCONFINED STRENGTH (tsf)	SHEAR STRENGTH (ksf)	PLASTICITY LL	PLASTICITY PI
						LABORATORY TEST DATA								
21	123	MCA		18	GW-GM	brown, medium dense, moist, primarily fine gravel with coarse sand, medium grained sand lenses locally			6.6					
22	122					GRAVEL WITH SILT AND SAND (GW-GM) (Con't)								
						Approximate elevation of channel bed invert								
						8/20/2010								
23	121					softer drilling below 22.7', groundwater encountered								
24	120													
25	119					gravel size increases, fine to coarse gravel, decreased sand content locally, wet								
26	118	MCA		17										
27	117													
28	116					GRAVELLY SILTY SAND (SW) brown gray, medium dense, wet, medium to coarse grained sand, fine to coarse gravel (1/4" to 1"), some silt								
29	115													
30	114													
31	113	MCA		16										
32	112													
33	111													
34	110													
35	109				SW	dense, coarse grained sand, gravels up to 2.5"								
36	108	MCA		31										
37	107													
38	106													
39	105													
40	104					medium to coarse grained sand, reduced gravel content, with some clay locally								
41	103	SPT		36										
42	102													
43	101													

DRAFT

Boring terminated at a depth of 41.5 feet below existing ground surface.
MCA and SPT blow counts converted to SPT N60 values using conversion factors of 0.6 and 1.0, respectively.

SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING
sage
INTEGRATING EARTH & STRUCTURE

Project No: 07-082.02

Figure: A-2

LOG OF BORING 07-082 GINT BORING LOGS.GPJ SAGE.GDT 3/10/11

PROJECT: Dry Creek Demonstration Reach, Sonoma County, CA

LOG OF BORING B2

BORING LOCATION: See Figure 2	**DRILLING SUBCONTRACTOR:** Clear Heart Drilling
DATE STARTED: 8/20/2010 **DATE FINISHED:** 8/20/2010	**DRILL RIG:** DR5KI Truck Mounted
LOGGED BY: D. Kennedy	**DRILLING METHOD:** 7-inch hollow stem auger
ELEVATION (FT): 142.3 **DATUM:** NAVD 88	
GW DEPTH (FT): 20.0 **GW DATE:** 8/20/2010	**HAMMER TYPE:** Rope and cathead (safety)
CASING NOTES: N/A	**HAMMER WT (LBS):** 140 **HAMMER DROP (IN):** 30
BACKFILL MATERIAL: Soil cuttings and neat cement	**SAMPLERS:** MCA, SPT

DEPTH (FT)	ELEV. (FT)	SAMPLE TYPE	SAMPLE	SPT N60 VALUE	LITHOLOGY	DESCRIPTION	LABORATORY TEST DATA: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	FINES (%)	TYPE of TEST	UNCONFINED STRENGTH (tsf)	SHEAR STRENGTH (ksf)	PLASTICITY: LL	PI
0	142					SANDY CLAY (CL) brown, medium stiff to stiff, moist, fine grained sand								
5	137	MCA		6	CL				64.6					
6	136					silty sand lense								
8	134	MCA		6										
10	132	MCA		6										
11	131				SM	SILTY SAND (SM) brown, loose, moist, fine grained sand DSDC: Ø=24°, c=250psf; See Appendix B	20.8	88						
15	127	MCA		26		GRAVELLY SILTY SAND (SM) brown, medium dense to dense, moist, medium to coarse sand, fine gravel, trace fines, weakly cemented locally								
18	124					**Approximate elevation of channel bed invert**								
19	123					8/20/2010 ▽								

DRAFT

MCA and SPT blow counts converted to SPT N60 values using conversion factors of 0.6 and 1.0, respectively.

SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING
sage
INTEGRATING EARTH & STRUCTURE

Project No: 07-082.02

Figure: A-3

LOG OF BORING 07-082 GINT BORING LOGS.GPJ SAGE.GDT 3/10/11

PROJECT: Dry Creek Demonstration Reach, Sonoma County, CA

LOG OF BORING B2

DEPTH (FT)	ELEV. (FT)	SAMPLE TYPE	SAMPLE	SPT N60 VALUE	LITHOLOGY	DESCRIPTION
21	121	SPT		24	SM	GRAVELLY SILTY SAND (SM) (Con't) some clay
22	120					
23	119					
24	118					
25	117					
26	116	MCA		6	SC	CLAYEY SAND (SC) gray, loose, wet, fine grained sand, marsh or overbank deposit
27	115	SPT		28	SM	GRAVELLY SILTY SAND (SM) brown, medium dense to dense, wet, medium to coarse sand, fine gravel with some coarse gravel, with thin clay lenses
28	114					
29	113				SP	SAND (SP) gray, loose to medium dense, wet, medium grained sand, trace fines
30	112					
31	111	MCA		17	SM	GRAVELLY SILTY SAND (SM) brown, medium dense, wet, medium to coarse grained sand, fine gravel with some coarse gravel
32	110					
33	109					
34	108					
35	107				GM	SILTY SANDY GRAVEL (GM) brown to yellow brown, dense, wet, with locally clean gravel lenses
36	106	MCA		30		
37	105					
38	104					
39	103					
40	102					little to no coarse gravel
41	101	SPT		25		
42	100					
43	99					

LABORATORY TEST DATA

MOISTURE CONTENT (%)	DRY DENSITY (pcf)	FINES (%)	TYPE of TEST	UNCONFINED STRENGTH (tsf)	SHEAR STRENGTH (ksf)	PLASTICITY LL	PLASTICITY PI

Boring terminated at a depth of 41.5 feet below existing ground surface.
MCA and SPT blow counts converted to SPT N60 values using conversion factors of 0.6 and 1.0, respectively.

SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING
sage
INTEGRATING EARTH & STRUCTURE

Project No: 07-082.02

Figure: A-3

DRAFT

FIGURE A-4 – LOGS OF TEST PITS TP1 THROUGH TP8

Test Pit Number	Depth (feet)	Soil Classification	Soil Description
TP1 (El. 126.0)	0' – 1'	SILTY GRAVEL (GM)	brown, loose to medium dense, dry with some sand, fine to coarse gravel, with organics
	1' – 6'	SANDY GRAVEL (GW)	brown, loose, moist to 3.5', wet below 3.5', primarily fine gravel with some coarse gravel, medium to coarse sand, with fines; Laboratory Gradation: 64.3% gravel, 35.4% sand, 0.3% fines Groundwater encountered at El. 122.8'
TP2 (El. 128.3)	0' – 0.5'	SILTY GRAVEL (GM)	brown, loose to medium dense, dry, with some sand, fine to coarse gravel, with organics
	0.5' – 3.5'	SANDY GRAVEL (GW – GM)	brown, loose, dry to moist, primarily fine gravel with some coarse gravel, medium to coarse sand, trace fines, clean gravel interbeds locally, estimate 50% gravel (40% fine, 10% coarse), 45% sand, 5% fines
	3.5' – 10'	GRAVELLY SAND (SW)	brown gray, medium dense, moist to 6.5', wet below 6.5', medium to coarse grained sand, gravel primarily fine with some coarse, trace fines; Laboratory Gradation: 37.7% gravels, 61.7% sand, 0.6% fines Groundwater encountered at El. 121.8'
TP3 (El. 131.1)	0' – 0.5'	GRAVELLY SILT (ML)	brown, soft to medium stiff, dry, with some sand, fine to coarse gravel, with organics
	0' – 3.0'	SANDY GRAVEL (GW – GM)	brown, loose to medium dense, dry, primarily fine gravel with some coarse gravel, medium to coarse sand, trace fines, clean gravel interbeds locally ,estimate 60% gravel (50% fine, 10% coarse), 35% sand, 5% fines
	3.0' – 4.5'	SAND WITH GRAVEL (SP)	brown, loose, dry to moist, medium grained sand, with fine to coarse gravel, some organics/roots, estimate 70% sand, 30% gravel
	4.5' – 12'	GRAVELLY SAND (SW)	brown gray, medium dense, moist to 8.5', wet below 8.5', medium to coarse grained sand, fine to coarse gravel, trace fines, estimate 60% sand, 35% gravel (25% fine, 10% coarse), 5% fines Groundwater encountered at El. 122.6'

DRAFT

TP4 (El. 126.6)	0' – 4'	GRAVELLY CLAY (CL)	brown, medium stiff, dry to moist, with some sand, fine to coarse gravel, with organics
	4' – 11'	SANDY GRAVEL (GW – GM)	brown gray, medium dense, moist to 4.4', wet below 4.4', primarily coarse grained sand with medium grained sand, fine to coarse gravel, trace fines, estimate 35% sand, 55% gravel (35% fine, 20% coarse), 10% fines, trace cobble Groundwater encountered at El. 122.2'
TP5 (El. 119.2)	0' – 10'	SANDY GRAVEL (GW –GM)	brown gray, loose to medium dense, moist, wet below 2.5', fine to coarse gravel, medium to coarse sand, trace cobbles (up to 6"), traces fines, estimate 60% gravel (40% fine, 20% coarse), 30% sand, 5% cobbles, 5% fines Groundwater encountered at El. 117.6'
TP6 (El. 118.5)	0' – 10.5'	SANDY GRAVEL (GW – GM)	brown gray, loose to medium dense, moist, wet below 2.4', fine to coarse gravel, medium to coarse sand, trace cobbles (up to 10"), trace fines; Laboratory Gradation: 64.4% gravel, 35.1% sand, 0.5% fines CLAYEY SAND (SC) interbed at ~10', medium grained, increased clay content locally, estimate interbed is less than 0.5' thick Groundwater encountered at El. 115.9'
TP7 (El. 121.4)	0' – 3.8'	SANDY GRAVEL (GW)	brown gray, loose to medium dense, moist, fine to coarse gravel, medium to coarse sand, trace fines, estimate 60% gravel (40% fine, 20% coarse), 35% sand, 5% fines
	3.8' – 5.5'	SAND (SP)	olive brown, loose to medium dense, moist, medium grained sand, trace coarse grained sand and fine gravel
	5.5' – 13.5'	SANDY GRAVEL (GW – GM)	brown gray, loose to medium dense, moist, wet below 6', fine to coarse gravel, medium to coarse sand, trace fines, trace cobbles, cobbles up to 6", estimate: 50% gravel (30% fine, 20%), 40% sand, 5% cobbles, 5% fines Groundwater encountered at El. 115.5'
TP8 (El. 118.0)	0' – 9'	SANDY GRAVEL (GW)	brown gray, loose to medium dense, dry in upper 1.5', moist 1.5' – 3.1', wet below 3.1', fine to coarse gravel, medium to coarse sand, trace fines (<5%), no cobbles observed, thin (~3") clean gravel (fine) lenses visible in upper 3' where pit can be safely accessed, increased sand content locally, estimate 50% gravel (30% fine, 20% coarse), 45+% sand, <5% fines Groundwater encountered at El. 114.9'

APPENDIX B
Laboratory Test Results

B.1 Laboratory Testing

Representative soil samples obtained from the borings were reviewed in our office to confirm field classifications. Representative samples were selected and submitted for laboratory testing. Samples were selected based on how representative they were of surrounding materials. Laboratory testing was performed to determine the following properties:

- Percent Passing the No. 200 sieve (Fines Content) per ASTM D1140;
- Consolidated-Drained Direct Shear (DSCD) per ASTM D3080;
- Particle Size Analysis per ASTM D422;

LABORATORY TESTING SUMMARY

Boring/Test Pit	Laboratory Test	Approximate Samp Depth (ft)
B1	Percent Passing No. 200	21
B2	Percent Passing No. 200	5.5
B2	Direct Shear	11
TP1	Particle Size Analysis	3
TP2	Particle Size Analysis	5.5
TP6	Particle Size Analysis	6.5

The laboratory reporting sheets for the laboratory testing follow. Note that there are two Direct Shear result sheets because the test was run twice with two different normal loads on the sample. A minimum of two different normal loads are required in order to calculate cohesion and internal friction.

EARTHTEC, Inc.
GEOTECHNICAL ENGINEERS • SPECIAL INSPECTORS
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

GRAIN SIZE ANALYSIS – WASH

Project	Sage Project No. 07-082.02	Job No.	110033		
Project Name	Dry Creek Phase 3	Boring No.	B1	Sample No.	6
Tested By	RD	Depth of Sample	21.0 ft		
Reviewed By	PF	Date of Testing	9/10/10		

Before Wash		**After Wash**	
Wt. of dry sample + Container (g)	941.6	Wt. of dry sample + Container (g)	889.3
Wt. of Container (g)	143.6	Wt. of Container (g)	143.6
Wt. of dry sample (g)	798.0	Wt. of dry sample(g)	745.7

Sieve analysis and grain shape

Sieve No.	Diam. (mm)	Wt. Retained	% Retained	% Passing
#200	0.075	745.7	93.4	6.6

1830 Vernon Street, Suite 7 • Roseville, CA 95678 • (916) 786-5262 • Fax (916) 786-5263 • E-mail: earthtec@surewest.net

EARTHTEC, Inc.
GEOTECHNICAL ENGINEERS • SPECIAL INSPECTORS
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

GRAIN SIZE ANALYSIS – WASH

Project	Sage Project No. 07-082.02	Job No.	110033		
Project Name	Dry Creek Phase 3	Boring No.	B2	Sample No.	1
Tested By	RD	Depth of Sample	5.5 ft		
Reviewed By	PF	Date of Testing	9/13/10		

Before Wash		**After Wash**	
Wt. of dry sample + Container (g)	785.5	Wt. of dry sample + Container (g)	359.2
Wt. of Container (g)	125.2	Wt. of Container (g)	125.2
Wt. of dry sample (g)	660.3	Wt. of dry sample(g)	234.0

Sieve analysis and grain shape

Sieve No.	Diam. (mm)	Wt. Retained	% Retained	% Passing
#200	0.075	234.0	35.4	64.6

1830 Vernon Street, Suite 7 • Roseville, CA 95678 • (916) 786-5262 • Fax (916) 786-5263 • E-mail: earthtec@surewest.net

EARTHTEC, Inc.
GEOTECHNICAL ENGINEERS • SPECIAL INSPECTORS
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

DIRECT SHEAR TEST RESULT

(ASTM D3080)

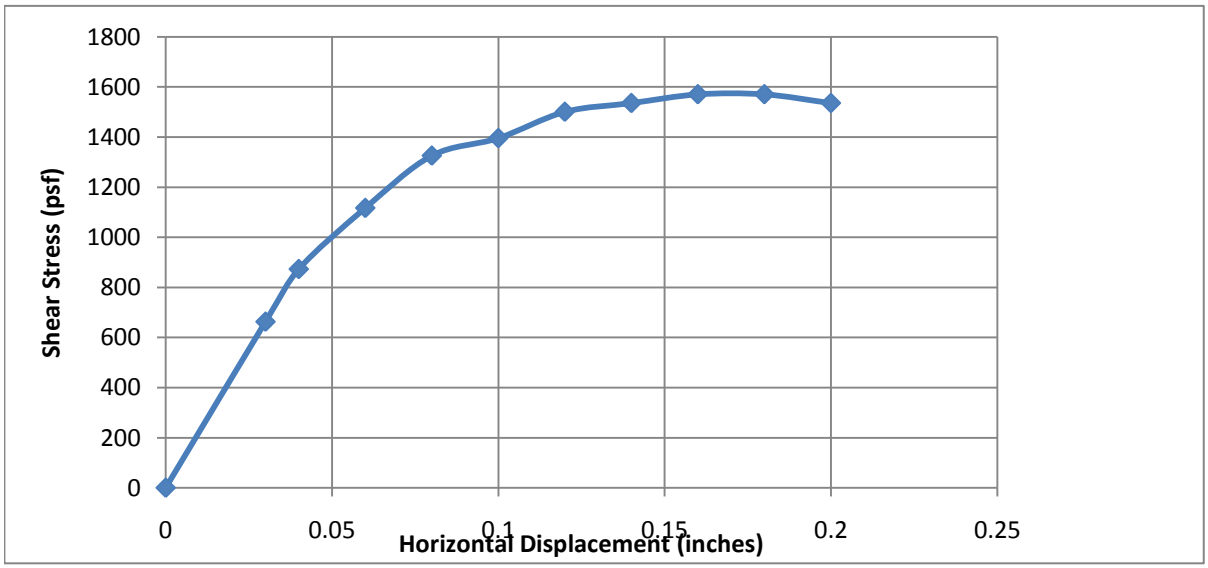
Horizontal Displacement (inches)	Shear Stress (psf)
0	0
0.03	663
0.04	873
0.06	1117
0.08	1326
0.1	1396
0.12	1501
0.14	1536
0.16	1571
0.18	1571
0.2	1536

Client: SAGE P.N. 110033
Date: 9-15-10
Sample No: B2-2 @ 11 ft.
Initial water content: 20.8 %
Final water content: 24.6 %
Dry density: 87 pcf

Sample sheared at strain rate = 0.031 in/min
Sample submerged, unconsolidated

Maximum Vert. Displacement: 0.173 inches

Normal Load = 3000 psf



1830 Vernon Street, Suite 7 • Roseville, CA 95678 • (916) 786-5262 • Fax (916) 786-5263 • E-mail: earthtec@surewest.net

EARTHTEC, Inc.
GEOTECHNICAL ENGINEERS • SPECIAL INSPECTORS
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

DIRECT SHEAR TEST RESULTS

(ASTM D3080)

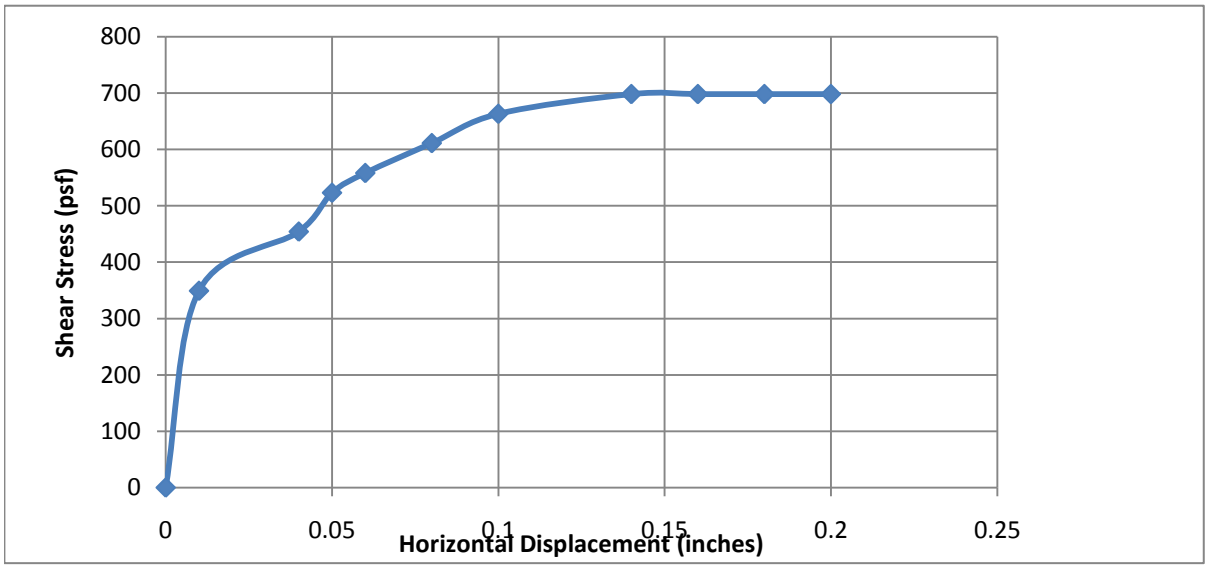
Horizontal Displacement (inches)	Shear Stress (psf)
0	0
0.01	349
0.04	454
0.05	523
0.06	558
0.08	611
0.1	663
0.14	698
0.16	698
0.18	698
0.2	698

Client: SAGE P.N. 110033
Date: 9-15-10
Sample No: B2-2 @ 11 ft.
Initial water content: 20.8 %
Final water content: 27.7%
Dry density: 88 pcf

Sample sheared at strain rate = 0.031 in/min
Sample submerged, unconsolidated

Maximum Vert. Displacement: 0.12 inches

Normal Load = 1000 psf



1830 Vernon Street, Suite 7 • Roseville, CA 95678 • (916) 786-5262 • Fax (916) 786-5263 • E-mail: earthtec@surewest.net

EARTHTEC, Inc.
GEOTECHNICAL ENGINEERS • SPECIAL INSPECTORS
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

GRAIN SIZE ANALYSIS – MECHANICAL

Project	Sage Project No. 07-082.02	Job No.	110033		
Project Name	Dry Creek Phase 3	Boring No.	TP1	Sample No.	1
Tested By	RD	Depth of Sample	3 ft		
Reviewed By	PF	Date of Testing	9/9/10		

Wt. of dry sample + Container (g)	2329.0
Wt. of Container (g)	363.0
Wt. of dry sample (g)	1966.0

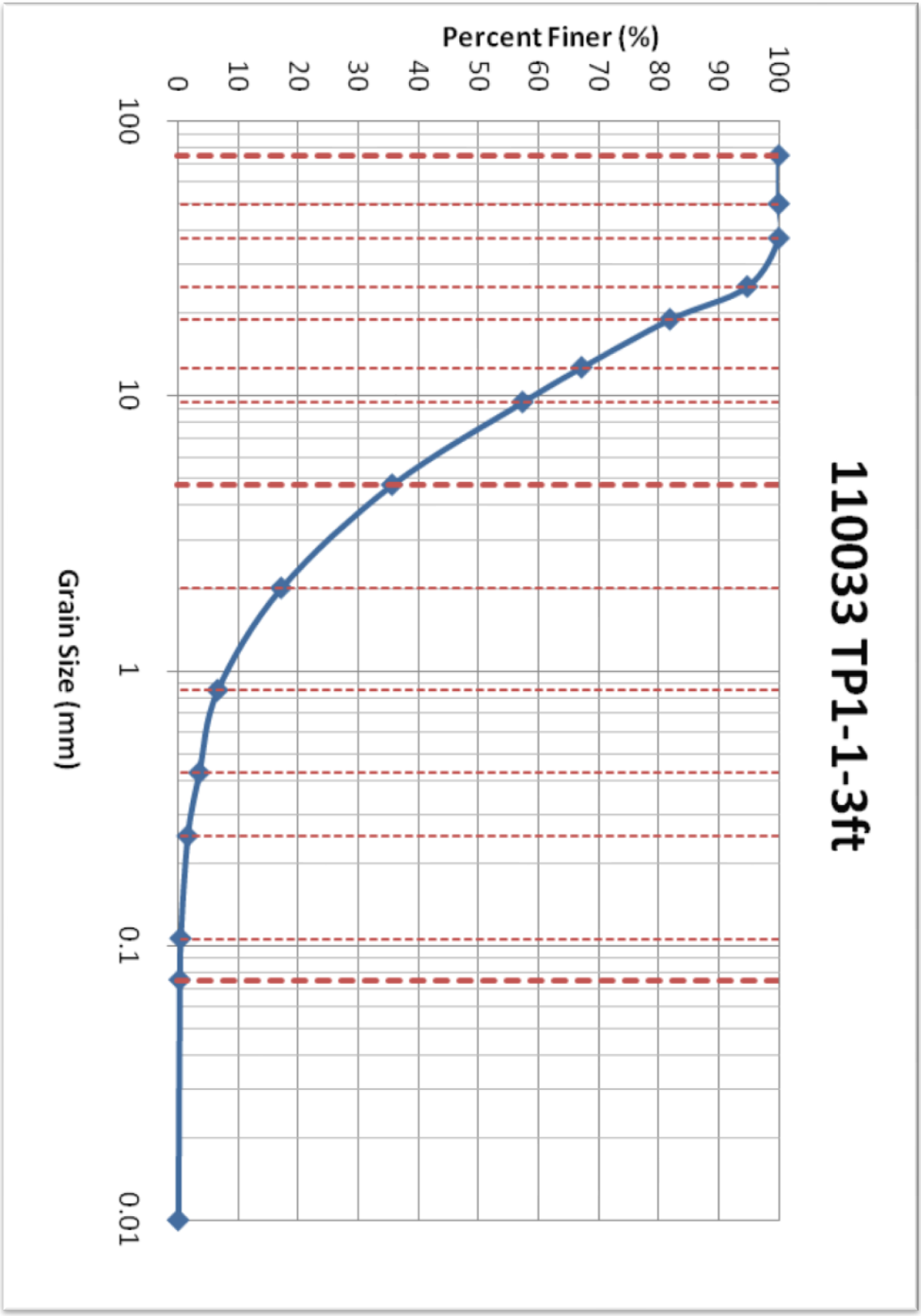
Sieve analysis and grain shape

Sieve No.	Diam. (mm)	Wt. Retained	% Retained	% Passing
3”	75.0	0	0	100.0
2”	50.0	0	0	100.0
1 ½”	37.5	0	0	100.0
1”	25.0	103	5.2	94.8
¾”	19.0	356	18.1	81.9
½”	12.7	645	32.8	67.2
3/8”	9.5	838	42.6	57.4
#4	4.75	1265	64.3	35.7
#10	2.0	1628	82.8	17.2
#20	0.850	1836	93.4	6.6
#40	0.425	1896	96.4	3.6
#60	0.250	1934	98.4	1.6
#140	0.106	1957	99.5	0.5
#200	0.075	1960	99.7	0.3
PAN		1966	100	0.0

% passing = 100 - ∑% retained

% Cobbles >3”	**% Gravel** <3” to >#4	**% Sand** <#4 to >#200	**% Silt & Clay** <#200
0	64.3	35.4	0.3

1830 Vernon Street, Suite 7 • Roseville, CA 95678 • (916) 786-5262 • Fax (916) 786-5263 • E-mail: earthtec@surewest.net



1830 Vernon Street, Suite 7 • Roseville, CA 95678 • (916) 786-5262 • Fax (916) 786-5263 • E-mail: earthtec@surewest.net

EARTHTEC, Inc.
GEOTECHNICAL ENGINEERS • SPECIAL INSPECTORS
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

GRAIN SIZE ANALYSIS – MECHANICAL

Project	Sage Project No. 07-082.02	Job No.	110033		
Project Name	Dry Creek Phase 3	Boring No.	TP2	Sample No.	1
Tested By	RD	Depth of Sample	5.5 ft		
Reviewed By	PF	Date of Testing	9/9/10		

Wt. of dry sample + Container (g)	3156.0
Wt. of Container (g)	363.0
Wt. of dry sample (g)	2793.0

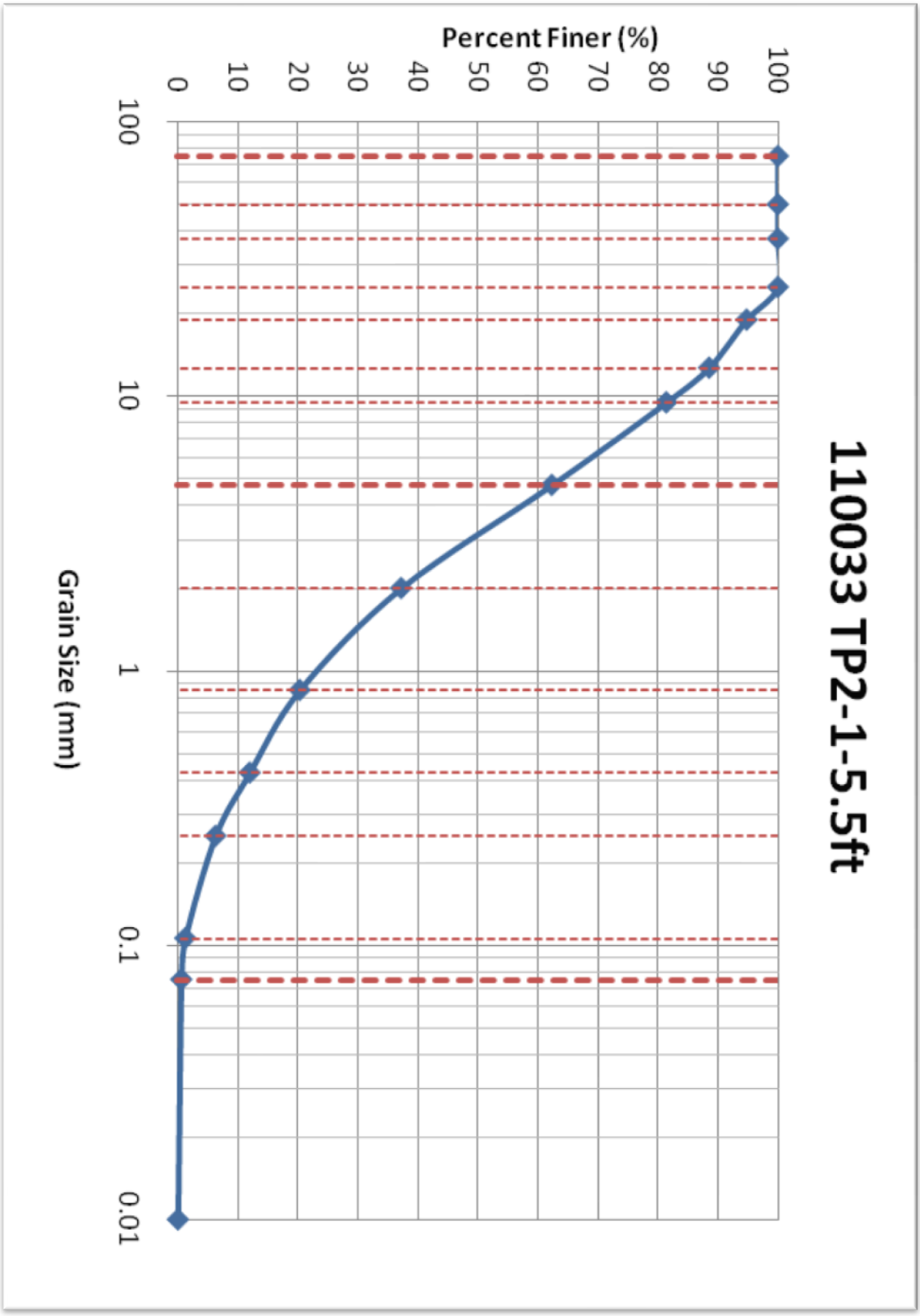
Sieve analysis and grain shape

Sieve No.	Diam. (mm)	Wt. Retained	% Retained	% Passing
3”	75.0	0	0	100.0
2”	50.0	0	0	100.0
1 ½”	37.5	0	0	100.0
1”	25.0	0	0	100.0
¾”	19.0	145	5.2	94.8
½”	12.7	320	11.4	88.5
3/8”	9.5	519	18.6	81.4
#4	4.75	1052	37.7	62.3
#10	2.0	1743	62.8	37.2
#20	0.850	2225	79.7	20.3
#40	0.425	2458	88.0	12.0
#60	0.250	2617	93.7	6.3
#140	0.106	2758	98.7	1.3
#200	0.075	2776	99.4	0.6
PAN		2792	100.0	0.0

% passing = 100 - ∑% retained

% Cobbles >3”	**% Gravel** <3” to >#4	**% Sand** <#4 to >#200	**% Silt & Clay** <#200
0	37.7	61.7	0.6

1830 Vernon Street, Suite 7 • Roseville, CA 95678 • (916) 786-5262 • Fax (916) 786-5263 • E-mail: earthtec@surewest.net



1830 Vernon Street, Suite 7 • Roseville, CA 95678 • (916) 786-5262 • Fax (916) 786-5263 • E-mail: earthtec@surewest.net

EARTHTEC, Inc.
GEOTECHNICAL ENGINEERS • SPECIAL INSPECTORS
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

GRAIN SIZE ANALYSIS – MECHANICAL

Project	Sage Project No. 07-082.02	Job No.	110033		
Project Name	Dry Creek Phase 3	Boring No.	TP6	Sample No.	1
Tested By	RD	Depth of Sample	6.5 ft		
Reviewed By	PF	Date of Testing	9/8/10		

Wt. of dry sample + Container (g)	3339.0
Wt. of Container (g)	947.0
Wt. of dry sample (g)	2392.0

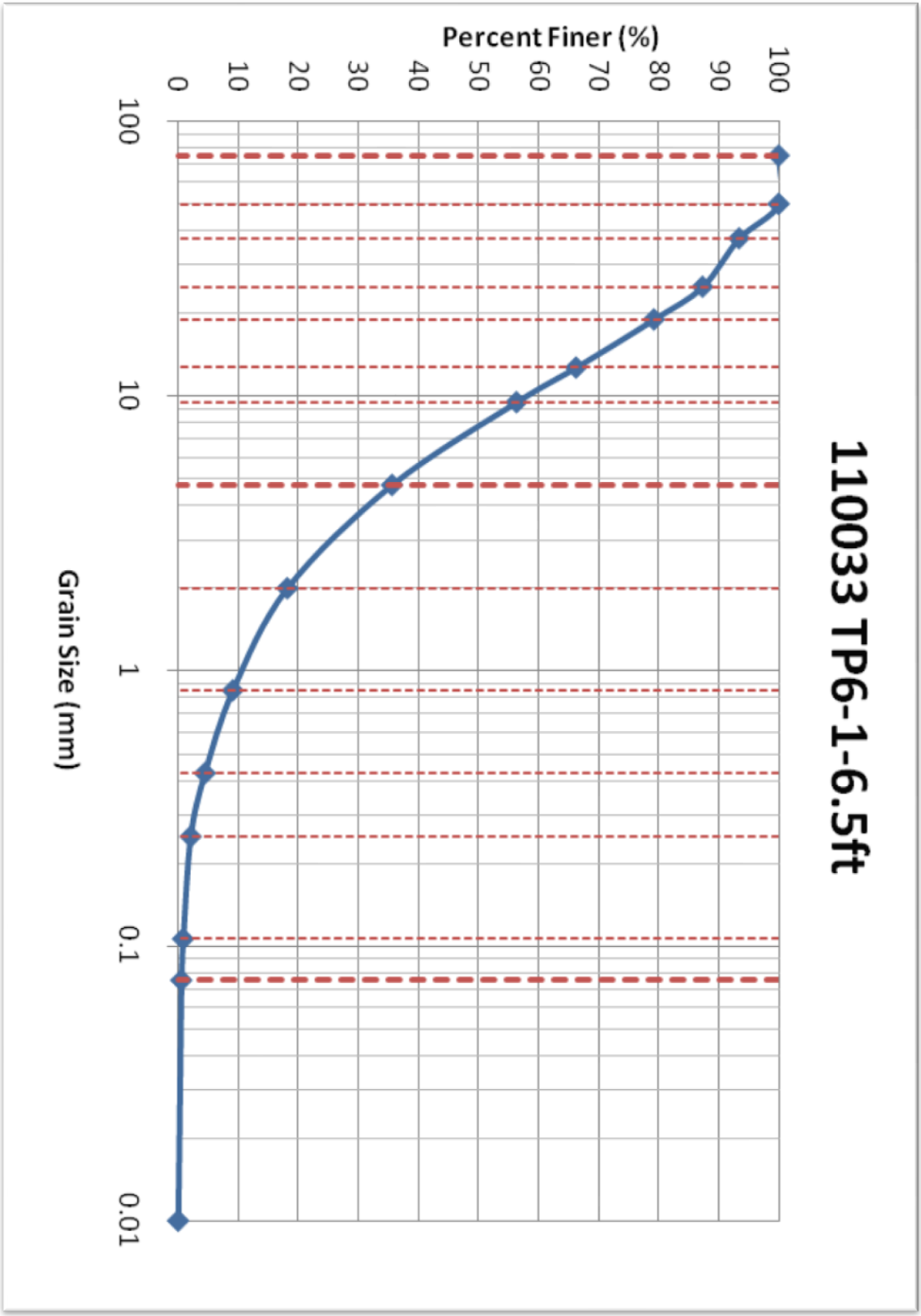
Sieve analysis and grain shape

Sieve No.	Diam. (mm)	Wt. Retained	% Retained	% Passing
3”	75.0	0	0.0	100.0
2”	50.0	0	0.0	100.0
1 ½”	37.5	159	6.6	93.4
1”	25.0	303	12.7	87.3
¾”	19.0	497	20.8	79.2
½”	12.7	807	33.7	66.3
3/8”	9.5	1044	43.6	56.4
#4	4.75	1540	64.4	35.6
#10	2.0	1957	81.8	18.2
#20	0.850	2174	90.9	9.1
#40	0.425	2285	95.5	4.5
#60	0.250	2342	97.9	2.1
#140	0.106	2372	99.2	0.8
#200	0.075	2379	99.5	0.5
PAN		2392	100.0	0.0

% passing = 100 - ∑% retained

% Cobbles >3”	**% Gravel** <3” to >#4	**% Sand** <#4 to >#200	**% Silt & Clay** <#200
0	64.4	35.1	0.5

1830 Vernon Street, Suite 7 • Roseville, CA 95678 • (916) 786-5262 • Fax (916) 786-5263 • E-mail: earthtec@surewest.net



1830 Vernon Street, Suite 7 • Roseville, CA 95678 • (916) 786-5262 • Fax (916) 786-5263 • E-mail: earthtec@surewest.net

APPENDIX C
Geophysical Survey Report

NORCAL GEOPHYSICAL CONSULTANTS, INC.

November 09, 2010

Mr. Drew G. Kennedy
Sanders & Associates Geostructural Engineering
4180 Douglas Blvd., Ste. 100
Granite Bay, CA 95746

Subject: Seismic Refraction Survey
Dry Creek Habitat Enhancement Demonstration Project
Off Channel Enhancement Area D, Demonstration Reach
Sonoma County, California
NORCAL Job # 10-916.04

Dear Mr. Kennedy:

This report presents the findings of a seismic refraction (SR) survey performed by NORCAL Geophysical Consultants, Inc. along Dry Creek in Sonoma County, CA. The survey was performed on October 20, 2010 by NORCAL Professional Geophysicists William E. Black and Donald J. Kirker, and geophysical technician David Spaulding. Logistical support was provided by Drew Kennedy of Sanders & Associates Geostructural Engineering (SAGE).

1.0 SITE DESCRIPTION AND PURPOSE

The geophysical survey was conducted in the "Off Channel Enhancement Area D" of the Demonstration Reach of Dry Creek. It is located approximately 6 miles downstream of the Warm Springs Dam on the Seghesio Parcel. The site comprises a relatively flat river cut terrace that is heavily vegetated. The parcel is accessed by a gravel/dirt road from an adjacent vineyard north of the creek.

The local geology, as indicated by SAGE, consists of alluvium (interbedded clays, silt, sand, and gravel) over Great Valley Complex sedimentary bedrock (sandstone, siltstone, and shale).

The seismic refraction survey was conducted along one line, as shown on Plate 1. It is designated as Line 1-1 and trends along the north bank of Dry Creek. Surface elevations along Line 1-1 range from 127- to 131-ft above mean sea level (msl).

The purpose of the SR survey was to obtain seismic refraction data to aid in evaluating the thickness of overburden and the depth and excavation characteristics (rippability) of the bedrock. We understand that this information will be used in conjunction with other geotechnical investigations to plan for the construction of backwater ponds and channels associated with habitat enhancements along the creek.

2.0 METHODOLOGY

The SR method is used to determine the compressional velocity of subsurface materials. The seismic velocity of fill, sediments, and rock are dependent on physical properties such as compaction, density, hardness, and induration. However, other factors such as bedding, fracturing, and saturation also affect seismic velocity. Typically, low velocities are indicative of loose soil, poorly compacted fill material, poorly to semi-consolidated sediments, and deeply weathered and highly fractured rock. Moderate velocities are usually indicative of dense and highly compacted sediments and fill, and/or moderately weathered and moderately fractured rock. High velocities are indicative of slightly weathered to unweathered rock with little fracturing. It should be noted that apparent velocities can be affected by the orientation of bedding planes with respect to the direction of the seismic profile. Apparent velocities of rock are typically slower when measured along lines oriented perpendicular to bedding planes of steeply dipping rock, than those measured along lines oriented parallel. A more detailed description of the SR methodology is provided in Appendix A.

3.0 FIELD INVESTIGATIONS

We obtained seismic refraction data along a single transect, designated as Line 1-1 on Plate 1. The line is 246 feet long and is located along the north bank of Dry Creek. It consists of two overlapping spreads that each comprises 24 geophones and three shot points distributed in a collinear array. The geophones were coupled to the ground surface at 6 foot intervals. Two of the shot points were located 6 feet beyond the end geophones of each spread. The third shot point was positioned in the center of the spread.

The SR data were recorded using a Geometrics ***Geode***, 24-bit digital seismic recording system and Oyo Geospace digital-grade geophones with a natural frequency of 10-Hz. We produced seismic energy at each shot point by striking an aluminum plate, placed on the ground surface, with a 16-pound sledge hammer. An accelerometer attached to the hammer transmitted a triggering pulse to the seismograph each time the plate was struck. The resulting travel time data were recorded on a seismograph and processed to generate seismic velocity cross-sections. A more detailed description of data acquisition and analysis procedures are also provided in Appendix A.

4.0 RESULTS

The results of the seismic refraction survey are illustrated by the seismic velocity profile shown on Plate 2. The vertical axis represents elevation (above mean sea level) and the horizontal axis represents distance. The solid line along the top of the profile depicts the ground surface. The color contours represent seismic velocities according to the color scale shown at the bottom of the section.

The profile shown on Plate 2 indicates seismic velocities that range from about 1,000- to over 6,800-ft/s. Since ground truth from borings is not available for comparison to the detected seismic

velocities shown along Line 1, our interpretation of these velocities is based on our observations of local geological conditions evident from nearby rock outcrops and our experience from past seismic surveys. Therefore, we interpret velocities ranging from 1,000 to about 3,000 ft/s (purple to dark blue) as representing surficial soils and unconsolidated sediments. Velocities ranging from 3,000 to 5,000 ft/s (green) are consistent with semi-consolidated sediments, saturated alluvium, and/or highly weathered/fractured bedrock. Velocities of over 5,000 ft/s represent moderately weathered and/or fractured rock. Plate 2 shows that the bedrock is very shallow at the northwest end (less than 2 ft deep) and increases to a depth of about 9-ft at the southeast end.

5.0 EXCAVATION CHARACTERISTICS (Rippability)

The interpreted bedrock exhibits velocities that range from 5,000 to over 6,800 ft/s. Seismic velocity charts relating seismic velocity and excavation characteristics have been developed from field tests by others. These charts list the seismic velocity of various types of rock and their relative ease of excavation using different types of rippers. Caterpillar Tractor Company publishes a performance manual that lists ripper performance charts for the D8L, D9L, and D11L tractors. The following information in Table A was obtained from a performance chart for a D9L Ripper:

Table A: D9L Ripper Performance Chart

PERFORMANCE	ROCK TYPE	VELOCITY RANGE (ft/s)
Rippable	Sedimentary	< 6,400 to 7,800
	Igneous	< 6,700 to 7,600
	Metamorphic	< 7,200 to 7,300
Marginally Rippable	Sedimentary	6,400 to 9,700
	Igneous	6,700 to 8,600
	Metamorphic	7,200 to 9,200
Non-rippable	Sedimentary	> 8,600 to 9,700
	Igneous	> 8,000 to 8,700
	Metamorphic	> 9,000 to 9,200

According to the D9L Ripper Performance chart above, velocities of 5,000 to 6,800 ft/s are consistent with rock that is rippable to marginally rippable. This information should only be used as a general guide, however, as many other factors should also be considered. These factors include rock jointing and fracture patterns, the experience of the equipment operator, and the equipment and excavation methods selected. Also, the computed velocities measured along each profile are an average for each layer, and that the data analysis routine assumes that the velocity of subsurface

materials increase with depth. Therefore, there may be localized zones within each layer where the velocities may be higher or lower than indicated. This is especially true in areas where bedrock is highly bedded and steeply dipping. Also, if a layer has velocities that are slower than those of the material above it, the slower layer will not be resolved. Since the accuracy of our findings is subject to these limitations, it should be noted that subsurface conditions may vary slightly from those depicted in the final results. A more detailed discussion of the limitations with regard to the seismic refraction method is presented in Appendix A.

6.0 STANDARD OF CARE

The scope of NORCAL's services for this project consisted of using geophysical methods to characterize the subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the standard of care ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.

We appreciate having the opportunity to provide you with this information.

Respectfully,

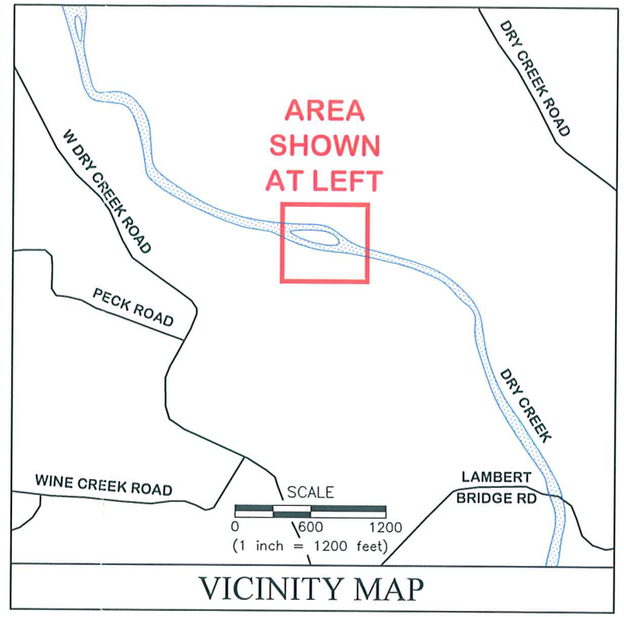
NORCAL Geophysical Consultants, Inc.

Donald J. Kirker

Donald J. Kirker
Professional Geophysicist, PGp-997

DJK/tt

Enclosures: Plates 1 and 2
Appendix A Seismic Refraction Survey



VICINITY MAP

SCALE

0 30 60 120

(1 inch = 60 feet)

LEGEND

	SEISMIC REFRACTION PROFILE LOCATION

NORCAL

SITE LOCATION MAP
OFF CHANNEL ENHANCEMENT AREA D
DEMONSTRATION REACH – SEGHESIO PARCEL

LOCATION: DRY CREEK, HEALDSBURG, CALIFORNIA

CLIENT: SAGE

JOB #: 10-916.04

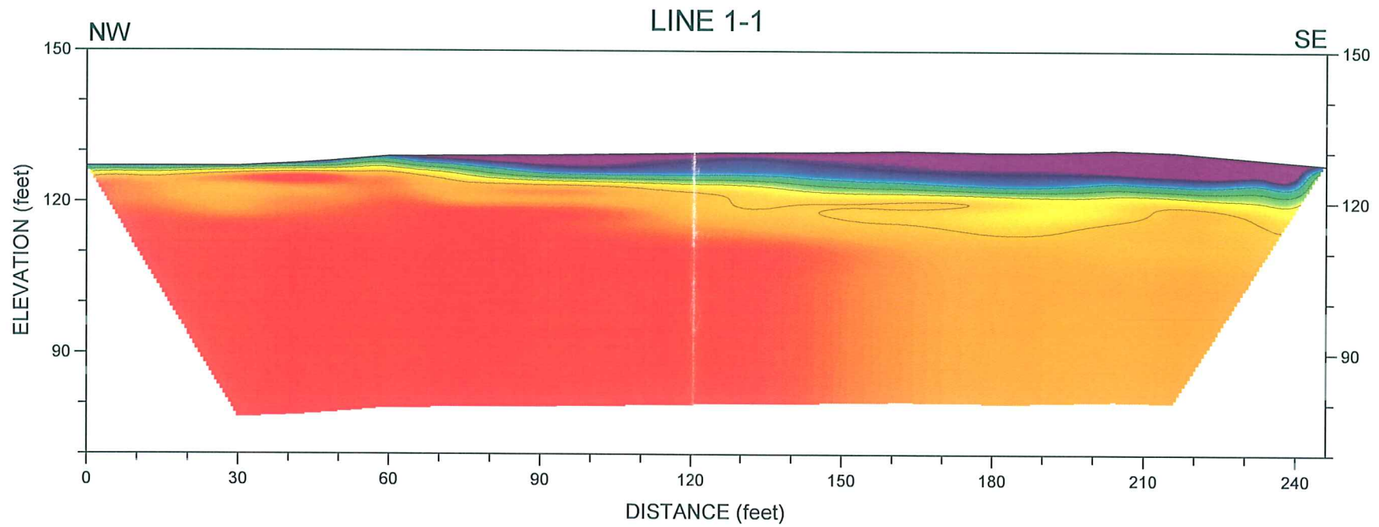
NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: NOV. 2010

DRAWN BY: G.RANDALL

APPROVED BY: DJK

PLATE 1



SEISMIC VELOCITY

1000 2000 3000 4000 5000 6000 7000

(feet/second)

SCALE

0 30 60

(1 inch = 30 feet)

NORCAL

SEISMIC REFRACTION PROFILE - LINE 1-1
OFF CHANNEL ENHANCEMENT AREA D
DEMONSTRATION REACH - SEGHESIO PARCEL

LOCATION: DRY CREEK, HEALDSBURG, CALIFORNIA

CLIENT: SAGE

JOB #: 10-916.04

NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: NOV. 2010

DRAWN BY: G.RANDALL

APPROVED BY: DJK

PLATE 2

Appendix A

SEISMIC REFRACTION SURVEY

Appendix A

SEISMIC REFRACTION (SR)

Methodology

The seismic refraction method provides information regarding the seismic velocity structure of the subsurface. An impulsive (mechanical or explosive) source is used to produce compressional (P) wave seismic energy. The P-waves propagate into the earth and are refracted along interfaces caused by an increase in velocity. A portion of the P-wave energy is refracted back to the surface where it is detected by sensors (geophones) that are coupled to the ground surface in a collinear array (spread). The detected signals are recorded on a multi-channel seismograph and are analyzed to determine the shot point-to-geophone travel times. These data can be used along with the corresponding shot point-to-geophone distances to determine the depth, thickness, and velocity of subsurface seismic layers.

The seismic refraction technique is based on several assumptions. Paramount among these are:

1) that seismic velocity increases with depth, and,
2) that the velocity of each seismic layer is uniform over the length of the given spread.

In cases where these assumptions do not hold, the accuracy of the technique decreases. For example, if a low velocity layer occurs between two layers of higher velocity, the low velocity layer will not be detected and the depth to the underlying high velocity layer will be erroneously large. Also, if the velocity of a seismic layer varies laterally within a spread, those variations will be interpreted as fluctuations in the elevation of the underlying seismic layer.

Instrumentation

Data acquisition is initiated along each SR line by producing seismic energy using a mechanical source. Mechanical sources produce energy by impacting a metal strike plate on the ground surface with either a 12-16 pound sledge hammer or an elastic-band driven weight drop. The resulting seismic wave forms are recorded using a Geometrics 24-channel engineering seismograph and Mark Products geophones with a natural frequency of 10 Hz. The data are recorded on hard copy records (seismograms) as well as on computer disks for future processing. The seismograms display the amount of time it takes for a compression (P) wave to travel from a given shot point to each geophone in a spread.

Data Analysis

The seismic data are downloaded to a computer and processed using the program ***Seisimager*** by Geometrics, Inc. This is an interactive program that is used to determine the shot point to geophone travel times, and to compute a 2D model based on those times. Once the travel times for a given line are determined, the programs time-term algorithm is used to compute a preliminary 2D seismic model. This model is then used as input for the programs tomographic routine. Using this procedure, the program divides the starting model into a network of cells and assigns velocities to those cells based on the starting model. The program then traces the refracted seismic travel paths through

those cells and computes the associated travel times. It then compares the computed travel times with the measured times and adjusts the velocities of the appropriate cells to improve the fit. The software is programmed to continue this procedure for twenty iterations. Typically, at the end of the twenty iterations the travel times associated with the computed model match the observed travel times to an accuracy of one milli-second (mS) or better. Once a satisfactory model is computed, the software contours the model velocities to produce seismic velocity vs. depth and distance cross-sections (profiles).

Limitations

In general, there are limitations unique to the SR method. These limitations are primarily based on assumptions that are made by the data analysis routine. First, the data analysis routine assumes that the velocities along the length of each spread are uniform. If there are localized zones within each layer where the velocities are higher or lower than indicated, the analysis routine will interpret these zones as changes in the surface topography of the underlying layer. A zone of higher velocity material would be interpreted as a low in the surface of the underlying layer. Zones of lower velocity material would be interpreted as a high in the underlying layer.

Second, the data analysis routine assumes that the velocity of subsurface materials increase with depth. Therefore, if a layer exhibits velocities that are slower than those of the material above it, the slower layer will not be resolved. Also, a velocity layer may simply be too thin to be detected. Due to these and other limitations inherent to the SR method, the results of the SR survey should be considered only as approximations of the subsurface conditions. The actual conditions may vary locally.

APPENDIX E
Dry Creek Habitat Enhancement Demonstration Project Mitigation Monitoring Plan

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
Draft Mitigation Monitoring Plan

In compliance with Section 21081.6 of the California Environmental Quality Act, the Sonoma County Water Agency (Water Agency) had prepared this Mitigation Monitoring Plan (MMP) for the Dry Creek Habitat Enhancement Project. All mitigation measures proposed in the Dry Creek Habitat Enhancement Demonstration Project Initial Study and Mitigated Negative Declaration (IS/Mitigated Negative Declaration) have been included in the MMP. Each mitigation measure and the method of monitoring or verifying the completion of the measure is described in the MMP. Upon approval of the MMP by the Water Agency's Board of Directors, each mitigation measure will be entered onto one the Water Agency's Mitigation Monitoring Report forms (MMR) and the mitigation measure will be entered into the Water Agency's Mitigation Monitoring Inventory Database. A sample MMR is provided in Exhibit A (which was prepared for another project). Before monitoring of a specific mitigation measure is required, the MMR will be forwarded by the Water Agency's Environmental Resources Section to the Water Agency department and/or staff responsible for monitoring.

Various Water Agency departments/staff members responsible for monitoring or verification of project mitigation measures and their general areas of responsibility are as follows:

The **Project Engineer** is responsible for project design.

The **Technical Writing Section** is responsible for preparation of project specifications.

The **Construction Inspection Section** is responsible for enforcement of the provisions of the project specifications during the construction period.

The **Environmental Resources Section** is responsible for preparation of the MMP, for informing the various departments of their mitigation responsibilities, for distribution of the appropriate reporting forms, for maintenance of the Database that tracks the status of mitigation measures, and for logging and evaluating the effectiveness of the mitigation measures. The Environmental Resources Section is also responsible for implementing and monitoring of some of the mitigation measures.

The **Right-of-Way Section** is responsible for coordinating with private property owners for acquisition of property or temporary and/or permanent easements; and for coordinating any issues concerning property rights with property owners.

The **Operations and Maintenance Division** is responsible for implementation of mitigation measures during the operation and maintenance phase of the project.

The Water Agency's **Board of Directors** approves and adopts the MMP and approves the project specifications.

The following is a description of the project's mitigation measures and the required monitoring/verification. Mitigation measure numbers correspond to the numbers presented in the Initial Study Environmental Checklist.

AIR QUALITY

Mitigation Measure DCHED-1*: The project specifications will require the contractor to comply with the dust control provisions of the Sonoma County Water Agency's Standard Contract Documents and theNorthern Sonoma County Air Pollution Control District's Rule 430 that regulate fugitive dust emissions. Measures to reduce dust emissions may include, but are not limited to: sprinkling unpaved construction areas with water; covering trucks hauling dirt; limiting dust generating activities during periods of high winds (greater than 15 miles per hour); replacing ground cover in disturbed areas as soon as possible; enclosing, covering, watering, or applying soil binders to exposed stock piles; removing earth tracked onto neighboring paved roads at least once daily; and limiting equipment speed to 10 miles per hour in unpaved areas.*

___	Project Engineer	_X_	Technical Writing	
_X_	Construction Inspection	___	Right-of-Way	
___	Environmental Resources	___	Operations	and
		___	Maintenance	

Monitoring: The mitigation measure will be considered effective when the project specifications have included the above provisions and when construction is completed in compliance with the project specifications. Monitoring will terminate upon completion of construction.

Mitigation Measure DCHED-2: *The project specifications will require that all construction vehicles and equipment emission levels meet current air quality standards and that idling time for all heavy equipment be minimized to reduce on-site emissions.*

___	Project Engineer	_X_	Technical Writing	
_X_	Construction Inspection	___	Right-of-Way	
___	Environmental Resources	___	Operations	and
		___	Maintenance	

Monitoring: The mitigation measure will be considered effective when the project specifications have included the above provisions and when construction is completed in compliance with the project specifications. Monitoring will terminate upon completion of construction.

BIOLOGICAL RESOURCES

Mitigation Measure DCHED-3: *During dewatering activities, fish located within the project site would be removed and relocated to appropriate habitat downstream of the project site. Qualified fisheries biologists, using methods approved by the National Marine Fisheries Service and California Department of Fish and Game, would perform the fish rescue and relocation.*

_X_	Project Engineer	___	Technical Writing	
_X_	Construction Inspection	___	Right-of-Way	
_X_	Environmental Resources	___	Operations	and
		___	Maintenance	

Monitoring: The mitigation measure will be considered effective when fish rescue operations have been implemented and fish have been successfully removed from the project site. Monitoring will terminate upon completion of construction.

Mitigation Measure DCHED-4: *Prior to beginning construction activities, pre-construction surveys will be performed within the project site. Should foothill yellow-legged frog or northwestern pond turtle be found within the construction area, individuals will be relocated by a qualified biologist to an area of appropriate habitat outside of the construction area.*

X	Project Engineer	___	Technical Writing	
X	Construction Inspection	___	Right-of-Way	
X	Environmental Resources	___	Operations	and
___		___	Maintenance	

Monitoring: The mitigation measure will be considered effective when pre-construction surveys have been completed and target species have been successfully removed from the project site. Monitoring will terminate upon completion of construction.

Mitigation Measure DCHED-5: *Prior to beginning construction activities, pre-construction surveys will be performed within the project site to determine the presence of special status species nests. If special status species nests are encountered within the project site, a nest protection zone will be defined, and physical barriers such as fencing will be installed to prevent construction equipment from disturbing the nest. Nests will be monitored weekly during construction activities, and protection measures or construction activities will be modified as necessary.*

.

X	Project Engineer	___	Technical Writing	
X	Construction Inspection	___	Right-of-Way	
X	Environmental Resources	___	Operations	and
___		___	Maintenance	

Monitoring: The mitigation measure will be considered effective when pre-construction surveys have been completed and protection measures have been implemented to protect nests, and/or when disturbance or destruction of nests have been avoided. Monitoring will terminate upon completion of construction.

Mitigation Measure DCHED-6: *The Water Agency will prepare and implement a revegetation plan to mitigate the loss of native riparian vegetation. Recontoured banks will be seeded and revegetated. Erosion control fabric will be placed on all exposed banks to prevent erosion. Plant species selected for revegetation will be based upon surveys of riparian habitat along Dry Creek upstream and downstream of the project site. Planting requirements in the revegetation plan will be based upon species composition and density recommendations associated with the overall habitat enhancement design for the project. The final revegetation plan will include details regarding planting, implementation, maintenance, and monitoring.*

X	Project Engineer	___	Technical Writing
X	Construction Inspection	X	Right-of-Way
X	Environmental Resources	___	Operations and Maintenance

Monitoring: The mitigation measure will be considered effective when the revegetation plan has been designed and implemented. Monitoring will terminate 5 years after installation of plants.

CULTURAL RESOURCES

Mitigation Measure DCHED-7: *The project specifications will require the contractor to comply with the Sonoma County Water Agency's Standard Contract Documents regarding the discovery of cultural resources. The Water Agency Construction Inspector and construction personnel will be notified of the possibility of encountering archaeological materials during project construction. The project specifications will provide that if discovery is made of items of historical, archaeological or paleontological interest, the contractor will immediately cease all work activities in the area of discovery. Archaeological indicators may include, but are not limited to, dwelling sites, locally darkened soils, stone implements or other artifacts, fragments of glass or ceramics, animal bones, human bones, and fossils. After cessation of excavation, the contractor will immediately contact the Water Agency's Construction Inspector. The contractor will not resume work until authorization is received from the Construction Inspector. If archaeological indicators are discovered during construction, the Water Agency will retain the services of a qualified professional archaeologist to evaluate the significance of the items prior to resuming any activities that could impact the site. If it is determined that the find is unique under CEQA and/or potentially eligible for listing in the California Register, and the site cannot be avoided, an archaeologist shall provide a research design and excavation plan outlining recovery of the resource, analysis, and reporting of the find. The research design and excavation plan will be submitted to the Water Agency's Construction Inspection Section and approved by the Water Agency prior to construction being resumed.*

X	Project Engineer	X	Technical Writing
X	Construction Inspection	___	Right-of-Way
	Environmental Resources		Operations and Maintenance
___		___	

Monitoring: The mitigation measure will be considered effective if the contractor identifies a potential cultural resource site and construction is halted at the site until an evaluation of the site's significance can be made. Monitoring will terminate upon completion of construction.

HAZARDS AND HAZARDOUS MATERIALS

Mitigation Measure DCHED-8: *The project specifications will require the contractor to comply with the Sonoma County Water Agency's Standard Contract Documents to protect the project area from being contaminated by the accidental release of any hazardous materials and/or wastes. Disposal of all hazardous materials will be in compliance with all current hazardous waste disposal laws. The construction contractor will contact the local fire agency and the Sonoma County Department of Environmental Health for any site-specific requirements regarding hazardous materials or hazardous waste containment or handling.*

___	Project Engineer	_X_	Technical Writing	
_X_	Construction Inspection	___	Right-of-Way	
___	Environmental Resources	___	Operations	and
		___	Maintenance	

Monitoring: The mitigation measure will be considered effective when the project specifications have included the above provisions and when construction is completed in compliance with the project specifications. Monitoring will terminate upon completion of construction and acceptance of contractor's work by the Water Agency.

Mitigation Measure DCHED-9: *The project specifications will require the contractor to prepare a Safety Plan in accordance with the Sonoma County Water Agency's Standard Contract Documents. If hazardous materials are encountered during construction activities, the contractor will be required to halt construction immediately and notify the Water Agency's Construction Inspection Section. Disposal of all hazardous materials will be in compliance with all applicable hazardous waste disposal laws.*

___	Project Engineer	_X_	Technical Writing	
_X_	Construction Inspection	___	Right-of-Way	
___	Environmental Resources	___	Operations	and
		___	Maintenance	

Monitoring: The mitigation measure will be considered effective when the project specifications have included the above provisions and when construction is completed in compliance with the project specifications. Monitoring will terminate upon completion of construction.

NOISE

Mitigation Measure DCHED-10: *The project specifications will require the contractor to confine construction activity on Monday through Friday to the hours between 7:00 am to 5:00 pm, on Saturday from 8:00 am to 5:00 pm, and to prohibit construction on Sundays or holidays. The project specifications will also require that all equipment and vehicles used for construction be maintained in good mechanical condition and have engine mufflers installed.*

___	Project Engineer	_X_	Technical Writing	
_X_	Construction Inspection	___	Right-of-Way	
___	Environmental Resources	___	Operations	and
		___	Maintenance	

Monitoring: The mitigation measure will be considered effective when the project specifications have included the above provisions and when construction is completed in compliance with the project specifications. Monitoring will terminate upon completion of construction.

Exhibit A. Mitigation Monitoring Report Sample
SONOMA COUNTY WATER AGENCY MITIGATION MONITORING REPORT

Project Name: Starr Creek Drainage Improvements **Report No.:** SCDI-4B

Project Type: ___ Water Supply X Flood Control ___ Sanitation ___ Other

Inspection/Verification Date: April 20, 1994

Inspection/Verification Performed By: Patty Clark Flugum, Susan Kuehn

(print name and initial)

(division/department) Technical Writing Section

Report Prepared By: Patty Clark Flugum

Impact Type: AIR

Mitigation Measure: The Technical Writing Section staff will verify that the specifications include the following provision. The Project specifications shall require the contractor(s) to comply with the dust control provisions of the *Standard Specifications for Public Works Construction* and any requirements of the Bay Area Air Quality Management District.

Mitigation Measure Status: Complete

Section 2.15, ENVIRONMENTAL PROTECTION

Subsection 2.15.2, Cleanup, Dust, and Air Pollution Control (in specs)

Exceptions From Mitigation Measures Described Above: none

Remaining Work Needed To Complete Mitigation Measure: none

Estimated Date For Completion of Mitigation: August 31, 1993

Mitigation Monitoring Report Due Date: September 30, 1993

To be filled out by the Environmental Resources Section:

Date sent to division/department: _____

Date returned to ECS: May 2, 1994

Date entered into MMP database & project binder: May 5, 1994

Entered into MMP database by: RTW

Date next Mitigation Report is required: N/A