Nevada Wetlands
Priority Conservation Plan

Technical Review Draft
January 2006

Nevada Natural Heritage Program

Edited by Ed Skudlarek

O the luxury of good sweet water to a thoroughly thirsty traveler! How little do we value the daily common bounties of Providence! For the past few days a draught of pure cold water has been prized at its true value…only the real absence of our comforts that causes us to estimate them at their full value…We are encamped at the head of the outlet from Carson Lake into the sink of Carson, where our fuel is dried rush. This outlet is about 50 feet wide and 3 or 4 feet deep, and voids the lake rapidly into its sink, which is some 10 to 15 miles to the northeast of us. The water is of a rather whitish, milky cast, and though not very lively, is yet quite good. The Carson River to the northwest, where it empties into the lake, can be seen quite distinctly, marked out by its line of green cottonwoods.

Report Of Explorations Across The Great Basin Of The Territory Of Utah
For A Direct Wagon-Route From Camp Floyd To Genoa, In Carson Valley
Captain J.H. Simpson
June 1859

Photograph by Scott J. Hein ©

Carson Lake Stilts

The Stillwater National Wildlife Refuge (SNWR) and nearby Carson Lake contain the largest marsh in Nevada and are important sanctuaries for migratory and other waterfowl. The marsh is maintained mostly by irrigation-return flow drained from agricultural fields in the Fallon area. Elevated concentrations of potentially toxic trace elements have been found in the drain water, bottom sediment, and biota.

Irrigation Drainage in and Near Stillwater Wildlife Management Area
U.S. Geological Survey
March 2003

Cover Photo. Franklin Lake marshland, August 1987, third drought year. Wetland grasses bear witness to the lake hidden below the surface in an unconfined aquifer. Drought-induced change in a wetland plant community is common. Glenn Clemmer photo.

NEVADA WETLANDS PRIORITY CONSERVATION PLAN

CONTENTS

NOTE TO TECHNICAL REVIEW DRAFT READERS

The Nevada Natural Heritage Program (NNHP) is preparing the Nevada Wetland Priority Conservation Plan (NvWP) in association with the Nevada Division of State Parks (NDSP) and the Nevada Department of Wildlife (NDOW). The preparation of this plan was financed in part through a planning grant from the National Park Service, Department of the Interior, under the provisions of the Land and Water Conservation Fund Act (L&WCF) of 1965 (Public Law 88-578, as amended), and, in part through a grant from the Environmental Protection Agency, under the provisions of the Wetland Program Development Grant Program (authorized in Section 104(b)(3) of the Clean Water Act). The NvWP is an element of the Nevada Statewide Comprehensive Outdoor Recreation Plan (SCORP), updated by the NDSP in 2003. Section 301, Emergency Wetlands Resources Act of 1986 (EWRA) directs states to maintain a wetland conservation plan element of its SCORP every five years to maintain eligibility for federal L&WCF grants. In recent years, the NDSP has received over $1 million annually from the L&WCF. The NDSP uses the grants to acquire or develop land and water for outdoor recreation, including natural and cultural resources. Half of the state's L&WCF allocation is shared with counties and municipalities for local projects.

The EWRA specifies the NvWP must: 1) be consistent with the National Wetlands Priority Conservation Plan, prepared by the U.S. Fish and Wildlife Service (FWS); 2) provide evidence of consultation with the state agency responsible for fish and wildlife; and, 3) identify wetland conservation priorities based on a comparative evaluation of losses and gains, threats, and functions and values, and the alternative strategies for conservation of priority wetlands. The key outputs are: an assessment of the conservation status of wetlands in Nevada; the state's list of priority (vulnerable and valuable) wetlands; and, strategies state agencies can employ to conserve priority wetlands.

The NvWP supplements other strategic initiatives: the Nevada Comprehensive Wildlife Conservation Strategy, prepared by the NDOW, and the Nevada Wetland Information System and GIS, a project initiated by the Nevada Division of Environmental Protection for the water quality planning program. The report compiles information useful to state resource agencies, public land managers, federal regulatory agencies, local governments, and conservation organizations seeking to secure wetlands and the galaxy of interdependent natural resources. Finally, the process, hopefully, will foster continuous, coordinated planning to protect and restore Nevada's wetlands.

The process of preparing the NvWP was initiated in October 2002, fifteen years after completion of the previous statewide wetland plan. The NNHP began the process with a workshop attended by people engaged in various facets of wetland resource management, representing over twenty government, industry, and nonprofit conservation organizations. Participants helped frame the contents of the NvWP and provided guidance on various information sources. The group advised the wetland plan be broad-based – it should highlight the relationship between the condition of wetlands to wildlife, native fishes, watershed, water quality, biodiversity and other important functions and services so that the resulting wetland priorities would be comprehensive and inclusive. We also learned that accessibility and consistency of wetland data would be a difficult challenge encountered with various agencies. The period following the 2002 workshop, was devoted to research, analysis, and writing the preliminary draft plan. The preliminary draft NvWP was submitted in 2005 to agencies that are funding the project or will determine the acceptability of the plan. Revisions were incorporated, and the Technical Review Draft prepared.

Preparation of the Technical Review Draft constitutes the first part of a major task in the NvWP development process. The sequence of subsequent tasks is outlined below.

Winter 2005/06. Distribute, take in comments, and revise Technical Review Draft;
Spring 2006. Develop wetland priority recommendations with technical advisory group, and prepare Public Review Draft;
Summer 2006. Distribute, take in comments on wetland priority recommendations and wetland conservation issues and strategies, and revise the draft; and,
Autumn 2006. Complete the final NvWP and submit it to the U.S. Fish and Wildlife Service and National Park Service for acceptance. Make the final NvWP available for public use.

More information may be obtained by contacting the NNHP Wetland Planner by phone (775-684-2907), e-mail (skudlarek@heritage.nv.gov), or in writing (Nevada Natural Heritage Program, 901 S. Stewart Street, Suite 5002, Carson City, NV, 89701).

PLAN SETTING

A wetland priority conservation plan was prepared in 1988 by Nevada Division of State Parks and Nevada Department of Wildlife. Since that time, population growth, land and water use, and wetland policies have changed markedly. And, knowledge of wetland functions has expanded. Studies show wetlands kept in good working order lead to productive, self-sustaining ecosystems and watersheds. We can marvel over recovery or restoration project sites where formerly decadent aquatic and terrestrial habitats now host flourishing populations of native fishes and wildlife, or are rife with palatable forage and browse. A wetland is an efficient meld of form and function that defies human replication. A place we know for its clear stream edged by meadow sod, shaded by cottonwood or aspen, inhabited by chirping, flying, buzzing, hopping, slithering, sprinting, floating, furry, and slime coated creatures is the same place where floods are deflated, mudflows coagulated, wildfires hindered; where fishers, hunters, campers, hikers, and watchers of wildlife congregate – a place where the web of life, food chain, and small wonders overflow onto arid uplands. These vital goods and services accrue to one and all, today and thereafter, to the extent we are circumspect and generous in their use and conservation. The fact is, wetlands are disappearing and falling into disrepair, as we tend still to undervalue or overlook the important place wetlands occupy in our lives.

Water-reliant habitats are rare and variable, more so where the Sierra Nevada rain shadow dictates precipitation and high desert sun hastens evaporation. Wetlands are limited first by natural aridity and second by imposed aridity, where land use thins out water and water-adapted vegetation resources too much. The heydays of homesteading, desert land entry, and reclamation have passed, but federal colonization programs remain imprinted on the landscape and in views of wetland worth. Water diversion and development, grazing, road-building, mining, urban and rural land subdivision, farming, logging, and motorized backcountry travel are conducted in a less wanton fashion today, but the increases in these land use activities exceed gains accrued through conservation actions. An oft-quoted wetland loss estimate from the 1970's suggests Nevada's pre-settlement wetland resource base has been halved. The best professional estimate by experienced experts holds that wetland losses are much greater. Vegetated wetlands occupy less than one percent of the land surface. Securing the remainder is a serious, difficult challenge.

The population and economy is growing by leaps and bounds. Of utmost concern is the management of limited water resources to meet human and natural needs. In basins intensively developed for urban, irrigated farming, or mining land uses, both surface and groundwater supplies are fully claimed. The rush is on to acquire agricultural water rights and tap dwindling unappropriated groundwater reserves. State water law requires that a water right must be held to secure water supplies for natural wetlands and water bodies. Acquiring water rights for natural beneficial uses is often competitive, costly, and controversial. More people today may prize wetlands for wildlife, recreation, water quality, and other benefits; but maintaining them remains contentious.

National trends indicate some states are making headway toward a balance between wetland gains and losses. The U.S. Fish and Wildlife Service's ten-year trend report covering the 1986 to 1997 period shows countrywide improvement in the annualized acreage loss rate, as do Natural Resources Conservation Service estimations for the nation's nonfederal farm wetlands. Winning strategies include federal and state programs to acquire wetland tracts, conservation easements, and water rights; public land policies that prioritize riparian and ecosystem management; federal Clean Water Act regulations that restrain and mitigate wetland development; plans for the recovery of threatened and endangered species; and the grassroots movement channeled by land conservancy actions of nonprofit organizations. Recent federal policy and funding changes will likely setback wetland recovery efforts.

The data from resource agencies and researchers are not sufficiently comprehensive to certify gains or losses. The body of available information does not allow us to assert the declining trend has halted. Pressures on the resource are mounting with growth in population and associated land and water development. Some counties use public financed programs to acquire wetlands mainly for public recreation, but defer the resolution of questionable wetland development proposals to federal regulatory action. Nevada lacks a purposive effort to plug protection program gaps, such as "isolated" wetlands not covered by Clean Water Act regulation. Federal agency data, to the extent obtainable, suggests participation in conservation incentive programs is low. Soft spots in wetland conservation strategies are evident in the breadth of state resource agency concerns with water quality; floodplain development; watershed condition; wildlife diversity and critical habitat; imperiled plants and animals; and, invasive nonnative plants and animals. The prospects for our wetland heritage appear to hinge on state leadership.

TABLES, FIGURES, and APPENDICES

PART 1. THE CONSERVATION STATUS OF THE WETLANDS OF NEVADA

Overview

Wetlands of Nevada are rare and profoundly vital to desert-dwelling communities, whether wild or human. Here the heavens dole out precipitation in miserly quantities, and the parched land is ill suited to hold onto it. Strikingly lush against the drab shrub-stubbled slopes that blanket this overwhelmingly arid state, wetlands would still be invaluable if their only purpose were to proclaim the presence of water. But the scattered meadows, marshes, and riparian zones mean much more to us than pretty places that display the richest diversity of life in Nevada. Wetlands are where Nature rolls up her shirtsleeves and gets down to the hard work of replenishing essential resources we consume and cleaning our messes. While resilient to natural disturbances, wetlands are fragile in the hands of humans, particularly vulnerable to resource uses that tend to amplify desert conditions and advance the power of erosion. Wetland habitats cover less than one percent of Nevada's 70.7 million acre spread. Arid climate and tilted topography set natural limits on wetlands, but their depleted condition is imposed by extravagant use, reckless encroachment, and excessive manipulation of water, stream, and watershed resources.

Wetland habitats exemplify the wondrous way that Nature intricately weaves together appealing form and essential function. Some people are lured to wetlands by the exuberance of life, cooling shade and water, to photograph shimmering shooting star and monkey face reflections, to watch trout rise or take the bait, to revel in birdsong, or to feel a deeper connection to the rhyme and rhythm of the natural order of things. Others measure wetlands for their inestimable natural utility to, for instance, restock food chains and preserve webs of life; cleanse water and recycle pollutants; protect communities from floods and augment precious water supplies; or produce foodstuff. Wetlands, adapted and resilient to the harsh and capricious environment of the Basin and Range region, fair poorly where subject to human disturbance. Since Peter Skene Ogden, Jedediah Smith, and John C. Fremont trod the riparian corridors of our major and minor river systems, the states' wetland heritage has deteriorated drastically. More than half of Nevada's vegetated wetlands are gone. Protection programs and conservation actions have slowed the nation's rate of wetland loss, but annually hundreds of thousands of acres disappear. Realizing we have yet to reach the low point of our wetland stewardship is troubling indeed.

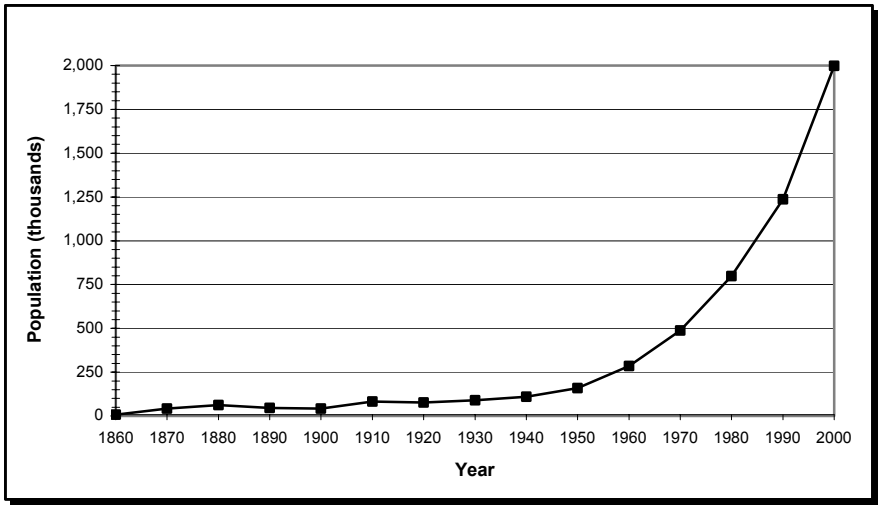
Priority Desert Sanctuaries. Preston Big Springs, White River System

Nevada is full of desert valleys and arid ranges of hills in which springs provide the only perennial water source. Riparian and marsh habitats associated with the scattered pools or pool/brook systems offer sanctuary and sustenance to a great variety of terrestrial animals, in addition to wetland birds, amphibians, and mammals. Strips of riparian vegetation buffer inhabitants of aquatic ecosystems. Where land and water use has altered the hydrology or vegetation of isolated spring systems, a variety of indigenous fishes, amphibians, aquatic invertebrates, and plant are at risk. Among the imperiled taxa at Preston Big Springs are Preston White River springfish (Crenichthys baileyi albivallis) and White River Valley springsnail (Pyrgulopsis sathos). The upper White River drainage is one of several valleys in which numerous spring resources are seriously threatened by changes in hydrology and morphology. Glenn Clemmer photo

Recent actions of government and conservation organizations to protect and restore wetlands may have slowed the rate of losses. However, wetland vulnerabilities mount as the state's population approaches

three million and as federal protection policies and programs falter. Without reinforcement, state and local efforts fall short of bridging the widening gap between conservation and development. The dim prospects for our wetland legacy are manifested throughout the state. The hyper-productive riparian lining of major and minor rivers appears less like sinuous green ribbons and more like unraveled fragments in fitful disarray. Many animal and plant species live a marginalized existence in degraded isolated-stream and spring habitats, surviving so long as emergency conservation care is administered. In terminal valleys, the once-sprawling marsh and meadow complexes have been reduced to paddy field-like tracts kept on life support by wildlife managers that constantly wrangle water, often settling for supplies marginal in quantity, availability, and quality. The pulse of flow from many springs is fading or has weakened to undetectable levels in groundwater basins where pumping exceeds aquifer recharge. Waterways subject to routine over-exploitation mostly linger in a disabled condition, diminished in their capabilities to hold wetland vegetation, retain peak snowmelt without collapse, remove pollutants, shelter and nourish wildlife, or resist outbreaks of invasive, nonnative plants. Any decline in wetland coverage presents prima facie evidence that water supplies, environmental quality, and wildlife and habitats are dwindling. Indeed, the extinction of many wetland-dependent species and water bodies is a matter of history that may re-occur without appropriate measures and commitments to protection. If water is the lifeblood of Nevada, then wetlands are the organs responsible for its strong, steady circulation. To say life here pivots around water resources is not an exaggeration. Therefore, wetland conservation success or failure will be influential in our future, whether we live in a land of sufficiency or poverty, of resiliency or instability.

Figure 1.1 Nevada Population Growth, 1860 to 2000



Wetland protection efforts are less likely to be effective where the emphasis on maintaining rapid rates of population growth, economic expansion, and landscape industrialization rises head and shoulders above the importance of conserving land, water, and biological resources. Native landscapes are less likely to be maintained intact, a critical condition if wetlands are to function properly, across political boundaries if resource development and use proceeds in disjointed, laissez faire-like decision making forums. On public lands, the opportunities for recovering exhausted stream and spring riparian zones slip away where "multiple-use" translates into economic uses of natural resources being superior to their ecological uses, both of which are equally crucial to civil society. The urgency of doing more to secure and recover wetlands remains high in Nevada. Long-standing consequences of stewardship shortcomings carry over into our priority conservation concerns today. Prominent among them are depressed populations of Lahontan cutthroat trout, Sage Grouse, and other formerly wide-ranging native species; the replacement of habitats deemed critical by wildlife biologists with serial subdivisions; hundreds of stream miles impaired by erosion and nonpoint sources of pollution; proliferation and invasions of nonnative plants; and, imperilment of aquatic and wetland flora and fauna known to occur only in Nevada.

The history of wetland utilization in Nevada repeats that of colonial cultures in other arid regions. It does not begin with cultivation, irrigation, deforestation, or mining. According to archeologists, the first

colonizers arrived from Asia eleven to twelve thousand years ago, apparently when postglacial melting and pluvial conditions were transitioning to a warmer, drier climate. As basin lakes and marshes receded, the once-verdant valleys no longer supported Pleistocene megafauna, such as camel, bison, sloth, horse, and mammoth. Winnowing forces of desertification favored prickly shrubs, squat grasses, and pygmy conifers. Luxuriant vegetation of pluvial environments retreated and adapted to marginal living arrangements in the highlands and sheltered canyons. River systems, streams, lakes, and springs retracted and separated into isolated water bodies separated by arid or rugged expanses. Prehistoric peoples confronted by drought and dealing with desert-limited supplies of food and fiber left the region or reconciled lifeways to scarcer, scattered aquatic and wetland resources. Similarly, California Argonauts, inquisitive farm families, and other adventurers navigating the maze-like Basin and Range region in the 1840s soon learned the vital essence of lush, wet places. Indeed, early emigrant routes traced long established pathways that led them along stream corridors and to waterbodies concealed by the folded terrain. Barely a decade later, farm settlements were springing up in river valleys across the territory.

Carving homesteads and communities out of desert wilderness clearly required diversion of water and development in floodplains. The Desert Land Entry and Homestead Acts of 1877, granted private ownership of six hundred forty and one hundred sixty acre plots, respectively, in exchange for irrigated crop production. By 1884, eight hundred ditches had been constructed stretching over two thousand miles to irrigate one hundred fifty thousand acres (Young, 1985). Keeping more wetlands as naturally productive tracts might have remained a compatible practice with true farmers and ranchers, but imperialist land barons acquired enormous tracts of land that contained a lion's share of the state's riparian and meadow resources. As the harvest and extraction of resources expanded to industrial-scale proportions, the reckless taking of water and wetland resources became customary and lawful. Unfettered by regulation or afterthought, uncounted miles of highways, utility lines, access roads, drainage ditches, and water conveyances were constructed in floodplains. Meandering stream reaches were realigned to accommodate cultivation, townsites, mines, and ranches. Hundreds of thousands of livestock repetitively grazed montane riparian corridors and meadows in summer and moved to the lowlands in winter.

The cumulative disturbance of upland shrub-steppe, woodland, and forest communities drastically altered watershed conditions, which magnified the deterioration of wetland and aquatic habitats. For scores of years, the commercial and industrial harvesting of renewable resources available in terrestrial ecosystems occurred without restraint. In the 1930s and 1940s, scientists began taking stock of natural resource damages. Early field studies connected excessive exploitation of water, vegetation, and mineral resources to widespread watershed deterioration. Wholesale cutting of trees for structures and fuel left slopes holding pinyon-juniper woodlands and conifer forests barren. Mines workings, mill sites, access and haul roads, and waste rock piles pocked tens of thousands of hillslopes and drainage-ways. Extravagant grazing practices sheered rangelands of grass, forb, and select shrub species from salt-desert scrub to montane sagebrush-steppe communities. The expansion of irrigated farming from river valley bottoms on sagebrush benchlands, in terminal basins, and ephemeral drainages in upper tributaries added to unstable watershed conditions. Skinned of vegetative cover, organic litter, and biological crust, the soil resources lost fertility, resistance to erosion, and water holding capacity. Gullies gashed alluvial fans and meadows, stream channels gouged floodplains, and as water tables dropped lush vegetation gave way to arid upland shrub communities. Given the harsh climate and environmental conditions here, recovery of over-exploited rangeland, forest, woodland, riparian, and wetland ecosystems proceeds slowly. Enough of the landscape was subject to excessive use and abuse that today the effects are still evident, such as head-cutting tributaries, incised channels, silt-clogged river bottoms, and water quality-impaired streams.

By the 1890s, serious water use conflicts and resource deterioration arose and pressured the state legislature to bring order to the diversion and consumption of water and control the waste of aquatic and wetland resources. These early attempts to restrain excessive exploitation resulted in the foundations of water law – vesting prior water claims; encouraging formation of irrigation districts; and adopting the

"prior appropriation" doctrine as the state policy and allocation system. Another century would pass before state water law acknowledged *in situ* or "instream" beneficial use (e.g., aquatic life, recreation, wetlands), but legislators did pass laws intended to protect the quality of water from industrial and commercial activities that had severely damaged fish, waterfowl, and wildlife habitat. Weak enforcement provisions hampered implementation, and the dramatic decline in wetland habitats and wildlife continued. Not until the Dust Bowl calamity of the 1930s did the nation begin to react to the unsustainable water, soil, and vegetation use in semi-arid and arid regions. Federal legislation, such as the Taylor Grazing Act of 1934 and the Soil Conservation and Domestic Allotment Act of 1935 (declared soil erosion a national menace), sought to improve natural resources management on hundreds of millions of cropland and rangeland acres. Ironically, federal subsidies supporting wetland conversion for farm production were expanded. The earliest action to conserve wetlands was the Duck (Migratory Bird Hunting and Conservation) Stamp Act of 1934, which set up a federal mechanism to fund wetland habitat acquisition for waterfowl production. Forty more years would pass before legislators enacted comprehensive wildlife and water quality protection laws that extended to wetlands. Another twenty years passed before federal agencies were directed to integrate the "no net wetland loss" policy into resource management plans.

From the 1850s to the 1970s, the federal programs that subsidized conversion of wetland to agricultural uses and construction of dams and reservoirs for irrigation dominated national natural resource policy. The extent of the impact of these well-intentioned programs was not revealed until the late-1980s, when a state-by-state survey led by the US Fish and Wildlife Service (FWS) estimated fifty-three percent of the nation's wetlands had been lost, mainly the result of irrigation diversion, farmland conversion, and grazing (Dahl, 1990). This study, along with widely declining waterfowl populations, provided impetus to reverse federal policies in favor of protection and conservation. The FWS survey reported Nevada losses at fifty-two percent. Since the study was completed, the population of Nevada has more than doubled and the economy (i.e., gross state product) has quadrupled.

In 1987, the EPA-convened National Wetlands Policy Forum, the findings and policies of which reshaped federal strategies and goals. The key issues were:

- Federal agency policies and resource management programs were inconsistent and contradictory;
- Few states had enacted comprehensive wetland protection policies;
- Local governments had not connected land use planning with wetland conservation; and,
- Subsidies or market incentives were insufficient to interest private conservation.

The Forum recommended adoption of a national "no net wetland loss" goal to unify and focus divergent policies and programs adopted by federal agencies and a few states.

The nation establish a national wetlands protection policy to achieve no overall net loss of the nation's remaining wetlands base, as defined by acreage and function, and to restore and create wetlands, where feasible, to increase the quality and quantity of the nations wetlands resource base.

The national goal provides for flexible implementation.

Although calling for a stable and eventually increasing inventory of wetlands, the goal does not imply that individual wetlands will in every instance be untouchable or that the no-net-loss standard should be applied on an individual permit basis – only that the nation's overall wetlands base reach equilibrium between losses and gains in the short run and increase in the long term.

The national policy also stresses the importance of sharing the responsibilities of corrective actions.

The public must share with the private sector the costs of restoring and creating wetlands to achieve this goal.

In 1988, the President ordered these recommendations incorporated into the nation's "no net wetland loss" goal. It espouses principles advocated by states concerned over federal regulations – balancing conservation and development, public and private responsibility, and short and long term interests. The goal was codified in 1990 amendments to the Water Resources Development Act, in which federal agencies received direction to develop action plans for the purpose of achieving the no net wetland loss target. Fifteen years later federal programs are in place, but implementation lags due to funding shortfalls and vacillating interpretations of federal laws and court rulings. Few states, Nevada included, and few local governments have adopted clear wetland protection policies. Proponents of land and water use and development activities, therefore, receive a mixed message about the importance of working around wetlands. Furthermore, state and local governments have not taken steps to identify and inventory our most valued wetland and aquatic resources, or evaluate the adequacy of protection. A large portion of our wetland resources are "isolated" and do not qualify for federal protection. As rapid growth continues, the value of wetlands to society increases as does the urgency of protection and conservation.

Climate, Water and Wetlands

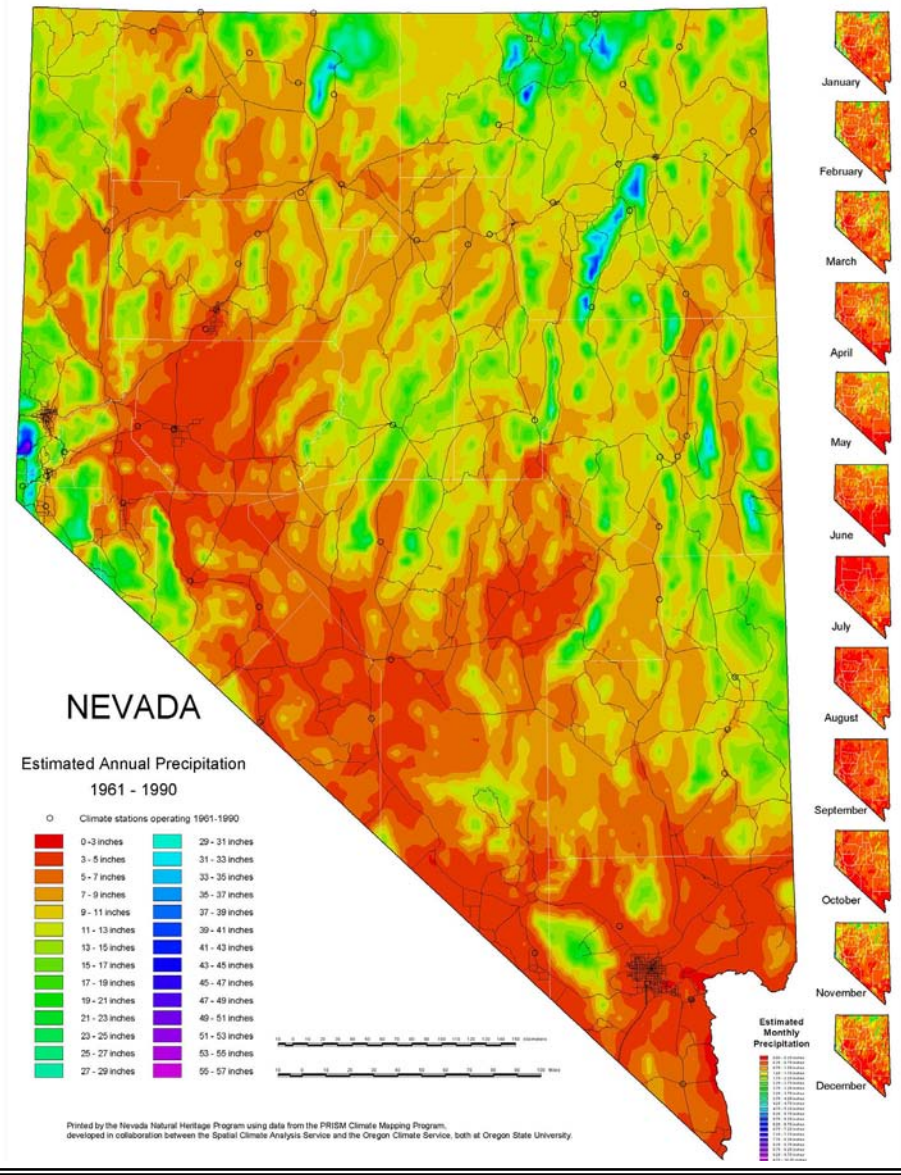
The Nevada state boundary corrals 70.7 million acres of restless, mutable Basin and Range terrain that defies easy characterization. The latitudinal span of seven degrees (about five hundred miles) and elevation spread of 400 to 13,000 feet leaves plenty of room for enormous variability. The average minimum and maximum temperatures range from 24.1 to 59.8 degrees in the north (Mountain City) and from 59.8 to 87.4 in the south (Laughlin). Geographers circumscribe 314 ranges of mountains and hills, scores of peaks attaining heights above 9,000 feet made variously of plutonic, volcanic, and sedimentary bedrock. The Nevada Ecoregion Project map delineates forty-two Level IV ecoregions (Bryce et.al., 2003), a hodgepodge of playas, lava plains and plateaus, pluvial lake and saline basins, bald and partly forested mountains, woodland, shrubland, brushland, high desert and high elevation carbonate wetlands. Hydrologists divide the state into 232 groundwater basins, most ideally formed to retain desert quantities of precipitation. The multivariate natural attributes give rise to a diversity of life zones, ecotypes, niches, flora and fauna. The crazy-quilt landscape is species rich, with nearly 3,900 plants and animals (excluding invertebrate and nonvascular plant species). Wetland resources reflect this diversification.

Nevada, however, contains more area designated as "desert" than any other state, which makes protection of wetlands all the more crucial to economic, societal, and environmental well being. An area normally receiving less than ten inches of annual precipitation or where evapotranspiration exceeds precipitation qualify as desert. The statewide average annual precipitation is nine inches and the potential for evaporation far exceeds that amount. Precipitation does, however, vary enormously – from four inches in Mojave Desert valleys to forty or more along the crests of the Ruby, Sierra Nevada, and Independence ranges. The uneven distribution of precipitation is illustrated in Figure 1.2. Enormous volumes of water evaporate from water and soil surfaces given the low humidity, intensity and duration of insolation (lack of cloud cover), and extended long warm or hot seasons. Figure 1.3 shows potential annual evaporation amounts ranging from about 2 feet in the high altitudes and latitudes to 8 feet in the Mojave Desert valleys. Annual evaporation exceeds precipitation by a factor of five in the north to 24 in the south. Just ten percent of the precipitation received is available to replenish water resources, a statewide statistic that reinforces the tenuous quality of water (Nevada Division of Water Planning, 1999). Scant precipitation, the annual drought season, and high evaporation rates are key factors contributing to the sensitive and variable nature of our aquatic and wetland ecosystems. However, wetland vegetation surrounding streams and springs cools the surface of water bodies and saturated soil, thereby reducing evaporative losses and enhancing recharge of water tables and aquifers.

The prevailing westerly wind pattern generally ensures low precipitation across the state. This occurs because the Sierra Nevada and Cascade ranges have the height and position to intercept much of the moisture passing eastward in Pacific weather systems. Semi-arid conditions do exist in the cooler,

northerly valleys of the state and also in the high altitude ranges, which more or less moderates the rain shadow effect. Terrain above 8,000 to 9,000 feet receives four to five times the annual precipitation of adjacent valleys, but the water yield benefits of higher precipitation zones are localized. Precipitation mainly arrives in the winter as rain in the lowlands and snow above. Snowmelt is the primary source of water resource replenishment, including surface and underground water bodies. The amount of precipitation fluctuates year to year. Climate statistics indicate drought (i.e., eighty percent of normal) years happen more frequently than non-drought (normal and above) years – about a 60/40 split. Spring can be an anxious time for Nevada, as the snow pack at that time sets water supply prospects for the spring-summer-fall dry season. Precipitation occurs sporadically if at all for six to eight months. Dry season convective thunderstorm events are capable of generating large volumes of runoff that cause extraordinary erosion and flooding below watersheds and hillsides cut with too many roads and jeep trails or with too much vegetation removed by grazing, wildfire, or invasive weeds.

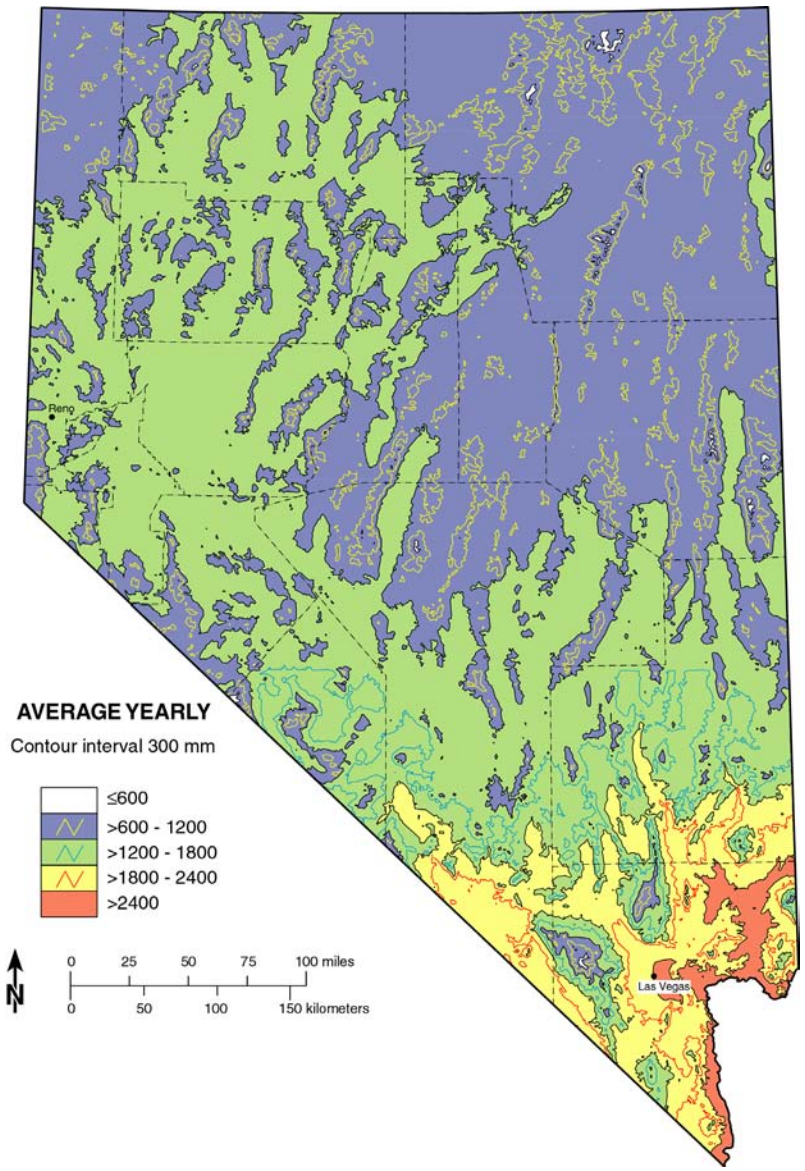
Figure 1.2 Nevada Annual Average Precipitation Map



The "normal" hydrologic cycle in the Basin and Range region begins as spring-to-summer snowmelt proceeds gradually toward a peak flow in early to mid summer, and then slowly tapers through the end of summer and into autumn. However, the whimsical climate here invalidates the notion of normal hydrologic conditions. The capacity of wetlands to detain and recharge large volumes of runoff augments drought year water supplies. Since snow is a temporary and uncertain water supply source, we can ill-afford a haphazard approach to preserving wetlands as natural storage and transmission systems; even more so now that climate data shows the temperature of higher elevation terrain is warming at an accelerated rate. Streams and springs continue to flow after rainless months in part because wetlands have trapped runoff and released it slowly to replenish surface and subsurface water bodies. As summer progresses and

snowfields dissipate, subsurface flow makes up a larger fraction of the channel flow, until base flow, or groundwater discharge conditions take over. The hydrologic benefits of wetlands become doubly pronounced during this time of the year – the augmentation of supply and reduction in evaporative losses aid in maintaining the presence of water in to the dry months. During dry years, the water table in unconfined and local aquifers recedes, resulting in the lowering of stream and local spring flow as well as habitats influenced by perched water tables. During prolonged drought, many wetlands disappear or substantially shrink. Seemingly robust aquatic and wetland resources, such as Washoe or Franklin Lake may disappear as drought tolerant plants encroach. During these times, there are changes in the species of plants dominating wetland vegetation. Some wetland areas may take on the appearance of upland plant communities, but wetland species have adapted to these conditions – the seed, rootstock, and vegetative materials necessary for re-emergence remain.

Figure1.3 Nevada Potential Evapotranspiration Map



Source: Nevada Bureau Of Mines And Geology, 1996. Report 48.
Note: 600 mm ≈ 24 in.; 1200 mm ≈ 47 in.; 1800 mm ≈ 71 in.; 2400 mm ≈ 95 in. (conversion factor ≈ 0.04 in/mm).

Generally, rainfall alone is too scanty to maintain persistent wetlands and aquatic habitats. Nevada is without "bogs" which are peat-enriched wetlands supported by precipitation (but fens, which are surface and groundwater maintained peaty wetlands, do occur in highland valleys). Rainfall does produce ephemeral wetlands that flourish during unusual storm events or wetter than normal periods that result in the inundation of playas and desert washes. This phenomenon is more apt to arise in southern Nevada during summer-monsoon periods, where amphibians, aquatic insects, and plant species have adaptations reconciled to unpredictability. For example, the Great Basin spadefoot toad (*Spea intermontanus*) is the rare case of an amphibian adapted to desert settings. The spadefoot depends on temporary wetlands for breeding and dispersal, living in burrows most of the year. Toads emerge during rainy periods to forage and breed in temporary pools. Inundated playas and pans also produce swarms of mosquitoes, stoneflies, mayflies, algae, and fairy shrimp, all-important pulses of food for bats, birds, and amphibians.

Ancient Lakes Occasion Wetlands

Nevada holds eighty-eight large playas offering solemn testimony of the magnitude of climate shift. Occasionally, the ancient lakes shrug off their deadpan expression. When snowmelt from nearby ranges (Granite Range) forms a standing pool, stirred by sunlight and warm breezes, a playa (Black Rock Desert) turns into a vibrant aquatic community. Tiny life forms emerge – brine shrimp and flies, tadpoles, zooplankton, and algae – manna for migrating birds, bat colonies, and local wildlife. Increasing warmth and salt content signals a period of reproductive haste. New banks of eggs, spores, and seeds are cached or scattered for another rainy day. Relatively little is known about the ephemeral ecology of playa wetlands. Joe FitzGerald photo (www.greatbasinnaturalhistory.org/).

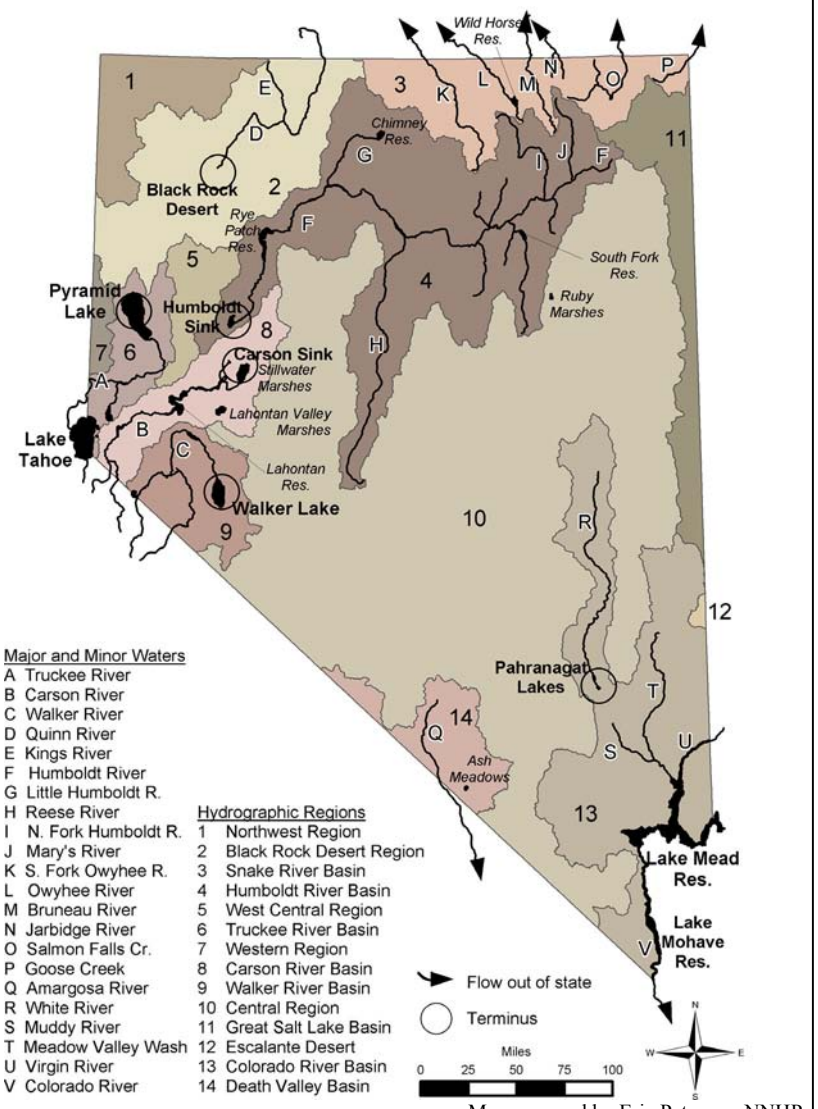
Present day aquatic and wetland habitats are miniature imprints from a much wetter period. Fifteen thousand years ago melting glaciers and a rainy (pluvial) climate produced mountain torrents that filled aquifers and basins to overflowing. The largest was Lake Lahontan, which joined seven western Nevada basins into one 5.5 million acre lake. Eighty-eight playas larger than one thousand acres are left to attest to long prevailing wet conditions in the past. The pluvial period ended about twelve thousand years ago, replaced by the long relatively warm and dry spell we are under today. Widespread changes in the composition, structure, and coverage of the vegetation contributed to profound changes in water, wildlife, and human life. Megafauna, such as the mammoth, sloth, camel, horse, and bison, were extinguished. Forests, marshes, and shallow lakes receded, replaced by drought tolerant shrubs, grasses, and pygmy conifers – dramatically altering the availability of food and shelter for animals and people. Humans, arriving in western North America at a time of transition in climate, were forced to confront a declining resource base. Archeologists, noting the absence of artifacts in the state's bio-stratigraphic record, speculate that intervals of drought so deep and prolonged that the land could not support permanent human habitation. People either established permanent population centers nearby permanent waters, or moved continually in conjunction with the procession and recession of the wet season and growing season. The ancient peoples and wildlife present today are those that adapted, evolved, or retired to niche environments, relicts from the pluvial past. Archeological investigations of sites inhabited during the past millennium have unearthed pit houses, artifacts, and tools that show our predecessors survived just as modern society does – by closely affiliating with water and wetland resources. A stark contrast, however, is our technological capabilities and willingness to massively alter the natural environment.

Wetlands At Large. Major water bodies are concentrated in the Humboldt, Truckee, Carson, Walker, and Colorado River Hydrographic Regions (river basins). The losses of wetland and riparian habitats in each are uniformly large. The flow in each major river system is fully allocated, almost entirely for off-stream uses. In years of exceptionally high flow substantial volumes of "surplus" water may be passed on to the terminal basins. Four major natural lakes and ten major reservoirs are contained in these basins. Wide ranging fluctuations in these lakes and reservoirs due to the combined effects of drought and diversions dampens the occurrence and permanence wetland vegetation. Large rivers are few, but scores of small perennial and intermittent streams carry snowmelt and spring flow down steep, narrow drainages. Mountain streams typically support stringers of riparian and meadow communities. The occurrence of expansive riparian zones along lowland stream and river reaches has dwindled, but flood events are reminders of the former shape of wetland areas in river valleys. Factors that have narrowing riparian zones include channel modification, encroaching land development, dewatering from diversions, and channel incision.

Minor rivers include the larger tributaries of the Humboldt, the Amargosa, Muddy, Virgin, Owyhee, Bruneau, Jarbidge, Salmon Falls Creek, and Quinn. Except for the Quinn River, which empties into the Black Rock Desert playa, each flows out of state (Figure 1.4). The sources of the Amargosa, Muddy, and White rivers in southern Nevada include carbonate formation spring systems. The aquatic and riparian habitats of these smaller rivers harbor many rare or imperiled fish, amphibian, and mollusk species.

The Humboldt River Basin contains the only major river that originates in Nevada. In addition to the state's longest river and most complex tributary system, the region's relatively cooler and wetter meteorological conditions support large numbers of isolated springs, creeks, lengthy stretches of riparian wetland, and fresh and alkaline marshes. The river and its robust tributaries drain an 11 million acre basin. However, a surprisingly small volume of runoff trickles into the terminal basin, with scattered intermittent or permanent marshes and pools. An extensive playa lake forms episodically. The weak constitution of the river flow and riparian zones along the lower reaches can be attributed largely to extensive irrigation. Still the river basin in total holds forty percent of the large vegetated wetlands and twenty five percent of the linear wetlands.

Figure 1.4 Hydrographic Regions Map with Major Rivers, Lakes and Reservoirs



Map prepared by Eric Peterson, NNHP

Four other major rivers originate and receive most of their flow from melting snowfields and rainfall in mountain watersheds of adjoining states. In western Nevada, the contiguous Truckee, Carson, and Walker Hydrographic Regions form a compact group of comparatively abundant water resources (Table 1.1). These river valleys and terminal basins hold the state's largest rivers, lakes, reservoirs, and marsh/meadow complexes. In a bit of natural irony, the largest lakes and marsh complexes in the state occupy the Lahontan Trough, a series of low elevation basins where annual precipitation averages four inches. Pyramid and Walker are relict terminal alkaline lakes widely considered globally rare. The Lahontan Valley marshes and meadows of the Carson Sink (augmented in wet years by resurgent alkaline marsh complexes in the adjacent Humboldt Sink) entail an internationally renowned migratory waterfowl and songbird habitat valued for its pivotal desert location in the midst of the Pacific Flyway. The rivers feeding the lakes and marshes rise more than one hundred

miles away in alpine and subalpine watersheds of the Sierra Nevada Range. Before reaching the lake, the water becomes a mixture of reused surface and groundwater, many times diverted and returned for use by the urban, agricultural, and industrial centers located along the waterway.

Table 1.1 Wetland Statistics of Major River Basins (Hydrographic Region)

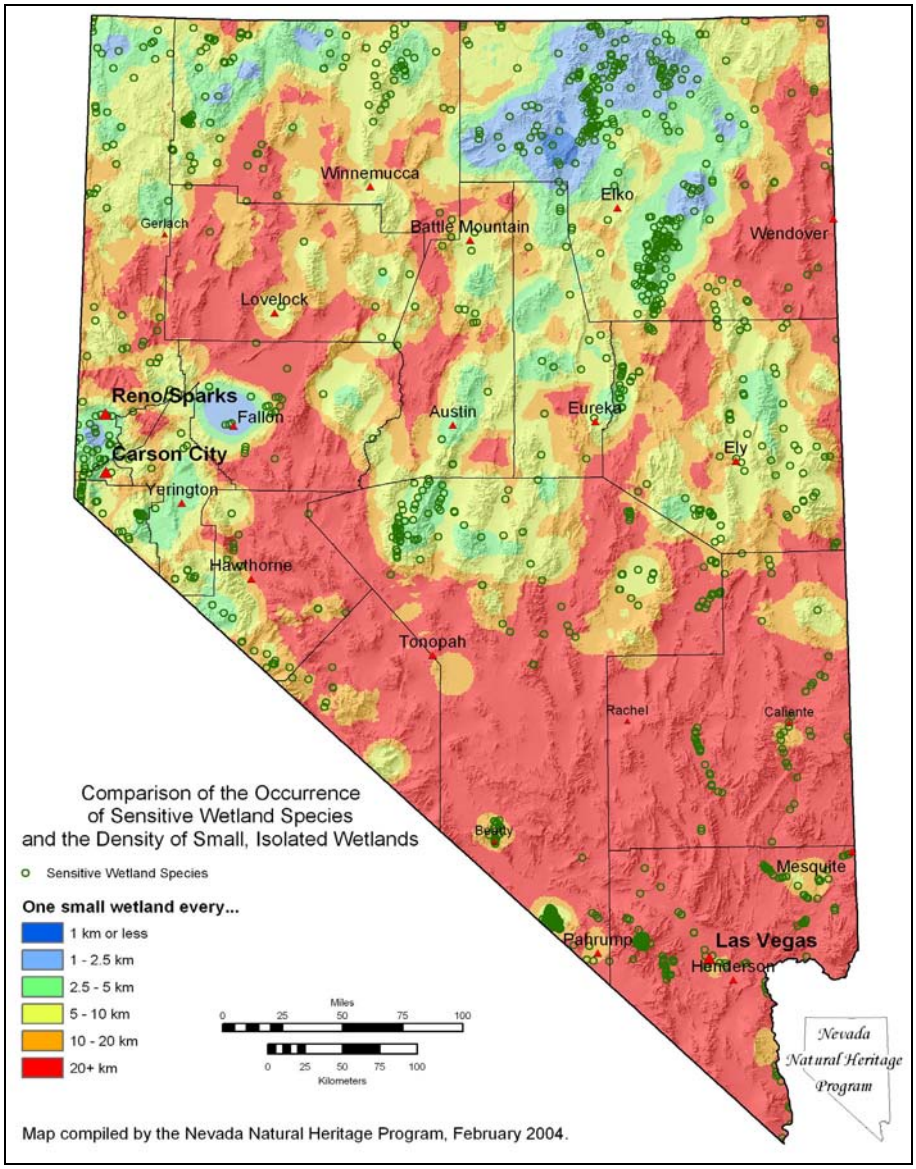
River Basin (Acres)	Major Lakes and Reservoirs	Major Tributary Streams	Open Water (Acres)	Vegetated Wetland (Acres)	Playa (Acres)	Major River Length (Miles)	Linear Wetland Miles
Carson River 2,252,936	Lahontan Reservoir	East Fork West Fork Truckee Canal	12,602	90,908	154,943	150	982
Colorado River 7,922,216	Lake Mead (Reservoir)	Virgin River Muddy River	95,794	28,178	8,764	130	2,842
Humboldt River 10,791,216	Chimney Reservoir Pitt-Taylor Reservoir Rye Patch Reservoir South Fork Reservoir	Mary's River North Fork South Fork Maggie Creek Rock Creek	16,128	328,917	12,110	310	9,441
Truckee River 1,478,670	Washoe Lake Lake Tahoe Pyramid Lake	Steamboat Creek	148,008	6,434	44,674	80	670
Walker River 1,942,946	Topaz Lake Reservoir Walker Lake Weber Reservoir	East Walker West Walker	37,809	34,756	808	125	1,394

Sources: Lake and reservoir surface area from Nevada State Water Plan (NDWP, 1999). Wetland and open water data from NWI.
Notes: Major lakes and reservoirs entail those > 1,000 surface acres. Values are for Nevada portions.

The fifth major river is the Colorado, which by the time it reaches the state border, has descended to the Mojave Desert ecoregion. The Nevada reach of the river is equal parts reservoir and stream channel. The geomorphology and ecology of the Colorado's riparian habitats, as well as those of the Nevada tributaries, are extensively altered. Minor rivers in the Colorado Hydrographic Region are fed by spring systems, some of which discharge from a region-wide carbonate aquifer. Public water suppliers in Clark and Lincoln counties have plans to divert large volumes of groundwater from the regional carbonate aquifer to support urban and industrial development. The river and tributaries, the Pahranagat, Meadow Valley Wash, Muddy, and Virgin rivers host many sensitive and rare native species. One fourth of the state's sensitive taxa and one third of the highest priority biodiversity conservation sites ranked by the Nevada Natural Heritage Program occur in association with the aquatic and wetland habitats in the Colorado River Hydrographic Region.

The Central Hydrographic Region, a vast region of internally draining basins, contains no major or minor rivers. However, numerous ranges exceed 9,000 feet and intercept substantial precipitation (twenty to thirty inches), sufficient to generate a large number of creeks and springs lined with slim riparian zones. Mountain ranges in this class include the Snake, Schell Creek, Ruby, Diamond, White Pine, Roberts, Simpson Park, Toiyabe, Toquima, and Clan Alpine massifs. The uplifted base-altitude of the region favors the valleys, many situated at elevations of 6,000 feet and higher, with a semi-arid climate and plant communities. Forty-two percent (thirty million acres) of the Nevada land mass falls within the Central Region. Small, isolated stream and wetland habitats are numerous and well distributed, in the moister northern two-thirds of the region, but the southern third is quite water limited, predominantly watered by spring systems. Of the 14 hydrographic regions, the Central is the largest and contains the most wetland features, including 450,000 acres of playa (almost half of the total) and nearly one quarter of the total linear wetland miles. More than 8,000 wetlands smaller than 40 acres dot this region, some of which are spring systems that support a large number of the state's sensitive and rare species and twenty-five highest priority conservation (or Scorecard) sites for biodiversity (NNHP, 2000).

Figure 1.5 Cluster Distribution of Wetlands Features <40 Acres Combined with Mapped Occurrences of At Risk Wetland Species



Source: Small wetland density cluster analysis by NNHP using NWI point data.
Notes: Small wetlands are features less than 40 acres, such as springs, ponds, and riparian fragments mapped by the NWI. The occurrence of wetland points per unit area is highest in blue areas, lowest in red.

The "wettest" hydrographic regions within Nevada are the Snake River Basin and Northwestern Region, in the remote volcanic uplands and plateaus of northeastern and northwestern Nevada. More precipitation and lower evapotranspiration rates are due to higher latitude and basin elevations. Valleys receive ten to twelve inches of rain and snow each year, generating a relatively high density of wetlands smaller than 40 acres and linear wetlands (Figure 1.5). The Northwestern Region drains internally into playa lakes and small reservoirs, but the Snake River Basin Region watersheds are tributaries to the Snake River in Idaho. Riparian and aspen woodlands, wet meadows, and emergent marshes are distributed throughout. Snake River tributaries rise in the Jarbidge and Independence ranges. These include the Owyhee, Bruneau, Jarbidge, and Salmon Falls, which course northward into Idaho. Wild Horse Reservoir is the largest water body (about 2,800 acres) and a popular water recreation area.

The Nevada portion of the Death Valley Basin Hydrographic Region expresses wetland resource attributes similar to the Colorado River Basin, but drier still. Spring systems fed by the regional carbonate aquifer emerge at Ash Meadows and in the Amargosa River valley. The wetlands of these sites also are biodiversity hot spots, inhabited by dozens of rare, endemic plant and animal species. Other hydrographic regions with relatively abundant and notable wetland features are the Black Rock Desert Basin Region and the Great Salt Lake Basin Region. The wetlands in the other hydrographic regions are less substantial and visible, but by no means less vital to the people and wildlife that depend upon them.

Wetland Defined and Classified

Nevada's constellations of water and wetland resources are continually shifting, dimming during droughts and flaring with the wet season. Unexploited, wetlands build up storehouses of biological capital rich and diverse enough to undergo extreme face-lifts and shape-changes in response to swings in weather conditions and natural disturbances. It is not possible to get a true sense or full appreciation of the plasticity of wetlands unless one observes their ability to expand, contract, and recreate themselves. The future of many wetland sites is determined on the basis of how it is defined or classified by regulatory and resource management agencies or landowners at a given point in time. Therefore the definition, classification system, and protocol used to describe a wetland has important ramifications.

Wetland Defined. The term wetland encompasses a variety of soggy places that we know by other names (Table 1.2). An ecologist's definition might be "lands where an excess of water is the dominant factor determining the nature of soil development and the types of animals and plant communities living at the soil surface. Wetlands span a continuum of environments where terrestrial and aquatic systems intergrade" (Cowardin et al., 1979). Three defining criteria commonly used to separate a wetland from upland and deep-water habitats are:

Table 1.2 Common Wetland Type Names and Descriptions

Bog – Peat (decomposing plant matter) accumulation dominated by moss. Receives only direct precipitation. Acidic, low nutrient water. Term has been applied to bog-like features near Jarbidge. Wildlife biologists have observed golden eagles bathing in what may be fens.
Fen – Peat accumulation dominated by sedge, reed, shrub, or forest. Receives some surface runoff and/or groundwater. Neutral pH and moderate to high nutrients. Fens are rare. In highland drainage bottoms and meadow depressions.
Marsh – Permanently or periodically inundated depressions with nutrient-rich water and emergent vegetation. Distributed throughout the state. Salty and freshwater varieties.
Playa – Shallow, seasonal ponds or lakes. Dry entirely or partially in most years. Generally of moderate to high salinity or alkalinity. Common, in terminal sinks and perched pans.
Slough – Low gradient channel with steady or seasonal water supply. Similar to oxbow. Associated with stream meanders partially to entirely disconnected from the channel. In gentle-sloped floodplain, sometimes excavated to store water for irrigation or flood control.
Swamp – Marsh-like but dominated by forested and tall shrub communities. Swamp is not a term typically applied to wetlands in Nevada. Lower riparian forests in floodplain depressions may appear swamp-like during unusual periods of prolonged inundation.
Wet Meadow – Open grassland with waterlogged soils, occasionally with seasonal standing water. Widespread from salt grass playa aprons to alpine valleys.
Spring – Small surface water body fed by groundwater discharged from aquifers. Thousands exist, due to prevalence of jointed, bedded, faulted, fractured, and porous rock formations; and impervious layers in valley fill. Unevenly distributed. Temperature and chemistry varies widely. Some springs flow into short-lived brooks or streams.
Seep – Zones of persistent or seasonal saturation associated with perched water table or aquifer discharge. Similar to a spring, but lacks surface water body. Often on slopes or slope toes. Aspen groves often occupy subsurface seep zones on hillsides and canyons.
Pond – Persistent or intermittent open water body less than 40 acres. Formed naturally in small depression or created by dredge and fill for storage of water or water containing pollutants.

- Surface and groundwater hydrology – water covers the surface or saturates the subsurface within the soil root zone during all or part of the growing season.
- Hydric soils – soils that experience and show indications of frequent, prolonged periods of saturation and low oxygen content.
- Hydrophytes – specialized plants adapted for growing in standing water or saturated soils.

The U.S. Army Corps of Engineers (ACOE) and Environmental Protection Agency (EPA) are responsible for implementation of the Clean Water Act Section 404 regulations. In a nutshell, the regulations are intended to protect the quality of certain water bodies (waters of the U.S.) by controlling dredge and fill activities in wetlands through a federal permit system. The regulatory wetland definition is:

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Federal regulatory guidance stipulates that indicators of all three criteria must be observed to determine the presence of a wetland or its boundaries. Importantly for arid regions, the regulatory guidance contained in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands cautions that most wetlands lack both standing water and waterlogged soils during at least part of the growing season (USACOE, 1987). During Nevada droughts, water may be absent from some wetlands for an entire year. The interests of the FWS in wetlands differ from the ACOE. From a biological perspective:

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes, (2) the substrate is predominantly undrained hydric soil, and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

The Federal Geographic Data Committee, which includes natural resource management and research agencies, has adopted the definition used by the FWS. However, when projects on public land require a CWA Section 404 permit, the ACOE definition takes precedence. The state legislature has defined the term wetland, but not in the context of water quality or wildlife protection. The definition, at NRS 244.388, authorizes county government to establish and operate a wetland mitigation bank.

Wetland means land that: (1) Has a predominance of hydric soil; (2) Is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions; and, (3) Under normal circumstances does support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions.

Wildlife Indicators of Intermittent Wetlands

Wetland dependent wildlife may provide an important clue to valuable intermittent or ephemeral wetland habitats. In southern Nevada, desert washes may briefly transform into essential wetland wildlife habitat during episodic summer rainfall events. For example, the widely spaced populations of red-spotted toads (*Bufo punctatus*) in Las Vegas and adjacent valleys suggest wetland conditions re-occur on irregular intervals in Mojave Desert washes. Probably widespread during the wetter Pleistocene period, toad populations persist in lower elevation spring riparian habitats. The spring habitats are isolated, separated by normally dry washes and arroyos. During exceptionally moist precipitation events, the movement of toads and may be facilitated by formation of temporary pools, seeps, springs, and streams. Dispersal is important to maintaining genetic variability and population viability. We cannot predict when surface water and saturated soil conditions will linger long enough for adults to move or young to be carried to another favorable habitat. However, we can use information about wildlife occurrences to evaluate where washes and arroyos should be managed as intermittent wetlands. In the case of red-spotted toads, land uses that interrupt or hydraulic structures that block the movement of toads may inadvertently eliminate populations.

The NDEP uses the ACOE/EPA regulatory definition to the extent the state agency has jurisdiction under CWA Section 401 to certify that a Section 404 permit issued by the ACOE will or will not impair water quality as a result of wetland disturbance activities. The NDOW uses the FWS definition for habitat management within state Wildlife Management Areas.

Particularly in Nevada, the definition used for wetland identification is crucial to retention of the resource base. Inflexible application of the ACOE criteria to identify wetlands in desert ecoregions can produce false negatives. The frequency, duration, and extent of saturated or inundated conditions decreases significantly during droughts and as a result of stream diversions and shallow groundwater pumping. Water level fluctuations of inches may substantially change the expression of wetland features at or near the surface. Small changes in surface runoff or ponding from month-to-month, season-to-season, or year-to-year may temporarily mask or alter biological and physical clues, such as the dominance of wetland plant species, soil mottles, sediment deposition, or observations of wetland-affiliated wildlife. Sagebrush may temporarily expand into a riparian meadow during a drought, for example, but die back as normal or above normal moisture conditions return. Determining the presence, boundary, and functions and values should be

done when water abundance and vegetative growth is optimal. Interannual variation in the dominant plants and reach of saturated soils can be enormous. The biological and hydrological potential of a wetland site cannot be properly characterized with a single field investigation or individual aerial photos or satellite images. Time series data are needed to fully describe the range of characteristics, ecosystem functions and socioeconomic services. However, agencies do not have the capacity to conduct periodic inventories under current funding and staffing levels. Inadequate site information can lead to unfortunate losses of wetlands and wildlife. Some wetland obligate species, such as desert-adapted amphibians, cannot breed until irregular weather events create the right conditions. Conventional wetland indicators are not useful in identifying irregularly occurring wetlands, especially in the desert drainages of southern Nevada used for urban and water developments.

Classification and Inventory of Wetlands of Nevada

Wetland conservation in Nevada is largely fragmented in the absence of a statewide classification system and inventory adapted to state-specific conditions. Variation in altitude, latitude, climate, and landform multiplies the diversity of hydrologic circumstances in which wetlands occur. The diversity of wetland plant communities is large, and given to interannual modulations by changing degrees of wetness. A comparatively large number of agencies and organizations are engaged in the management and study of wetlands, each with a somewhat different focus on the resource base and approach to their participation in management. This variability, without the common grounding of a widely accepted classification system, complicates the communication of information and coordination of priorities essential to successful statewide conservation programs. A classification system, if it gains widespread use, provides a conduit for the sharing of knowledge and data, which of course improves the chances for coordination. In fact, a statewide inventory does exist, based on the classification system used by the National Wetland Inventory, a branch of the FWS. However, the Cowardin et al. classification system, discussed in more detail below, constitutes a rudimentary system compared to that needed to capture the diversity in distribution, biological and physical characteristics, ecological functions, and socioeconomic values of the broad spectrum of wetland habitat occurring here. However, the NWI has completed an inventory of wetlands in Nevada, and although the attribute categories are broad and scale of mapping coarse, the Nevada NWI dataset provides a foundation upon which a state classification system can be overlain.

The Nevada Division of Environmental Protection (NDEP) and the Nevada Natural Heritage Program are in the midst of a phased project to develop a detailed classification system and inventory intended to meet the information needs of state resource agency and that of other agencies and organizations. The development of the Nevada Wetland Classification System (NVWET) and the Nevada Wetland Information System and GIS (NVWETIS) was co-funded by EPA and designed by wetland and GIS consultants with extensive experience in Nevada (NDEP, 2000b). The NVWET establishes a standard protocol for the collection of comprehensive site data, including attributes of the geography, hydrology, water regime, landform, biology, soils, land use activity, ecological functions, and socioeconomic services. The NVWETIS is a computerized database integrated with geospatial mapping and analytical capabilities. It is designed to archive and manage wetland site data obtained with the NVWET protocol, as well as data obtained using other legitimate methods. The NVWET and NVWETIS is still a developmental program. Agencies assisting in the process are the National Wetland Inventory (NWI) office (FWS Pacific Region), the ACOE Reno office, and the Carson City Field Office of the Bureau of Land Management (BLM). The classification system, inventory methods, and geo-database software programming were field tested in a project that generated a wetland inventory for Carson City. Since the Carson City inventory was concluded, modifications were made to the software that increased the range of wetland data sources that may be added to the database. The NNHP has encountered delays in testing the upgraded program. As soon as feasible, field investigations will be conducted using the NVWET and NVWETIS, after which data exchange partnerships with agency and other experts will be sought.

The NVWET combines classification systems developed by the FWS, NWI, and ACOE and already used in planning and regulatory applications.

- FWS Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979), based on landscape setting, water regime, land cover type, substrate;
- USACOE wetland delineation method for identification of dominant species by stratum, hydrology indicators, and hydric soil indicators (USACOE, 1987); and,
- USACOE Hydrogeomorphic Classification for Wetlands (Brinson, 1993).

In addition, the NVWET includes a generic system for describing and coding ecological functions, socioeconomic services, and modes of disturbance. The Field Data Form (Part 1 Appendix 2) outlines the attributes from these classifications and illustrates how they have been integrated.

The only statewide wetland dataset currently available was created by the NWI. An overview of the wetland classification and mapping data is presented below.

NWI Classification of Wetlands and Deepwater Habitats. The National Wetland Inventory (NWI), a special program in the Fish and Wildlife Service, has classified and inventoried Nevada wetlands using the Cowardin et.al taxonomy. The classification is hierarchical:

System
Subsystem
Class
Subclass
Dominance Types (vegetation)
Modifiers (water chemistry, regime, source)

The NWI mapped and classified Nevada wetlands at the scale of 1:250,000 using 1:58,000 scale color infrared aerial photography taken in the summer from 1980 through 1986. These maps provide only general location, type, and extent of wetlands. The coarse scale of mapping is not conducive to site specific management or regulatory activities, but provides a basis for general planning purposes. The data may be obtained at the NWI web page, http://www.nwi.fws.gov/downloads.htm. Three wetland systems are present in Nevada – Palustrine, Riverine, and Lacustrine (Marine and Estuarine omitted). NWI differentiated the wetlands by System, Subsystem, and Class. To classify wetlands according to subclasses (inorganic or organic substrate), dominance types (dominant plant species), and modifiers (water regime, water chemistry), more detailed data must be collected from site investigations. The NNHP plans to conduct field investigations and collect detailed site data, and to coordinate with others interested in developing a detailed state wetland database that will facilitate planning for the conservation of wetlands as well as associated natural resources, including watershed, wildlife, and water quality.

System and Subsystems

[P] Palustrine System - The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergents, mosses or lichens. Wetlands lacking such vegetation are also included if they exhibit all of the following characteristics:

1. Are less than 8 hectares (20 acres);
2. Do not have an active wave-formed or bedrock shoreline feature; and,
3. Have at low water a depth less than 2 meters (6.6 feet) in the deepest part of the basin.

The Palustrine System was developed to group the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie. It also includes small, shallow, permanent or intermittent water bodies (e.g., ponds). Palustrine wetlands may be situated shoreward of lakes or river channels; on river

floodplains; in isolated catchments; or on slopes. They may also occur as islands in lakes or rivers. The Palustrine System is bounded by upland or by any of the other four systems. The Palustrine System does not contain subsystems.

[R] Riverine System - The Riverine System includes all wetlands and deepwater habitats contained in natural or artificial channels periodically or continuously containing flowing water or which forms a connecting link between the two bodies of standing water. Upland islands or Palustrine wetlands may occur in the channel, but they are not part of the Riverine System.

The Riverine System is bounded by upland, by the channel bank (including natural and man-made levees), or by wetlands dominated by trees, shrubs, persistent emergents, mosses, or lichens. In braided streams, the system is bounded by the banks forming the outer limits of the depression within which braiding occurs. The Riverine System terminates at the downstream end where the channel enters a lake. It terminates at the upstream end where tributary streams originate, or where the channel leaves a lake. Springs discharging into a channel are part of the Riverine System. Where a river enters a lake, the extension of the lacustrine shoreline across the mouth of the river forms the Riverine/Lacustrine break. Oxbow lakes are placed in the Palustrine or Lacustrine Systems unless they are connected to a Riverine System by an open channel at both ends either permanently or intermittently. Differentiating systems for run-of-the-river dams is handled in the same manner as described above, with the Lacustrine System extending upstream to the contour approximating the normal spillway or pool elevation. The USGS maps or USGS Water Resources Data (stream gauge data) are used as a primary data source in determining if the riverine channel is a Perennial or Intermittent stream.

[R2] Lower Perennial Subsystem - Subsystem is characterized by low gradient and slow water velocity. Some water flows throughout the year. The substrate consists mainly of sand and mud. The floodplain is well developed. Oxygen deficits may sometimes occur.
[R3] Riverine Upper Perennial Subsystem - Subsystem is characterized by a high gradient and fast water velocity. Some water flows throughout the year. This substrate consists of rock, cobbles, or gravel with occasional patches of sand. There is very little floodplain development.
[R4] Riverine Intermittent Subsystem - Subsystem includes channels that contain flowing water only part of the year, but may contain isolated pools when the flow stops. Intermittent channels of the Riverine System are classified as Streambed. Landforms such as beaches, bars, and flats are included in the Unconsolidated Shore class.

[L] Lacustrine System - The Lacustrine System includes wetlands and deepwater habitats with all of the following characteristics:

1. Situated in a topographic depression or a dammed river channel;
2. Lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; and,
3. Total area exceeds 8 hectares (20 acres).

Four Mile Flat Playa Below Sand Mountain

Eric Peterson photo

Basins or catchments less than 8 hectares in size are included if they have at least one of the following characteristics:

1. A wave formed or bedrock feature forms all or part of the shoreline boundary; or
2. Have at low water a depth greater than 2 meters (6.6 feet) in the deepest part of the basin.

The Lacustrine System is bounded by upland or by wetland dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. Lacustrine Systems formed by damming a river channel are confined by the contour approximating normal spillway elevation or summer pool elevation, except where

Palustrine wetlands extend lakeward of that boundary. Where a river enters a lake, the extension of the Lacustrine shoreline forms the Riverine/Lacustrine boundary. Rivers with dams that impound water to the extent that the ecological character of the river is significantly impacted are considered Lacustrine to the upstream point that approximates spillway or normal pool elevation, or to the upstream point where Riverine characteristics return.

[L1] Lacustrine Limnetic – This Subsystem extends outward from Littoral boundary and includes all deep-water habitats within the Lacustrine System.
[L2] Lacustrine Littoral – This Subsystem includes all wetland habitats in the Lacustrine System. Extends from shoreward boundary to 2 meters (6.6 feet) below annual low water or to the maximum extent of nonpersistent emergents, if these grow at depths greater than 2 meters.

Classes and Subclasses. Class describes the general appearance of the habitat as either the dominant life form of the vegetation or the physiography and composition of the substrate. Trees, shrubs, and emergent plants are used to define classes because they are easily recognizable, do not change distribution rapidly, and have traditionally been used to classify wetlands. Other forms of vegetation such as submerged or floating-leaved vascular plants are more difficult to detect. Substrates reflect regional and local variations in geology and the influence of wind, waves, and currents on erosion and deposition of substrate materials. (The classification maps of Nevada wetlands by NWI describe classes, but not subclasses.)

[AB] Aquatic Bed - Includes wetlands and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Aquatic beds generally occur in water less than 2 meters (6.6 feet) deep and are placed in the Littoral Subsystem (if in Lacustrine System). Water regimes include the following: permanently, intermittently, semipermanently, and seasonally flooded.
[EM] Emergent - Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. All water regimes included.
[FO] Forested - Characterized by woody vegetation that is six meters (20 feet) or taller. All water regimes included.
[SB] Streambed - Includes all wetlands contained within the Intermittent Subsystem of the Riverine System. Water regimes include the following: seasonally, temporarily, and intermittently flooded.
[SS] Scrub-Shrub - Includes areas dominated by woody vegetation less than six meters tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. All water regimes included.
[UB] Unconsolidated Bottom - Includes all wetlands and deepwater habitats with at least 25 percent cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30 percent. Water regimes are restricted to: permanently, intermittently, and semipermanently flooded.
[US] Unconsolidated Shore - Includes all wetland habitats having three characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders, or bedrock; (2) less than 30 percent areal cover of vegetation other than pioneering plants; and (3) any of these water regimes: Temporarily, intermittently, or artificially flooded.

Table 1.3 NWI Statistics for Nevada Wetlands

Wetlands smaller than 40 acres	31,917 (count total)
Large Wetlands Wetlands greater than 40 acres Wetland/upland complexes Playas	1,698,900 acres 662,600 acres 100,800 acres 935,500 acres
Linear wetlands	29,810 miles
Lakes and reservoirs	364,800 acres

Notes: These values are taken from the NWI draft report "Wetlands of Nevada." Other estimates used in the report for these wetland groups are slightly different as a result of spatial analysis by the NNHP. The "large wetland" group as used in this report includes vegetated, playa, and wetland/upland complex types.

NWI Wetland Groups. In the draft report *Wetlands of Nevada* (USDI, 2002), the NWI reports on the estimated coverage of linear wetlands; wetlands larger than forty acres; wetland/upland complexes; playa; open water; and wetlands

smaller than forty acres (Table 1.3). The NWI dataset for Nevada, however, presents more detailed coverage data according to wetland type using the Cowardin classification. These data are presented in Tables 1.4 and 1.5 for "linear wetlands" and "large vegetated wetlands." The NWI dataset does not list the types of wetlands placed in the "smaller than 40 acres" group. The "large wetland" group was created by NNHP for analytical purposes in the preparation of the plan. Figures 1.6, 1.7, and 1.8 display mapped distributions of linear wetlands, large wetlands, and wetlands smaller than forty acres in the NWI dataset.

The total large wetland acreage in the draft NWI report amounts to 1.7 million acres, or approximately 2.3 percent of the surface area in the state (USDI, 2002). This includes playas, major water bodies (open water), and wetland complexes (wetland/upland mosaic). The NWI maps and classifies wetlands primarily by analyzing satellite images and aerial photos, followed up with limited field verification. The NWI reconnaissance scale mapping approach does not provide details about the flora, hydrology, or geomorphology of wetland; however, this dataset presents a comprehensive baseline inventory that has its uses in various planning applications, but should not be substituted for site specific management, regulatory, or land use decisions. Because these data were selectively obtained from satellite imagery and aerial photos showing wet year conditions (1980s), the NWI maps might be viewed as an approximation of the maximum potential extent of the resource base. Thus, the NWI dataset lays a solid foundation on which to build a more detailed statewide inventory.

Linear Wetland Group. Linear wetlands are mainly riparian, occurring with natural and artificial watercourses carrying perennial, intermittent, or diverted flow. Table 1.4 presents statistics on the linear wetland types and miles mapped by the NWI. Roughly one third of the linear wetlands are classified as well vegetated (greater than thirty percent cover), supporting emergent, forested, scrub-shrub communities. About two-thirds are mapped as partially vegetated, i.e., vegetative cover is less than thirty percent (e.g., unconsolidated shore or bottom, open water, streambed). The NWI identified nearly 32,500 linear wetlands miles in Nevada. Linear wetlands do not precisely coincide with perennial and/or ephemeral stream, due to the extensive loss of riparian wetlands. The magnitude of the difference between linear wetlands and flowing stream length is indicated by comparing data from the NWI and the Nevada Water Quality Assessment 305(b) Report. The latter provides estimates that the state contains 143,578 miles of rivers, streams, and creeks. Of the total, 14,988 miles are characterized as perennial, 126,257 miles as intermittent, 1,782 miles as ditches and canals. A comparison of total linear wetland miles (32,500 miles) to the total rivers, streams, and creeks presented in the 305(b) report (143,578 miles) suggests the magnitude of riparian losses along waterways in Nevada may exceed seventy-five percent. Additionally, well-vegetated linear wetland conditions may exist along approximately 10,000 miles of the total waterway miles. These comparisons require additional scrutiny since the statistics are produced by different sources, but the numbers concur with observations of riparian zone fragmentation.

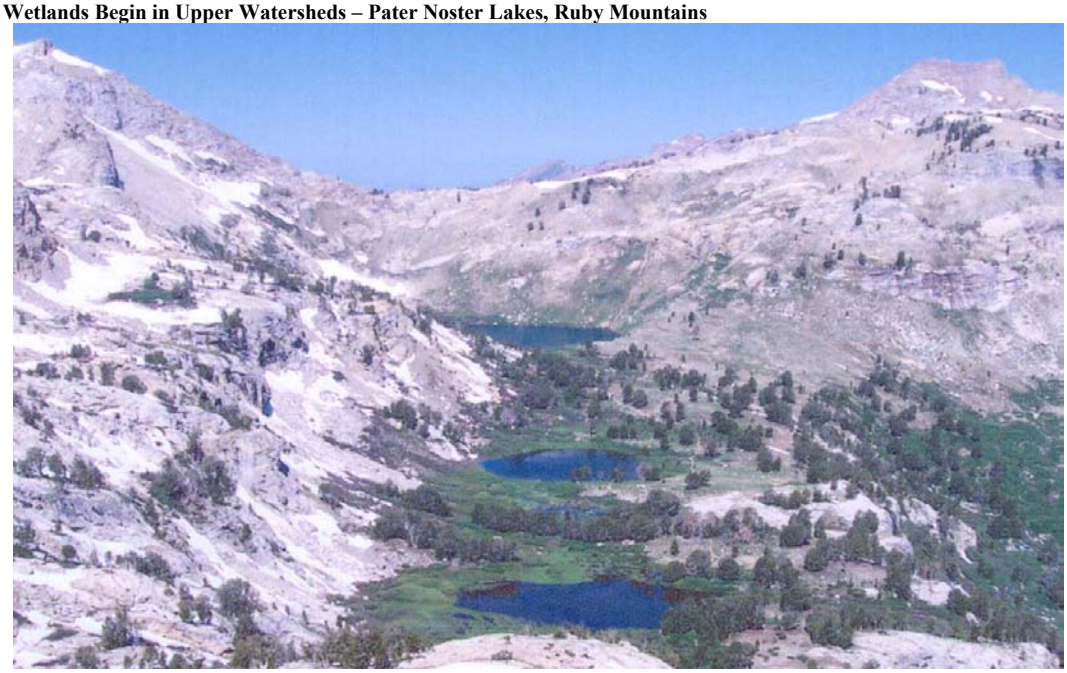
Linear Wetland in Dry Hills, Rock Creek (Trail Canyon)

Hundreds of thin blue lines appear on hydrologic maps. Some mark the course of perennial or seasonal streamflow, such as Rock Creek (Trail Canyon) in Esmeralda County – a live stream with slender riparian zones, or linear wetlands maintained by snowmelt, seeps, and springs. Many isolated streams and wetlands exist in the shaded folds of semi-arid mountain drainages and disappear into coarse alluvial fan deposits at canyon mouths. These steep riparian zones aid in the recharge of local and deep valley fill aquifers. The NWI estimates there are nearly 33,000 miles of linear wetlands. They are critical to wildlife throughout the millions of acres that receive little precipitation. Highland watersheds are sensitive to land uses that reduce plant cover or channelize runoff. Jim Morefield photo.

Table 1.4 Linear Wetland Types and Miles in Nevada Mapped by NWI		
Wetland Mapping Code	**Wetland Type**	**Miles**
EM	Emergent	4,737
FO/SS	Forested/Scrub-Shrub	3,173
L2US	Lacustrine Littoral Unconsolidated Shore	2
PEM	Palustrine Emergent	882
PFO	Palustrine Forested	158
PSS	Palustrine Scrub-Shrub	1,145
R3UB	Riverine Lower Perennial Unconsolidated Bottom	30
R4SB	Riverine Streambed	4,476
US/OW/UB/SB	Unconsolidated Shore/Open Water/Unconsolidated Bottom/Streambed	17,971
Total Linear Wetland Miles		32,574

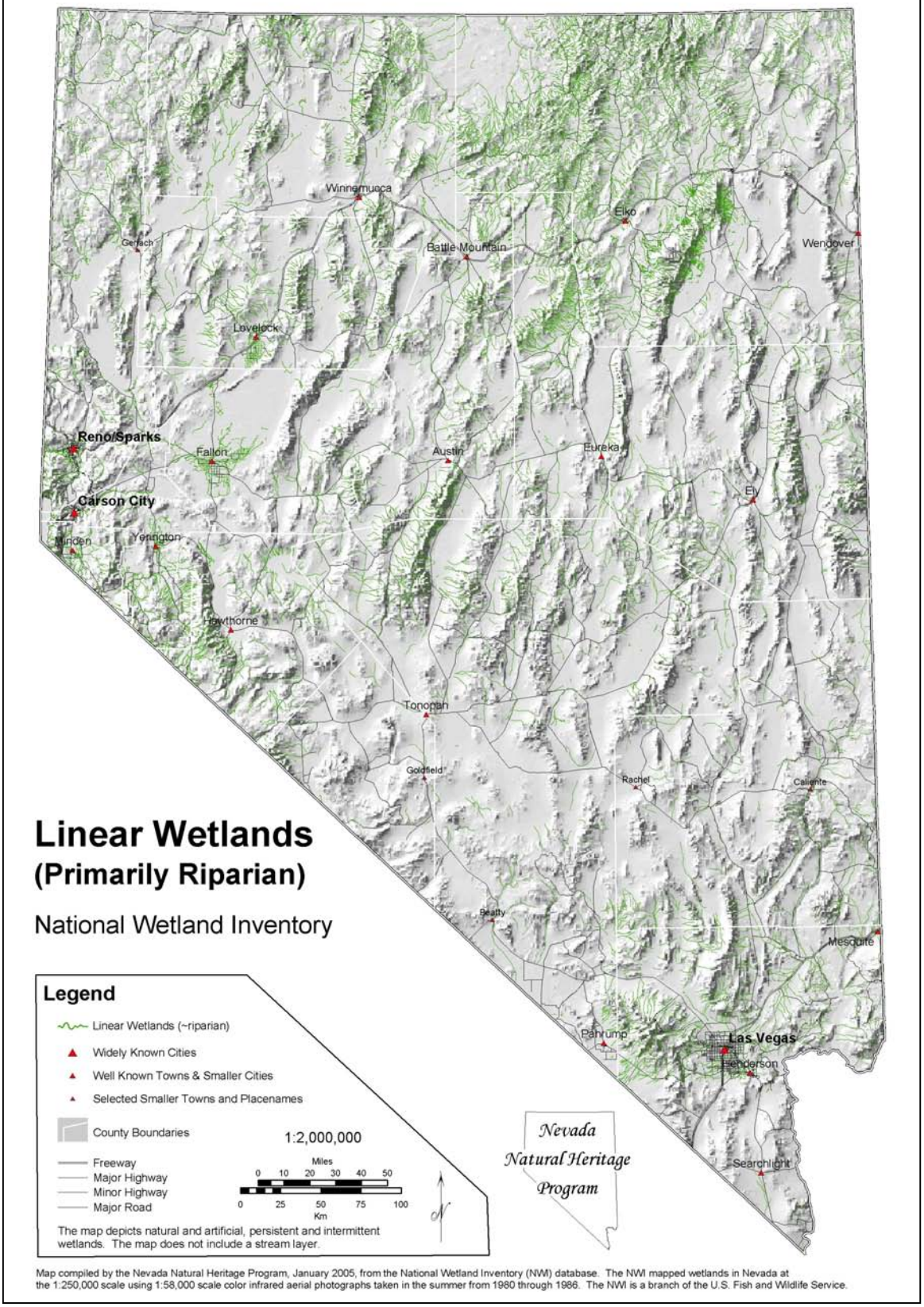
Figure 1.6 maps linear wetland data from the NWI. Linear wetlands generally represent riparian settings associated with intermittent or persistent flow. The difference between mapped linear wetlands and streams can be illustrated by comparing the NWI linear wetland map to blue stream-lines appearing on U.S. Geological Survey (USGS) topographic maps. For instance, a visual trace of the Walker River channel shows gaps in linear wetland coverage. Linear wetlands are more plentiful in the cooler, moister hydrographic regions (Northwest, Snake River, Humboldt, Black Rock Desert, and northern half of the Central regions) where the combined effects of latitude and altitude promote deeper, longer lasting snowpacks able to sustain perennial and robust intermittent stream flow. Southward, linear wetlands occur with the Muddy, Virgin, Pahranagat, and Amargosa rivers and confluent spring systems.

Linear Wetlands Begin in Upper Watersheds – Pater Noster Lakes, Ruby Mountains



Linear wetlands are maintained by the flow of water over and below the surface of tall mountain ranges, such as the Rubys. The first conservation action for the Ruby Mountains occurred in 1906 when President Roosevelt created by proclamation the Ruby Mountain Forest Reserve. Two years later it was consolidated into the Humboldt National Forest. Congress enacted the Forest Service Organic Administration Act in 1897, which established a system of National Forests to improve and protect the forests, furnish a continuous supply of timber, and secure favorable conditions of water flow – which is of paramount importance in Nevada. The Multiple Use Sustained Yield Act of 1960 expanded the purpose of national forest land to include improvement and protection of outdoor recreation, range, fish, and wildlife resources. The administrative purpose also was modified by emphasizing multiple use and sustained yield of renewable resources, a more complicated and controversial responsibility than that of the 1897 Organic Act. Multiple use means management of all renewable surface resources of the national forests to meet the needs of the American people. Sustained yield means achievement and maintenance of a high-level, regular output of renewable resources without impairment of the land's productivity. In 1989, Congress created the Ruby Mountains Wilderness Area, which covers 90,000 of the nearly 650,000 acres enveloped by the mountain range. The resources on public land designated wilderness must be protected in their natural condition, a prudent strategy for securing favorable watershed conditions in the major water-producing ranges in arid Nevada. Bruce Thompson photo, courtesy Nevada Biodiversity Initiative.

Figure 1.6 Linear Wetlands Map, Nevada NWI



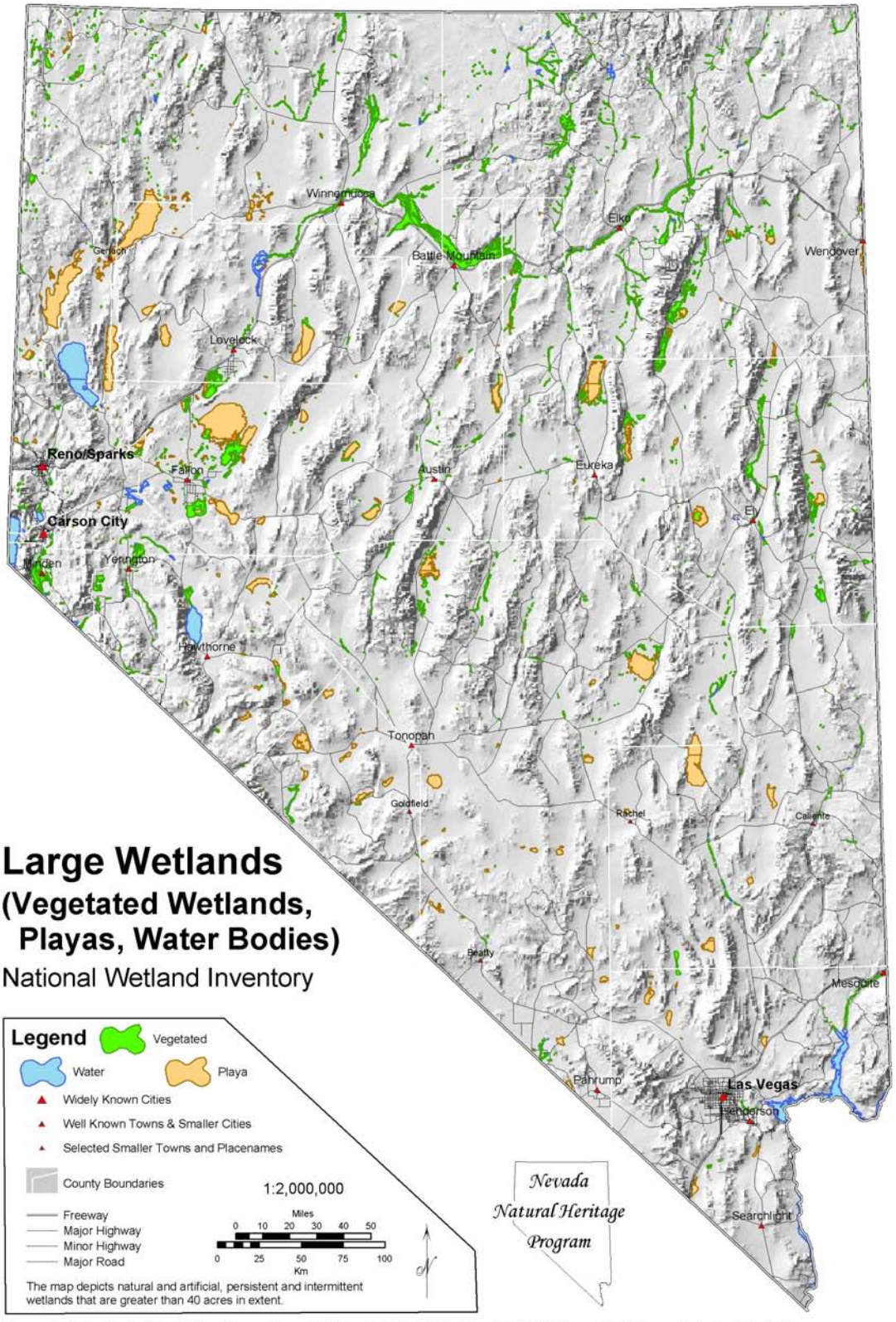
Map compiled by the Nevada Natural Heritage Program, January 2005, from the National Wetland Inventory (NWI) database. The NWI mapped wetlands in Nevada at the 1:250,000 scale using 1:58,000 scale color infrared aerial photographs taken in the summer from 1980 through 1986. The NWI is a branch of the U.S. Fish and Wildlife Service.

Large Wetland Group. The NWI classifies about 2.2 million acres as large (i.e., greater than 40 acres) wetlands, which includes 360,000 open water acres. The large wetland group includes marsh, meadow, shorezone, lake, reservoir, and large pond habitats, plus playa and wetland/upland mosaics (Table 1.5).

Table 1.5 Large Wetlands (Vegetated, Playa, and Open Water) and Acreage in Nevada Mapped by the NWI

Wetland Mapping Code	Wetland Type	Acres
L1OW	Lacustrine Limnetic Open Water	218,276
L1UB	Lacustrine Limnetic Unconsolidated Bed	255,451
L2AB	Lacustrine Littoral Aquatic Bed	29,516
L2AB/EM	Lacustrine Littoral Aquatic Bed/Emergent	129
L2AB/OW	Lacustrine Littoral Aquatic Bed/Open Water	4
L2OW	Lacustrine Littoral Open Water	8,003
L2UB	Lacustrine Littoral Unconsolidated Bottom	3,424
L2US	Lacustrine Littoral Unconsolidated Shore	940,161
PAB	Palustrine Aquatic Bed	235
PAB/EM	Palustrine Aquatic Bed/Emergent	199
PEM	Palustrine Emergent	487,299
PEM/AB	Palustrine Emergent/Aquatic Bed	223
PEM/OW	Palustrine Emergent/Open Water	766
PEM/SS	Palustrine Emergent/Scrub-Shrub	17,610
PEM/US	Palustrine Emergent/Unconsolidated Shore	3,837
PFO	Palustrine Forested	26
PFO/SS	Palustrine Forested/Scrub-Shrub	29
POW	Palustrine Open Water	167
POW/EM	Palustrine Open Water/Emergent	39
PSS	Palustrine Scrub-Shrub	139,554
PSS/EM	Palustrine Scrub-Shrub/Emergent	12,626
PSS/L2US	Palustrine Scrub-Shrub/Lacustrine Littoral Unconsolidated Shore	8,758
PSS/R2US	Palustrine Scrub-Shrub/Riverine Upper Perennial Unconsolidated Shore	2,717
PSS/US	Palustrine Scrub-Shrub/Unconsolidated Shore	103
PUB	Palustrine Unconsolidated Bottom	170
PUS	Palustrine Unconsolidated Shore	1,653
PUS/EM	Palustrine Unconsolidated Shore/Emergent	431
PUS/SS	Palustrine Unconsolidated Shore/Scrub-Shrub	689
R2OW	Riverine Upper Perennial Open Water	81
R2UB	Riverine Upper Perennial Unconsolidated Bottom	1,739
R2US	Riverine Upper Perennial Unconsolidated Shore	1,148
R2US/PSS	Riverine Upper Perennial Unconsolidated Shore/Palustrine Scrub-Shrub	427
R3OW	Riverine Lower Perennial Open Water	303
R3UB	Riverine Lower Perennial Unconsolidated Bottom	1,334
R3US	Riverine Lower Perennial Unconsolidated Shore	201
R4SB	Riverine Intermittent Streambed	323
	Total	2,137,651

Figure 1.7 Large Wetlands (Vegetated, Playas, and Open Waters) Map, Nevada NWI



Map compiled by the Nevada Natural Heritage Program, January 2005, from the National Wetland Inventory (NWI) database. The NWI mapped wetlands in Nevada at the 1:250,000 scale using 1:58,000 scale color infrared aerial photographs taken in the summer from 1980 through 1986. The NWI is a branch of the U.S. Fish and Wildlife Service.

Large vegetated wetlands occur throughout the state associated with river and stream floodplains, in intermediate valleys, and terminal sinks of the major and some minor river systems (Figure 1.7. In eastern Nevada valleys, such as Ruby, Railroad, and Moapa, the discharge of spring systems supports diverse riparian and marsh habitats. About 662,600 acres have been mapped as large vegetated types, having greater than thirty percent plant cover. The amount of forested wetland acres mapped by NWI (Table 1.5) is notably low. Further analysis is needed to determine whether aspen communities were omitted or selectively mapped by the NWI as wetlands. Large vegetated wetlands in the Truckee, Carson, and Colorado River basins generally qualify for protection from extensive land development under federal Clean Water Act regulations, but in other areas, they are more than likely considered isolated. All are vulnerable to depletion due to diversions or water development.

Figure __. Quaking Aspen in Subalpine Sagebrush

Quaking aspen (*Populus tremuloides*) typically occupy sites kept moist by subsurface flow. They mark the presence of springs, seeps, and streams in subalpine, montane, and even shrub-steppe zones. The patchy occurrence of groves and riparian stringers of aspen are most familiar in the mountain ranges of the northern half of the state. Aspen communities present as a multi-story canopy and a diversity of plant species attractive to large numbers and varieties of wildlife. Aspen reproduce by seed, but the ability to regenerate from root sprouts give rise to clustered stands, or clones. Clones resurrect more quickly than conifers after fire, flood, or slope failure events, giving aspen a competitive edge. Improper management of grazing and fire interferes with aspen reproduction, key factors in a noticeable decline in distribution. Cattle, sheep, and wild ungulates may contribute to excessive grazing pressure. James Morefield photo

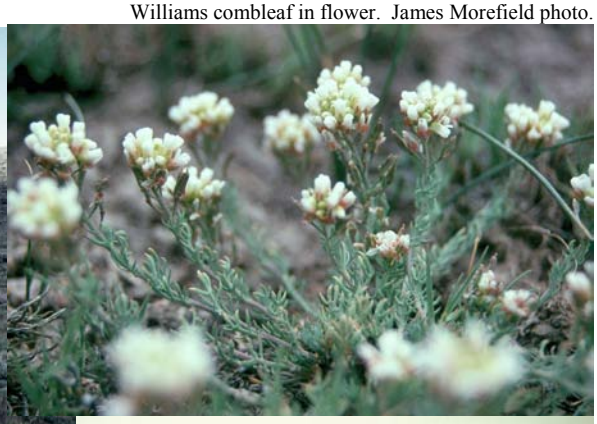
Playas often appear as dry lakebeds in terminal sinks and arid valleys below 5,000 feet. Playas comprise almost half of the wetland resource base mapped for Nevada by the NWI. Appendix 1, Part 1 identifies eighty-eight major playas larger than 1,000 acres, the two largest located in the Black Rock Desert (108,000 acres) and Carson Sink (272,000). In the summer, playas are inhospitable. Even when the air crackles with heat, dryness, and light, shimmering mirages remind us of the ancient origin and purpose the playa – to gather snowmelt and rain, shape it into a pool (or lake), and provide the broth needed for latent seeds, eggs, cysts, and rootstock to re-emerge into an ephemeral aquatic community. Desert plants, amphibian, insects, reptiles, and mammals for millennia having dwelt with the irregular wet/dry heartbeat of playa ecosystems, have behavioral and physiological adaptations to survive long droughts. Some, e.g., Washoe and Franklin lakes, hold shallow lakes most years, desiccating only after extended or severe periods of drought. A number of apparently dry playas actually contain small marsh patches kept watered or wet by a spring or high water table that persist by virtue of basin-wide subsurface drainage. Because playas occupy the harshest environments, they may be perceived as wastelands. The aquatic and wetland habitats that sprout during above normal precipitation periods are a boon to migratory birds and resident wildlife populations. What effort agencies, conservationists, and researchers have invested in playas concentrates on those often inundated. Terminal playas located downstream of populated valleys preoccupied with agricultural, urban, and mineral developments are susceptible to degraded hydrological and environmental conditions. Direct land uses are rather limited. A few support industrial salt extraction operations. Interest in outdoor recreation, particularly wind surfing, motorized recreation, and a variety of mass-appeal special events, may be growing.

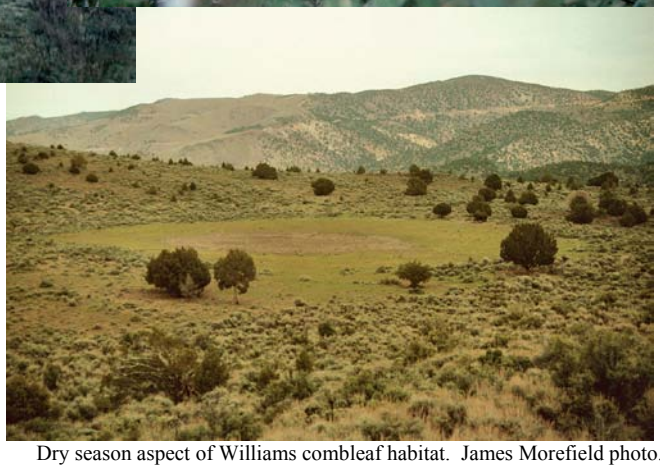
Wetlands Smaller than Forty Acres. The NWI did not refine the classification of wetland features smaller than forty acres. Almost 32,000 individual features were identified as wetland habitat (Figure 1.8). Among those mapped are vegetated springs and seeps, seasonally flooded vegetated wetlands, seasonally flooded flats, and permanently flooded ponds. Created ponds on farmland, ranchland, golf courses, and parks are presumed to be part of the smaller wetland dataset. Of particular interest are natural springs and seeps and seasonal pools, since the associated wetland habitats often mark the only stable water resources in extremely dry valleys and hills available to wildlife over large areas. Also, many spring systems host rare endemic fishes, amphibians, mollusks and plants. These isolated wetlands also present crucial refuge for migratory birds and waterfowl during droughts and in the event storms force birds to ground. The distribution of springs generally follows the pattern of higher precipitation, as is evident by the clustering in the north and in association with tall mountain ranges.

Seasonal Pools and Wetlands

Wet season aspect, Williams combleaf habitat, Pine Grove Hills. Robert Holland photo.

Williams combleaf in flower. James Morefield photo.



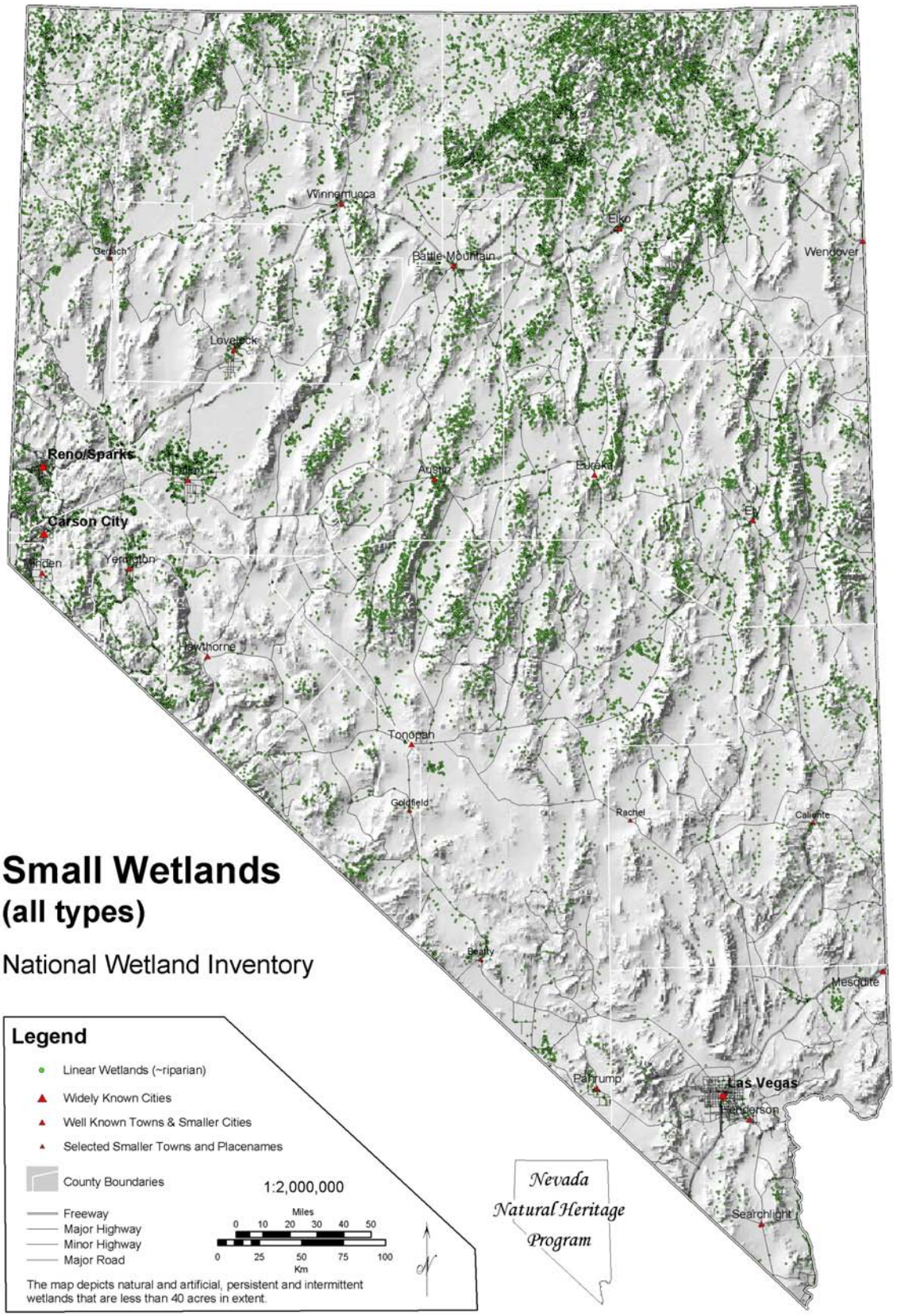


Dry season aspect of Williams combleaf habitat. James Morefield photo.

Rare and imperiled, Williams combleaf (Polyctenium williamsiae) is a perennial herb found in wetlands associated with uncommon seasonal lakes that occupy small upper elevation basins in western Nevada mountain ranges. Typically, volcanic bedrock and clayey soil sub-horizon restricts percolation of snowmelt and rainfall runoff. The slower evaporation rate at higher elevations slows water loss enough to prolong inundation and saturated conditions necessary to support wetland plant communities. Seasonal pools are similar to the vernal pools of northeastern California, which are known for their biodiversity. Land uses that damage this uncommon resource include grazing or trampling by livestock and feral horses, water diversions and developments, and off-road vehicle use. Williams combleaf is classified in NAC Chapter 527 as a fully protected species. A permit must be issued and conservation plan approved by the NDF before engaging in a land use activity that may destroy or damage any plants. Being isolated from navigable rivers, the wetlands associated with seasonal pools may not qualify for protection under CWA Section 404 regulations.

Seasonal pools make up another subset of wetlands smaller than forty acres. They are found in widely scattered geologic depressions nestled in ranges of hills and mountains throughout northwestern Nevada. Droughts may reduce the shallow ponds and wetland vegetation to playa-like mud flats. As isolated and ephemeral wetlands, they provide valuable wildlife habitat, but are sensitive to various land uses and unprotected by federal regulations. Rare endemic plant species occupy seasonal pool sites . Inventorying and characterizing seasonal pool resources will be a priority of the NVWETIS project.

Figure 1.8 Wetland Features Smaller Than Forty Acres Map, Nevada NWI



Map compiled by the Nevada Natural Heritage Program, January 2005, from the National Wetland Inventory (NWI) database. The NWI mapped wetlands in Nevada at the 1:250,000 scale using 1:58,000 scale color infrared aerial photographs taken in the summer from 1980 through 1986. The NWI is a branch of the U.S. Fish and Wildlife Service.

Artificial Wetlands. A portion of the Nevada wetland resource base are maintained "artificially." Artificial wetlands are intentionally or incidentally created, primarily by the diversion and impoundment of water for irrigated cropland. The NDEP estimates there are 1,782 miles of ditches and canals in Nevada. Some riparian (linear) features mapped by the NWI are artificial wetlands. Artificial wetlands occupy the margins of irrigation ditches, drains, dams, and impoundments may also coincide with similar features constructed for urban and industrial stormwater drainage, flood control, disposal of treated wastewater, urban parks and golf courses, and mining operations. Artificial wetlands also include marshes and meadows created by stream or spring diversions to feed livestock or create wildlife habitat. Important differences exist between artificial and natural wetlands, particularly with regard to permanence, functions and values, and regulatory protection. Artificial wetlands by definition occupy sites where the conditions that sustain natural wetlands did not exist or have been significantly altered. Typically, the disturbances to vegetation, soil, and hydrology of ongoing land use activities limits the natural qualities of artificial wetlands and precludes ecological succession. In some instances, primarily on public land, artificial wetlands will be managed with the objective of enhancing ecological functions or socioeconomic services. Many artificial wetlands have been created as mitigation projects.

Artificial wetlands may constitute an increasing share of the state's wetland resource base. The latest FWS status and trends report notes that the amount of artificial ponded acreage has increased while other natural wetland types have decreased. Ponds created in upland locations for urban stormwater control, to stock introduced fishes, or contain tailwater from cultivated fields provide fewer benefits than native wetlands. In fact, a major problem with the Section 404 program that permits wetland fill and dredging activities is that wetlands created to mitigate losses often fall far short of providing the functions and services of eliminated wetlands. Nevertheless, artificial wetlands are part and parcel of the Nevada resource base. Though compensation for the loss of native wetlands will never be entirely successful, especially in "working landscapes," artificial wetlands are preferable to the net loss of wetlands at this point in time. At least some benefits are retained. For instance, in intensively farmed areas, maintaining artificial wetlands may reduce the additional inputs of nutrients, sediment, salts, and pesticides derived from cultivation and livestock operations. Artificial wetlands lack biological diversity, but may still provide important habitat to migratory birds and other wildlife, during storms or droughts for example.

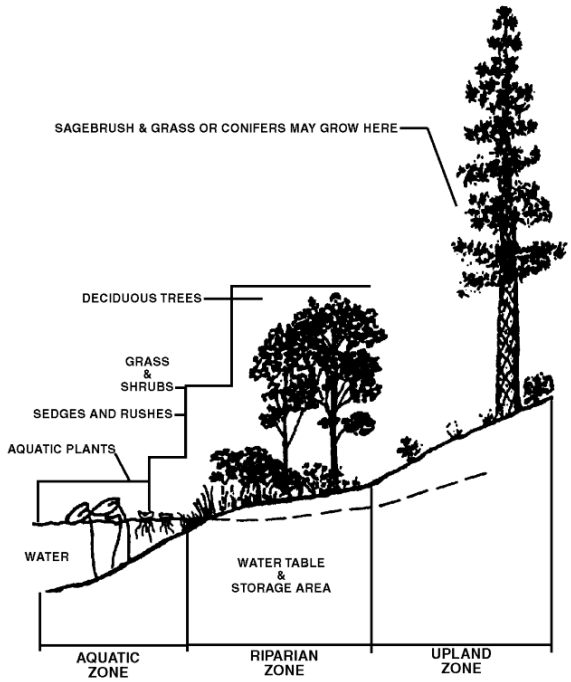
Riparian Areas and Wetlands. Riparian zones generally are slender lushly vegetated belts of predominantly wetland plants, often scrub-shrub or forest dominated plant communities, growing along the margin of flowing water bodies. Like wetlands, riparian areas include a wide variety of trees (e.g., willow, cottonwood, mesquite, alder, aspen), shrubs (e.g., currant, woods rose, buffalo berry, snowberry, willow), forbs, grasses, and grass-like species. Informally, the term "riparian" has become a generic term used in reference to any strip of wetland-adapted shrubs and trees growing along a variety of water resource settings. Riparian ecosystems basically are valued for the same reasons wetlands are prized. The benefits flowing from healthy riparian ecosystems may include better water quality, competent stream banks, richer forage, and flood attenuation. An enormous number of wildlife and a great diversity of species live in around riparian communities. People relish outdoor recreation in shaded riparian areas. The NWI has adopted a provisional definition and classification system of riparian resources created for the western states where mean annual evaporation exceeds precipitation (USFWS, 1997). The FWS definition of riparian areas is:

Plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent lotic and lentic water bodies (rivers, streams, lakes, or drainage ways). Riparian areas have one or both of the following characteristics: 1) distinctively different vegetative species than adjacent areas, and 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms. Riparian areas are usually transitional between wetland and upland.

This definition was adopted by ten federal agencies and resource agencies in twenty-two states, including the Nevada Department of Wildlife. For mapping riparian areas, the FWS has developed a classification system similar to the Cowardin wetland classification system. The riparian definition and classification system procedures were applied to a trial exercise to map and classify riparian zones using aerial photos of Great Basin National Park with favorable results (USFWS, 1997). Another riparian classification is available that was developed by the Humboldt-Toiyabe National Forest. Two "Riparian Field Guides," were produced after an extensive effort to classify and map riparian and wetland ecosystems in the Eastern Sierra and Central Nevada. These handbooks were developed by vegetation ecologist on the Humboldt-Toiyabe National Forest mainly for the purpose of evaluating changes in the ecological status.

The need to make a distinction between riparian zones and wetland areas often arises in the context of federal regulations. The FWS riparian report discusses the differences between procedures for inventorying riparian zones for resource management purposes and for determining the presence and boundaries of wetlands for federal permit actions. Federal regulations may or may not apply to riparian zones depending upon the wetland characteristics present. Recognizing that riparian areas, even those that do not exhibit all the wetland criteria in strict accord with the CWA Section 404 definition, provide the same functions and services, several states have chosen to extend wetland protection to riparian zones. Since federal (FWS, NPS) have already coordinated with a state agency (NDOW) in the mapping of riparian zones at Great Basin National Park, the potential exists for Nevada resource agencies to coordinate with federal agencies in the mapping of critical riparian habitats on public lands. Another program that tends to support such a state initiative is the use of the Riparian Proper Functioning Condition Assessment (PFC) method by the BLM. Utility of the PFC method would be enhanced if it were integrated with the FWS riparian classification system and with the NVWETIS project under development by the NNHP.

Riparian Zone Diagram



Source: Oregon Watershed Improvement Coalition

Wetland Classification at the Community Level. A plant community is made up of a distinctive combination of plant species that varies across the land according to various environmental and natural resource conditions. The environmental conditions imposed by natural as well as human influences are expressed in the composition and distribution of plant communities. They also indicate the variety of animal or plant species that might occupy an area. The National Vegetation Classification (NVC) provides a classification system and is used to inventory plant communities. The NVC establishes a common protocol that wetland scientists and managers can use to identify, catalogue, and describe ecological attributes of wetland, riparian, aquatic, and terrestrial plant communities. Developed by state Natural Heritage Programs, NatureServe, and The Nature Conservancy, use of the NVC is endorsed and encouraged by the Ecological Society of America and the Federal Geographic Data Committee, which includes all federal agencies involved in natural resource research and management.

The NVC is a hierarchical system. The highest level separates communities by growth forms or structure, differentiating forests from shrublands, for example. At this level, the NVC system can be cross-

referenced to the Cowardin classification system, an important consideration in the development of a detailed state wetland inventory. The lowest level (association) identifies dominant and co-dominant species to distinguish more detailed vegetation patterns. A list of the NVC wetland associations that are known or likely to occur in Nevada can be viewed at http://heritage.nv.gov/ecology/nv_nvc.htm. The entire NVC can be browsed or queried on the NatureServe website. An association description taken from the NVC, shown below, describes the Bulrush Wet Meadow association. The NNHP proposes to use the NVC to classify wetland communities inventoried for the Nevada Wetland Information System and GIS (NVWETIS) project.

Ecological System	Terrestrial
Formation Class	V - Herbaceous Vegetation
Formation Subclass	V.A - Perennial graminoid vegetation
Formation Name	V.A.5.N.l - Semipermanently flooded temperate or subpolar grassland
Alliance Name	V.A.5.N.l.6 - SCHOENOPLECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE
Association	*Schoenoplectus pungens Herbaceous Vegetation*
Association Summary	This bulrush wet meadow community is found in the western United States in the intermountain basins, as well as in western parts of the Great Plains. Stands are found along low-gradient, meandering, usually perennial streams and around the margins of ponds and marshes. *Schoenoplectus pungens (= Scirpus pungens)* dominates the dense, 0.3- to 0.6-m tall herbaceous vegetation layer. Other species that often are present include *Schoenoplectus maritimus (= Scirpus maritimus), Spartina gracilis, Hordeum jubatum, Pascopyrum smithii, Juncus balticus, Eleocharis palustris, Lemna minor, Sagittaria latifolia*, and *Typha* spp. Stands of this association contain no tree or shrub layer, but a few scattered trees and shrubs may be present, most commonly *Populus deltoides, Salix amygdaloides, Salix exigua, Symphoricarpos occidentalis*, or *Sarcobatus vermiculatus*. Substrates are generally dark, organic, fine-textured soils derived from alluvium.
Association Classification Confidence Level	Moderate

Wetland Plant Species. To assist regulatory agencies in the determination of presence of hydrophytic vegetation for wetland permit actions, the FWS prepared the *National List of Vascular Plant Species That Occur in Wetlands*. The 1996 National Plant List is the most recently updated version and can be viewed at http://wetlands.fws.gov/bha/. Nevada is grouped with Utah and western Colorado in the Intermountain Region. The 1996 National List presents the "wetland indicator" status of each species. The wetland indicator represents the probability that a species will occur in a wetland site (e.g., obligate wetland species are found in a wetland 99 percent of the time). The 1996 National List contains vascular plant species only. A more complete list of wetland plants (including lichens, mosses, and liverworts) can be obtained through the National PLANTS Database. The Natural Resources Conservation Service (NRCS) prepared and periodically updates the National PLANTS Database. It can be accessed on the Internet at http://plants.usda.gov/index.html. The database can be easily queried to list wetland plants by specified region (Nevada falls within Region 8, the Intermountain Region) or an advanced query can produce a state list of wetland plant species.

Arctic Willow (*Salix arctica*) in Ruby Mountain Alpine Meadow.

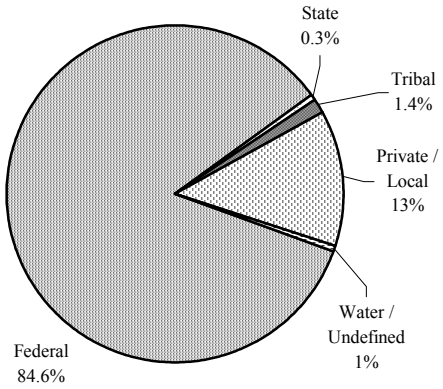
James Moorefield photo.

Distribution of Wetlands by Land Status, County, and Hydrographic Region

The Nevada NWI dataset is not appropriately detailed for use in site-specific assessments; however, it has applications as a general planning tool for state or county analysis. In this section we examine how wetlands are distributed by land status, by county, and by hydrographic region. Though these data are approximations of wetland coverage mapped during an above-normal precipitation period, they do

represent the "best" data currently available for examining the state's wetland resource base. Therefore, we take some liberties in using the NWI database to draw general inferences about the status of wetland resources distribution in various contexts, and what the relationships may mean in terms of protection levels and conservation need.

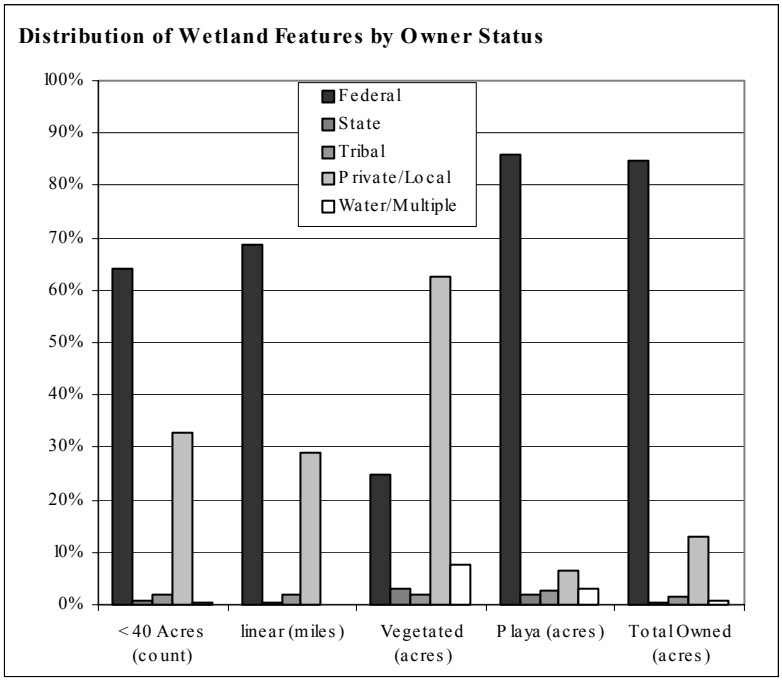
Figure 1.9 Ownership Status of the Nevada Land Base



Wetland Distribution by Land Status. Federal agencies administer about eighty-five percent of the Silver State, most of which is managed as multiple use lands. Land in private ownership approximates thirteen percent; tribal governments own about 1.4 percent; and the State of Nevada about 0.3 percent (Figure 1.9). (The one percent water/undefined slice includes multiple ownerships with unclear boundaries at the scale of mapping used in the land status spatial dataset.) Knowing the proportionate distribution of wetland types by land ownership category allows us to make some general observations about protection status. This topic is covered in more detail in Part 5, Wetland Protection, Conservation, and Management.

Table 1.6 presents estimates of the distribution of small, linear, large vegetated, and playa wetlands (the large wetland category presented in the previous section has been subdivided into vegetated and playa wetland groups). Figure 1.10 presents the same data graphically, as proportionate shares owned in land status category. The data supports general observations that a disproportionately large amount of the remaining wetland base occurs on private land. Approximately thirty percent of the smaller than forty acres and the linear wetlands occurs on private land, as do over sixty percent of the large vegetated wetlands. Clearly, however, public lands contain the majority of smaller wetlands, linear wetlands and certainly playas. A breakdown of wetlands owned by federal agency and management priority is presented in the section on Wetland Protection, Conservation, and Management. State-owned wetland acreage occupies state parks and wildlife management areas. The state probably owns a large share of the "water/multiple" acreage, since the state lays claim to submerged lands that are situated below the customary high water mark of several major water bodies.

Figure 1.10 Relative Distribution of NWI Wetland Types by Land Owner Category



Source: Analysis by NNHP using Nevada NWI and BLM Nevada land ownership datasets.

In general, the level of protection afforded wetlands is greater on public land than on nonfederal land. One reason is that federal protection afforded private wetlands from fill or dredge projects is limited to Clean Water Act Section 404 regulatory program as implemented by the ACOE and NRCS and

Table 1.6 Distribution of NWI Wetland Types by Land Ownership Status

Status	Total Area in Status (acres)	Wetland Group				Open Water (acres)
		< 40 Acres (count)	Linear (miles)	Vegetated (acres)	Playa (acres)	
Federal	60,659,129	20,453	22,314	189,553	813,182	16,202
State	235,403	225	103	22,562	17,354	2,593
Tribes	1,023,904	655	571	13,172	25,709	1,952
Private/Local	9,172,912	10,500	9,463	474,028	61,554	10,258
Water	475,481	62	61	59,280	29,558	329,705
State Total	70,731,431	31,895	32,512	758,594	947,357	378,865

Source: NNHP spatial analysis of NWI and BLM Nevada land status datasets.
Notes: "Water" status unspecified in dataset.

enforced by the EPA. The criteria used to establish the presence of a wetland, its boundaries, and agency jurisdiction excludes many types of wetland common in Nevada. Also, the federal rules require agencies to issue general permits that allow exemptions for losses categorized as minor impacts, but may become cumulatively significant. In contrast, on public lands CWA Section 404 rules apply, as do those of the National Environmental Policy Act and numerous other federal policies and laws, including the federal "no net wetland loss" policy, which must be integrated into public land use permitting, management actions, and resource plans. Federal land managers also must evaluate the impacts of agency actions and decisions on the full spectrum of wetland values, such as wildlife, habitats, biodiversity, water quality, and watershed condition. What private and public protection efforts do hold in common is the pressure that a burgeoning population and economy exerts on water and wetland resources. The federal agencies that regulate both private wetland use and public resources do not hide the fact that staffing and funding are not sufficient to properly manage the resources given the increase in commercial activities, utility leases and rights-of-way, outdoor recreation usage, mineral development, and other uses.

Wetland Distribution by County. Wetland resources are unevenly distributed across the state's seventeen counties (Table 1.7). The unevenness reflects large differences in surface area, and smaller but equally influential differences in precipitation, topographic relief, regional drainage, and water development and use. The vast majority of large vegetated wetlands occur in the northeastern agricultural counties of Elko, Humboldt, Lander, White Pine, and Eureka. Nearly two-thirds of the wetlands smaller than forty acres also occur in those counties. Forty percent of the linear wetlands course through Elko and Humboldt counties. Playas in general are widely distributed, but there is a concentration of these ephemeral wetlands (nearly forty percent) in Churchill, Pershing, and Washoe counties, which contain terminal basins of major rivers. About seventy-five percent of open waters occur in Clark, Mineral, and Washoe counties,

Table 1.7 Distribution of NWI Wetland Types by County

County	< 40 Acres (count)	Large Vegetated[1] (acres)	Wetland/Upland Complex[1] (acres)	Playa[1] (acres)	Lakes and Reservoirs[1] (acres)	Linear Wetland (miles)[2]
Carson City	38	350	----	----	6,950	50
Churchill	1,374	27,150	34,900	181,050	23,400	750
Clark	369	11,500	----	23,700	97,800	750
Douglas	328	27,950	900	----	17,250	350
Elko	11,556	181,900	1,050	25,900	9,550	8,790
Esmeralda	341	5,700	1,800	38,300	1,450	180
Eureka	1,675	37,700	6,000	48,250	----	1,560
Humboldt	3,522	134,350	950	28,900	4,050	3,380
Lander	1,460	79,400	3,550	35,900	50	1,490
Lincoln	679	11,650	2,800	71,700	1,150	1,240
Lyon	879	16,950	11,300	7,150	8,800	840
Mineral	693	9,750	150	23,500	36,600	1,160
Nye	2,770	30,800	15,900	114,350	1,700	2,750
Pershing	965	19,450	1,750	146,650	16,300	1,650
Storey	36	100	----	----	----	40
Washoe	2,840	22,200	800	152,450	139,150	1,800
White Pine	2,392	49,200	18,950	37,700	650	1,600
Nevada Total	31,917	666,100	100,800	935,500	364,850	29,800

Table 1.8 County Ranking by Share of Large Wetland Area, with Land Status Statistics

County	Total Surface Area (Acres)	% County w/ Large Wetland	Large Wetland Surface Area	% County Federal Land	% County Non-Federal Land
Churchill	3,144,320	7.7	243,100	82.2	17.8
Douglas	480,640	6	28,850	51.4	48.6
Pershing	3,859,840	4.3	167,850	75.6	24.4
Washoe	4,229,120	4.1	175,450	78.5	21.5
Eureka	2,676,480	3.4	91,950	78.9	21.1
Lander	3,597,440	3.3	118,850	83.2	16.8
Lyon	1,295,360	2.7	35,400	69.6	30.4
Humboldt	6,210,560	2.6	164,200	81.4	18.6
Esmeralda	2,284,800	2	45,800	98	2
Elko	10,995,840	1.9	208,850	74.2	25.8
White Pine	5,699,200	1.8	105,850	95.4	4.6
Mineral	2,455,680	1.4	33,400	94.5	5.5
Nye	11,560,960	1.4	161,050	98.1	1.9
Lincoln	6,816,000	1.3	86,150	97.9	2.1
Clark	5,173,760	0.7	35,200	86.7	13.3
Carson City	97,920	0.4	350	52.8	47.2
Storey	167,680	0.1	100	9.1	90.9

Sources: Land Status statistics from Nevada Division of State Lands. Large Wetland Area statistics from Nevada NWI dataset.
Notes: Large Wetland group includes acreage in large vegetated, wetland/upland complex, and playa categories. % County Large Wetland calculated using table values.

coincident with lakes Mead, Walker, and Pyramid. The counties experiencing rapid population growth and land development (Clark, Douglas, Lyon, and Washoe) contain over half of the total large vegetated wetland acreage 361,000 large wetland acres and 5,000 linear wetland miles.

The drier southern counties (Clark, Lincoln, Nye) contain relatively less vegetated wetland acreage than northern counties (Table 1.8). Storey and Carson City have the least amount of wetland coverage in relative and real measure even though a major river and small creeks occur in each. Carson City is the state's most densely populated county, and Storey County consists almost entirely of steep, rocky terrain. The wetland largess of arid Churchill County stems from the presence of two sinks, that of the Humboldt and Carson rivers, plus a substantial contribution via the Truckee River diversion. Similarly, Pershing County's wetland affluence is associated with the long lower reach of the Humboldt and a portion of its sink. How long such terminal marshes and meadows persist may be decided by water use and conservation in upstream counties where urban growth and mining may effect water supplies. Lyon County's wetland coverage appears disproportionately low compared to Douglas County, given that both enjoy the rare good fortune of having two Sierra-snowpack fed rivers mosey about the valleys there.

Wetland Distribution by Hydrographic Region.

Since wetlands form the backbone of watershed functions that maintain stream flow, groundwater recharge, and water quality, the appropriate geographic framework for organizing and examining wetland information might be the system used by state water resource managers. The configuration of the hydrographic classification system used to inventory, assess, and manage water resources by the Nevada Division of Water Resources (NDWR) reflects the

Table 1.9 Distribution of NWI Wetland Types By Hydrographic Region

Hydrogeographic Region	% Region Designated Status	Linear Wetland (Miles)	Wetlands < 40 Acres (Count)	Playas (Acres)	Open Waters (Acres)	Vegetated Wetlands (Acres)
Northwest	0	1,030	1,752	6,287	289	29,997
Black Rock Desert	46	2,784	2,920	210,602	1,233	26,311
Snake River Basin	23	3,827	5,026	0	6,225	53,577
Humboldt River Basin	69	9,441	8,466	12,110	16,128	328,917
West Central	19	407	189	27,636	0	1,876
Truckee River Basin	51	670	856	44,674	148,008	6,434
Western	77	87	145	7,026	0	2,030
Carson River Basin	100	982	1,345	154,943	12,602	90,908
Walker River Basin	53	1,394	1,128	808	37,809	34,756
Central	45	7,838	8,024	450,058	773	197,760
Great Salt Lake Basin	46	1,029	802	7,723	153	7,731
Escalante Desert	0	0	4	0	0	0
Colorado River Basin	56	2,842	1,008	8,764	95,794	28,178
Death Valley Basin	41	186	236	4,171	255	4,541

Source: NNHP analysis using NWI dataset and Nevada Division of Water Resources hydrographic region/administrative groundwater basin spatial layer.

regional- and intermediate-scale watersheds inherent in the basin and range landscape. There are fourteen hydrographic regions, which consist of six major river basins and eight areas of interior drainage (Figure 1.6, p. 1-9). Each hydrographic region is subdivided into "administrative groundwater basins," distinct alluvial basins circumscribed primarily by the watershed divide or in some cases according to the direction of groundwater movement. The three hundred-plus ranges of mountains and hills partition the state into two hundred fifty-six administrative groundwater basins varying in size from a few thousand to several hundred thousand acres. Table 1.9 shows wetland statistics for each hydrographic region.

The second column in Table 1.9 reports the percentage of the hydrographic region administered as part of a "designated" groundwater basin. A basin is "designated" by the State Engineer when data indicate a major aquifer(s) is at risk of being depleted, in which case special rules may be ordered to control the withdrawal of groundwater. An exceptionally important characteristic of Nevada hydrology is interaction between groundwater and surface water. Nevada water law requires the NDWR to administer surface and groundwater resources as distinct systems, but inventorying and permitting in separate accounts may be producing optimistic estimates of a basin's water balance. Surface-groundwater interactions are characterized in a variety of nonregulatory management plans, but even then benefits of wetland occurrence or the detriments of wetland loss with respect to water supplies rarely are factored into water yield analyses. Perennial yield, the estimated volume of groundwater that can be withdrawn each year for an indefinite period without the depleting underground water supply has been calculated for each groundwater basin. It is the benchmark the Division of Water Resources uses to evaluate whether the yearly amount of groundwater pumping permitted exceeds the volume recharged over time. Hydrological studies have linked groundwater pumping for mining, agriculture, or urban development to declines in spring discharge or streamflow, in the middle Humboldt River Basin; the southern Central Region, and Moapa Valley in the northern Colorado River Basin. In basins with significant surface-groundwater interaction, the USGS can estimate "system yield," or the average annual volume of usable surface plus groundwater that can be economically withdrawn for an indefinite time without depleting the "system."

Desert Springs Change with Season and Use

June and August (1991) photos of Crystal Spring illustrate wet to dry season changes in desert spring hydrology and riparian vegetation. By August, the water table and wetland plants have receded. Desert springs fed by local aquifers fluctuate seasonally. This spring supports a population of the rare Amargosa Toad (*Bufo nelsonii*), endemic to Oasis Valley. Dense cattails make good bird habitat, but breeding amphibians require some open water. Seasonal drying and moderate grazing thin the emergent vegetation. The Amargosa Toad Working Group monitors toad populations and those of other at-risk species inhabiting other isolated spring riparian areas. The Working Group of local residents, agency and university biologists, and conservation organizations are implementing a FWS conservation agreement. Tasks involve monitoring, habitat improvement, and threat mitigation. Threats include invasive flora and fauna, wild horses and burros, off road vehicles, water diversion, and development. Glenn Clemmer photos.

Interest in the hydrology and ecology of spring systems in particular has risen in response to increasing rates of change regarding the use and management of water and wetland resources. A major concern is the increased use of groundwater as a key supply strategy for growing municipalities, new electric power plant projects, and to supplement agricultural surface water usage. Other concerns

involve wildlife habitat protection and enhancement, outdoor recreation use, and gaps opened in federal wetland protection law and agency policy since the Supreme Court reinterpreted the applicability of the Clean Water Act to "isolated" waters of the U.S. A study of spring systems in the Great Basin was conducted fifteen years ago to assess the hydrological and ecological conditions of aquatic and riparian habitats. More than five hundred springs in northern, central, and eastern Nevada were surveyed (Sada, 1991). Almost seventy-five percent of the springs on BLM and private land were highly disturbed, and very few were undisturbed. The springs on Humboldt-Toiyabe National Forest lands were in better condition, with about fifty percent rated as moderately to slightly disturbed and about sixteen percent undisturbed. Spring brooks of highly disturbed sites exhibited denuded, sloughing banks, and/or were completely contained in a diversion structure. Livestock grazing and water diversions were the most common threats. Outdoor recreational uses were infrequently cited as the medium for disturbed conditions, but the assessment reflects the effects of land use levels of fifteen years ago.

Wetland Losses and Gains

To make informed choices on wetland conservation priorities, Nevada needs to know about both the extent and content of historic losses and the ongoing changes in wetland resources. Knowing what types of wetlands are declining or increasing, where and in what ways they are changing, and how closely-associated resources (e.g., fisheries, declining rare species, water quality) and natural systems (e.g., river systems, aquatic ecosystems, watershed runoff retention) are responding to wetland conditions helps us turn our attention and efforts to the vulnerable and valuable resources. However, conducting an assessment of losses and gains in wetland quantity and quality requires a sufficiently detailed inventory and a baseline database that is updated periodically. The NNHP and NDEP have the database model and a general plan for developing a detailed statewide inventory, but project work is postponed until administrative resources become available. In addition, assessing the status and trend of wetland resources requires input on the regulatory and non-regulatory program activities in the state. Unfortunately, the types of comprehensive information sources needed do not exist. To build the necessary capacity to assess wetland conditions and implement effective conservation strategies, we need a sustained, joint commitment by state resource agencies; the cooperation of federal agencies and nongovernmental conservation organizations; and time. The status and trends information used in the preliminary Nevada Wetland Priority Conservation Plan (NvWP) report primarily comes from nationwide reconnaissance-scale surveys conducted by the NWI and NRCS; from district office-level estimates that indicate riparian conditions on BLM administered public land; and general observations from various management experts about wetland use and conservation actions. The scarcity of data about changes in the quantity and quality of wetlands is a serious limitation in the state's ability to respond to many natural resource issues, including those concerning how fish and wildlife, biodiversity, water quality, and water supply are being and will be affected by mining, urban development, agriculture, and outdoor recreation.

The prevailing perception among knowledgeable people is that wetland resources are vanishing throughout the working and developing landscapes of Nevada, albeit in a less discernible, piecemeal mode than in the past. Gaging the gradual dissolution of wetland resources requires attentive eyes, especially in the absence of routine assessment or monitoring, but the signs abound. Urban and industrial subdivisions up and down our river valleys skim the edges off of marshes and seasonal wetlands and condense creeks into buried pipes or trapezoidal ditches. The flow of diversion-dominated streams pulse erratically in trough-like channels, usually bordered by laser-leveled fields but occasionally there remains a paper-thin riparian strip clinging to eroding embankments. Slide-rule streams sandwiched within urbanized floodplains are periodically excavated to remove sediment plugs or emplace riprap girdles, nearly stripped of natural features. Dry-land shrubs advance into desiccating riparian woodland and meadow vegetation, roots dangling above the fallen water table of an incising stream. In distant places, the beaten tracks of congregating livestock, wild horses, and off road vehicles ring around and radiate

from springs and creeks leaving puddled, eroding soils and nonnative weed plantations. These altogether too frequent scenes show that gaps exist in the wetland protection strategies or efforts to implement them.

Agencies do not make a practice of compiling data on the results of protection and conservation actions, which is an obstacle to evaluating progress towards and enhancing strategies for achievement of the no net wetland loss goal. Apparently federal and state agencies have not implemented mechanisms to estimate gains or losses in acreage or track the results of permitting, enforcement, grant funding, or condition assessment programs. Just knowing that nonregulatory conservation and restoration efforts to some extent fill the gaps in regulatory efforts is not sufficient to gage statewide wetland conservation success or needs. Without the means to examine the performance of wetland programs implemented by federal and state agencies, we are missing basic information needed to evaluate alternatives to act more effectively. National and regional assessments prepared by the NWI and the NRCS are the most reliable sources for information about trends. The initial NWI status report estimated pre-1980 wetland losses for each of the lower forty-eight states. The NWI has not reproduced the state-by-state survey, although refined wetland maps are available, but two national status and trends surveys have been completed since the initial study.

National Historical Loss Assessment – Nationwide 1780s to 1980s. The Emergency Wetland Resources Act of 1986, which tasked states with completion of a wetland priority conservation plan before grants from the federal Land and Water Conservation Fund could be obtained, assigned the National Wetlands Inventory (NWI) office with the responsibility of mapping and classifying wetland resources of the U.S. This task includes maintaining and updating a database for the preparation of maps that other entities can use for wetland planning and management. The NWI has mapped eighty-nine percent of the conterminous states, including Nevada. Work to refine the maps is ongoing, and the NWI is also developing a digital database at a more detailed scale of mapping and classification. The nationwide database is almost forty percent complete, but less than ten percent of Nevada has been resurveyed and digitized. Congress also directed the NWI to produce status and trends reports at ten-year intervals that provide a comprehensive and statistically valid estimate of the gains and losses of wetlands. Since then, two updates to the initial comprehensive survey completed in 1984 have been produced, one in 1990 and another in 2000.

In 1989, when the National Wetland Policy Forum was deliberating over wetland loss issues and policy adjustments, the most thorough assessment of wetland status and trends was the 1984 National Wetland Inventory (NWI) report, *Wetlands of the United States: Current Status and Recent Trends*. The first NWI status report estimated that the nation's 221 million acre wetland base declined 53 percent since the 1780s (Dahl, 1990). The same study estimated that 52 percent of the vegetated wetlands in Nevada had been lost or converted prior to 1980 (Dahl, 1990). Nevada ranked third among western states in wetland acreage reduction in the Dahl survey (Table 1.10). The latest nationwide status and trends assessment reports on changes in wetland coverage during the period 1986 to 1997. Freshwater wetland acreage in the conterminous states continued to decline. During the survey period, 633,600 acres were

Table 1.10 Estimated Historic Wetland Losses for Western States.

State	1780s Estimated Wetland Acres	1980s Estimated Wetland Acres	Estimated Historic Loss	
			Acres	% Change
California	5,000,000	454,000	4,546,000	-91
Idaho	877,000	385,700	491,300	-56
Nevada	487,350	236,350	251,000	-52
Colorado	2,000,000	1,000,000	1,000,000	-50
Oregon	2,262,000	1,393,900	1,868,100	-38
Wyoming	2,000,000	1,250,000	750,000	-38
Arizona	931,000	600,000	331,000	-36
New Mexico	720,000	481,900	238,100	-33
Washington	1,350,000	938,000	412,000	-31
Utah	802,000	558,000	244,000	-30
Montana	1,147,000	840,300	306,700	-27

Source: Wetland Losses in the United States, 1780s to 1980s. (Dahl, 1990)

converted to upland land uses (Dahl, 2000). About fifty-one percent (383,300 acres) of the losses were attributed to urban (30 percent) and rural (21 percent) development. Agriculture (26 percent) and silviculture (23 percent) also contributed to the net decline. However, the annualized rate of wetland loss for the entire country fell compared to the rate of previous survey periods. The annual average loss rate (acres/year) declined from 290,000 in the 1970s-1980s to 58,500 in the 1980s-1990s.

The results of the latest nationwide assessment show that attaining the "no net loss" standard remains elusive. Such is the case for states as well, including those that have implemented comprehensive wetland protection statutes and programs to augment federal regulatory and incentive programs. Only one state, California, claims to have reached a balance between losses and gains, although the assertion is somewhat circumstantial. Importantly, the California Resources Agency and the state Environmental Protection Agency report that most of the success can be credited to restoration efforts that rely on state partnerships with private landowners, and the actions of The Nature Conservancy, Ducks Unlimited, the Trust for Public Lands and other non-governmental conservators (Sunding and Zilberman, 2003).

The lower annual loss rate calculated for the past study periods is cause for optimism, but should be viewed within the limits of the study parameters. For instance, the NWI data analysis does allow for state specific extrapolation, and provides limited insight on changes in wetland quality or whether gains attributed to mitigation for permitted project losses are providing wetlands with equivalent functions and services to those eliminated. However, the report notes that decreases in freshwater emergent marshes and forests were offset by gains in constructed ponds; wetland restoration or creation on upland sites; and, freshwater shrubs. Gains in freshwater shrub wetlands may be the result of partial drainage of emergent wetlands. Pond types include beaver; farm; livestock watering; runoff and water retention; open mine pits; recreational; and residential lakes; water traps on golf courses; fish farms; and natural ponds. Constructed ponds and created wetlands generally are qualitatively inferior to the wetland types found to be declining (Dahl, 2000). If the countrywide pattern of tradeoffs in terms of wetland types and functions were prevalent in Nevada, it would not be viewed as a positive trend. The freshwater marshes and riparian woodlands have been widely and seriously reduced, and the state's wetland resource base already consists of many artificial wetlands that lack various ecosystem functions and socioeconomic services.

Western Nevada Losses. The most substantial historical losses occurred in western Nevada river valleys, primarily in the middle, lower, and terminal valleys. The FWS in 1987 estimated that 82 percent of wetland acreage formerly occupying the terminal valleys of the Truckee, Carson, and Humboldt River basins had been converted since settlement of western Nevada in the 1850's (Thompson and Merritt, 1987). Table 1.11 presents refined historical wetland loss data (86 percent) for Lahontan and Winnemucca Lake valleys. In addition, Thompson and Merritt estimated the lower Humboldt wetland area decreased from 58,000 to 12,837 acres (78 percent loss).

Table 1.11 Historical Losses of Major Wetlands in Western Nevada

Site	Historic Area (Acres)	1987 Area (Acres)	Minimum Area Lost (Acres)	Percent Lost (%)
Carson Lake	25,600+	5,625	19,975	– 78
Stillwater WMA	33,400	9,650	23.750	– 71
Fallon NWR	26,500	0	26,500	– 100
Winnemucca Lake NWR	27,500*	0	27,500	– 100
Totals	113,000	15,275	97,725	– 86

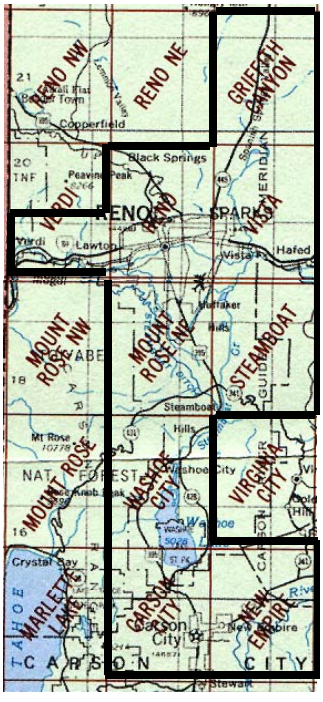
Source: Adapted from Newlands Project, Nevada – California, Operating Criteria and Procedures, Record of Decision (Office of the Secretary of the Interior, 1988).
Note: *The only records available indicate that Winnemucca Lake fluctuated from 0 to > 60,000 acres. Based on long-term flow records, before diversion, it appears the average would have been around 27,500 acres.

Winnemucca Lake Valley exemplifies the difficulties that arise when proposals for water developments, particularly those that export water resources, are constructed without careful analysis of the relationships to wetland ecosystems and associated resources. In the case of the now dry bed of Winnemucca Lake, the valley formerly held a fluctuating shallow lake and marsh complex. Surface area of the lake was estimated to peak at 60,000 acres, but

grew or receded according to the volume of water overflowing Pyramid Lake. Like Carson Lake and the Lahontan Valley wetlands, which also faced complete desiccation, Winnemucca Lake lay within the Pacific Flyway and was an important desert stopover for migratory waterfowl and shorebirds, bald eagles, pelicans, and large numbers of many other migratory and resident species of birds. Designated as Nevada's first national wildlife refuge in 1936, the lake became desiccated shortly thereafter, the victim of drought and water diversions from the Truckee River to the Carson River basin. By 1962 the deterioration of wetland wildlife habitat was so profound that the Fish and Wildlife Service rescinded the national wildlife refuge designation. A similar fate may befall Walker Lake unless stakeholders find the mutual inspiration that united Truckee River stakeholders to negotiate and compromise over the allocation of river flow, thereby arresting the fall of Pyramid Lake and the demise of Lahontan Valley marsh and meadow land and Carson Lake.

The Pacific Region office of the NWI recently completed preliminary analysis on a survey of wetland gains and losses in the Reno-Carson City area (map inset). The results give us insight on post-1980 trends in a portion of western Nevada that has been experiencing relatively high rates of population growth and robust land development. The preliminary survey results indicate that losses far exceeded gains between 1980 and 1999. During the period of study, the total reduction in wetland acres amounted to fourteen percent, or a net loss of 2,813 acres. An important note is that the comparison of 1980 to 1999 wetland acreage reflects permanent changes in wetland and riparian areas due to new land development, as opposed to temporary reductions due to seasonal dry or drought conditions. Other valleys in western Nevada's river basins also are undergoing a surge in residential, commercial, and industrial developments, in the middle and lower portions of the Carson and Walker river valleys, including Carson, Dayton, Lahontan, and Mason valleys (Douglas, Lyon, and Churchill counties). The development of subdivisions in the floodplains of western Nevada river valleys has become a contentious issue that local governments continue to struggle to resolve. Among the concerns are the impacts of natural resources already degraded, including water quality, scenic natural areas, urban open space, fish and wildlife and their habitat, farmland, and outdoor recreation access. The changes in wetland coverage were estimated from spatial analysis of satellite imagery, aerial photos, and field site survey. This study, though the results are provisional, is important because it represents the only post-1980's study using a systematic approach to quantify wetland conservation trends within the state.

Study Area, Wetland Loss/Gain Analysis of Land Development Activities in the Reno – Carson City Vicinity, 1980 – 1999, NWI Pacific Region Office



Source: Preliminary Data, NWI, Pacific Region, January 2004.
Note: Study area includes USGS quads and Verdi portion outlined by black.

Table 1.12 Net Change In Wetland Acreage Due To Development Activities In the Reno – Carson City Study Area, 1980 – 1999

USGS Quadrangle	1980 Acreage	Losses	Gains	Net Change	1999 Acreage	% Change
Griffith Canyon	171.04	50.22	110.07	+ 59.85	230.89	+ 34.99
Vista	2,033.28	754.40	169.99	- 584.41	1,448.87	- 28.74
Reno	374.08	72.74	19.33	- 53.41	320.67	- 14.28
Verdi*	303.25	17.60	8.40	- 9.20	294.05	- 3.03
Steamboat	3,633.08	1,354.80	107.02	- 1,247.78	2,385.30	- 34.34
Mt. Rose NE	1,330.53	783.72	79.95	- 703.77	626.76	- 52.89
Washoe City	7,685.41	157.86	39.35	- 118.51	7,566.90	- 1.54
New Empire	1,177.86	212.67	170.88	- 41.79	1,136.07	- 3.55
Carson City	3,262.24	161.53	47.25	- 114.28	3,147.96	- 3.50
Total	19,970.77	3,565.54	752.24	- 2,813.30	17,157.47	- 14.09

Source: Provisional data. NWI Pacific Region Office, Portland.
Note: * partial map (southern third)

Nonfederal Wetland Status, Natural Resources Conservation Service. The initial 1984 nationwide status and trend assessment by the FWS reported that agricultural activities were responsible for almost eighty percent of the pre-1980 wetland losses. Afterward, Congress directed the U.S. Department of Agriculture, more specifically the NRCS, to periodically assess the status and trends of wetlands on nonfederal crop and ranch land, and produce periodic assessments. The NRCS data management program is the Natural Resource Inventory (NRI). The NRI updates inventory data on patterns of land use and natural resource occurrences. The data are generated by interpretation of aerial photos and satellite imagery. Tables __ and __ presents NRI-estimated wetland acreage for palustrine, lacustrine and riverine systems. The system totals apparently include adjacent open water acreage. The NRI and NWI wetland acreage estimates are difficult to compare primarily because each takes a different approach to segregating the land surveyed and organizing the estimates. The NWI data used in this report include both federal and nonfederal land and the totals are not segregated by landownership, but the NRI only surveys wetlands on land owned privately and by nonfederal governments. The NRI wetland totals include the amount of open water associated with the system of wetland, but the NWI classifies open water separately. Linear (or riparian) wetlands are measured in units of miles by the NWI, but the NRI estimates riparian (mostly palustrine) acres. Also, the NRI dataset may not include playa acres. Finally, the NWI wetland data represent analysis performed with imagery and photos during a different period of time, and under different weather and water resource conditions. Taking these differences into consideration, and given the margin or error inherent in the survey methods used, the estimates appear to fall in the same ballpark.

Table 1.13 Wetland and Adjacent Deepwater Acreage in Nevada, Nonfederal Land, 1997.

Palustrine	Lacustrine	Riverine	Total
385,600	365,700	63,400	814,700

Source: NRCS, Natural Resources Inventory, 2000

Table 1.14 Palustrine Wetland Acreage in Nevada, Nonfederal Land, Grouped By Land Cover/Use, 1997.

Crop/pasture/CRP	Rangeland	Forest	Rural	Developed	Water	Total
169,700	199,000	0	6,900	6,200	3,800	385,600

Source: NRCS, Natural Resources Inventory, 2000

More recent nationwide wetland status analysis by the NRI indicates that agricultural land use no longer is the prevalent driver of additional wetland losses. During the 1992 to 1997 period, approximately 51,200 acres were eliminated by agricultural developments, but urban and rural land development results in the loss of 188,800 acres. The NRI data is not segregated by state, so it is unclear if that trend occurs in Nevada, but in the rapidly growing counties of western and southern Nevada, clearly urban and rural land development is the major wetland threat. The results of the NWI wetland trend for the nation are shown in Table 1.15. Nationwide, the NWI estimated a net loss of 633,600 acres over ten years ending in 1997. The results of the 1997 to 2002 survey period indicate the total nationwide loss was 281,600 acres, sixty-seven percent of which were eliminated by urban and rural development (Table 1.16). Urban and rural development entails large tracts of urban and built up land; small tracts of built up land less than 10 acres; and other land in roads, railroads and associated right of ways. From 1997 to 2002, the NRI estimates wetland acreage on nonfederal land netted a 69,200-acre increase.

Table 1.15 NWI Estimated Gains and Losses, Freshwater Wetland Acreage, Nationwide, 1986 to 1997

Freshwater Vegetated	
Emergent	-1,226,200
Forested	-1,201,100
Shrub	+1,130,400
Freshwater Non-vegetated	
Ponds	+63,.300
Miscellaneous	+32,000
Gains	+1,793,700
Losses	-2,427,300
Net change	-633,600
Total Freshwater Wetlands	100,165,500

Source: NWI Status and Trends Report, 2000.

Table 1.16 NRI Estimated Gains and Losses by Land Use, Non-Federal Land, Nationwide, All Wetland Types, 1997 to 2002

Land Use Category	Loss	Gain	Change
Agriculture	51,200	182,600	+131,400
Developed Land	188,800	168,200	-62,200
Other Factors	41,600		
Combined Total	281,600	350,800	+69,200

Source: Natural Resources Inventory (NRCS web page, January 2005, http://www.nrcs.usda.gov/technical/land/nri02/wetlands.pdf)

Table 1.17 NRI West Region Estimated Losses and Gains, Palustrine and Estuarine Wetlands (Acres), 1992 to 1997	
Gross losses:	-36,200
Agriculture	-11,800
Silviculture	-3,800
Development	-10,400
Miscellaneous causes	-10,200
Gross gains	56,200
Net change	+20,000
Palustrine and estuarine wetland total	6,415,000

Source: Natural Resources Inventory (NRCS, 2000).
Note: Nevada contains no estuarine wetland acreage.

The NRI's regional wetland trend analysis is a positive half step toward assisting states with needed data. In the West Region (Nevada is grouped with Washington, Oregon, California, New Mexico Arizona, Utah, and Idaho) from 1982 to 1992 the NRI estimated nonfederal wetland acreage increased 80,000 acres but decreased 113,000, for a net loss of 53,000 acres. More recent survey data suggest the net loss trend has reversed, and more wetland acreage is being restored and created. From 1992 to 1997, the NRI estimated that 56,200 acres were gained, and 36,200 acres were lost for a net change of plus 20,000 acres (Table 1.17). In the western region, wetland losses on urban and rural developed lands contributed to almost twenty-nine percent of the total, and losses on agricultural land approximated thirty-three percent of the total. Nationwide, net losses on nonfederal land totaled 163,000 acres, with development accounting for forty-nine percent of the losses, and agriculture twenty-six percent.

While the national data provide general guidance on trends, the NRI and NWI assessments would be more useful if the analysis presented the trend data by wetland class and described ramifications of wetland class trends in terms of functions and services. The NWI, in the latest status and trends report, did provide some perspective with respect to natural and artificial wetlands. The report noted open water pond acreage doubled since the 1950s, and experienced the largest percentage increase during the 1980s to 1990s. This change in the resource base may reflect a trend in substituting artificial impoundments as mitigation for wetland losses. Ponds, which often are created for mining, ranching, farming, urban runoff, golf courses, aquaculture, and recreation uses, do not replace the functions and values of native vegetated wetlands.

The Impact of Federal Programs on Wetlands, DOI, 1994. The DOI reported to Congress about its investigation of the influence of federal regulations, resource development subsidies, and public land management on the status of wetlands on public lands subject to multiple use policies and regulations. Areas studied were western riparian wetlands of the Carson, Humboldt, Truckee, Walker and the Snake, Columbia, and Rio Grande River systems (DOI, 1994). Relevant to the status of riparian wetlands in the West, the DOI report cites the following findings from a 1988 General Accounting Office report:

- Some riparian areas have declined by as much as ninety to ninety-five percent;
- Surveys of riparian areas within public rangeland indicate most are vulnerable, and are ecologically unhealthy and under-functioning;
- Tens of thousands of stream miles are in need of restoration; and,
- In Nevada, small diversions is thought to cause as much riparian wetland loss as large multipurpose projects.
- On the Humboldt River, seventy-fiver percent of riparian wetlands have been lost as a direct result of multipurpose water projects.

Riparian and Wetland Proper Functioning Condition Assessment. The riparian "proper functioning condition" assessment (PFC) method was established as a systematic approach to gaging the stability of riparian and wetland site conditions. The PFC method can be applied to both riparian zones along flowing water (lotic) features and wetland sites with standing water (lentic) features such as springs, marshes, and wet meadows. The criteria that constitute Proper Functioning Condition for lotic and lentic sites are described in the box, below. The assessment method works on the theory of dynamic equilibrium. The dimensions of a wetland's physical features (i.e, surface and groundwater, soil, sediment, vegetation, landform) exist in a continuous state of flux, but the dimensional changes occur within a range of natural variation typical for the site such that disturbance (e.g., water or wind erosion, sediment accumulation) and resistance forces appear to be in balance over time.

Description of Proper Functioning Condition at Wetland (Lentic) and Riparian (Lotic) Sites

Lentic riparian-wetland areas are functioning properly when adequate vegetation, landform, or debris is present to:

- Dissipate energies associated with wind action, wave action, and overland flow from adjacent sites, thereby reducing erosion and improving water quality;
- Filter sediment and aid floodplain development; improve flood-water retention and groundwater recharge;
- Develop root masses that stabilize islands and shoreline features against cutting action;
- Restrict water percolation;
- Develop diverse ponding characteristics *to provide* the habitat and the water depth, duration, and temperature necessary for fish production, water-bird breeding, and other uses; and,
- Support greater biodiversity.

Lotic riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to:

- Dissipate stream energy associated with high water flow, thereby reducing erosion and improving water quality;
- Filter sediment, capture bedload, and aid floodplain development;
- Improve flood-water retention and groundwater recharge;
- Develop root masses that stabilize streambanks against cutting action;
- Develop diverse ponding and channel characteristics *to provide* the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and,
- Support greater biodiversity.

In 1996, the BLM, USFS, and NRCS agreed to implement the riparian and wetland assessment. The objective for establishing a coordinated network acknowledges that riparian areas and wetlands form a system within a watershed framework that crosses jurisdictional boundaries. In Nevada, only the BLM appear to have adopted the PFC method as an agency-wide evaluation and monitoring strategy. Annual summary data of PFC assessment results provided by the Nevada BLM office are presented in Tables 1.18a and 1.18b. The PFC assessments method provides information resource managers need to evaluate trends and adjust use or management activities in response to changes in vegetation, hydrogeomorphology, erosion and deposition, soil and water quality attributes of stream reaches or wetland sites. Riparian and wetland areas may be found to be in: 1) proper functioning, when the vegetation, landform, or large woody debris is present to dissipate energy associated with high water flow; 2) functioning at risk where soil, water, or vegetation attributes make them susceptible to degradation; or, 3) non-functional where vegetation, landform, or large woody debris is not sufficient to dissipate stream energy associated with high flows.

The statewide summary data displayed in Tables 1.18a and 1.18b indicate the quantity of riparian miles and wetland acres assessed (Total) and the amount meeting "functioning" criteria has increased significantly since 1997. The lower number of riparian miles and wetland acres in the "Unknown" column indicates the BLM has expanded PFC monitoring efforts and/or has improved data management. In 2003, almost sixty-five percent of the riparian miles were assessed as at risk or nonfunctioning, while forty-six percent of the wetlands were in functioning condition. We might speculate that the decrease in total wetland acreage assessed is due to drought conditions, but the increase in total riparian area seems to contradict this supposition.

Tables 1.18a and 1.18b Statewide Proper Functioning Condition Assessment Results for Riparian Areas and Wetlands on BLM Land in Nevada

Riparian Areas (Miles)					
Year	Proper Functioning Condition	Functioning at Risk	Non-Functional	Unknown	Total
1997	361	543	513	840	2,257
1999	660	1,127	392	268	2,447
2001	825	1,225	470	30	2,550
2003	854	1,232	475	53	2,614

Wetlands (Acres)					
Year	Proper Functioning Condition	Functioning at Risk	Non-Functional	Unknown	Total
1997	3,551	785	4,158	25,165	33,659
1999	8,821	1,712	4,098	19,566	34,197
2001	9,338	2,234	213	18,578	30,363
2003	8,569	2,855	296	6,845	18,565

Source: BLM Public Lands Statistics, Nevada BLM Office.
Notes: Even-year data intentionally omitted.

In Nevada, the BLM is the only federal agency to routinely use the PFC assessment to track the status of riparian and wetland ecosystems. The Humboldt-Toiyabe National Forest (HTNF) reports that forest-wide monitoring for the purposes of tracking

wetland gains or losses is not conducted. The HTNF contends there should be no recent loss of wetland/riparian habitat with emphasis being placed on protecting, maintaining, and enhancing aquatic habitat, water quality, and the stream corridor. Furthermore, the implementation of new range standards and guidelines, the quality of riparian/wet meadow habitat will most likely improve over current conditions. The standards and guidelines were expected to be approved in the new forest plan, perhaps by 2007 (HTNF correspondence, 2003). Forest Service lands in Nevada are intensively used and developed for grazing, mineral and energy resource extraction and exploration, improved and unimproved roads, outdoor recreation including trails for motorized touring, utility corridors, and water developments and diversions. Information about riparian PFC assessments, or other monitoring activities conducted by the NRCS in Nevada is not available.

Improper Grazing in a Steptoe Valley Wetland

Wetlands in depressional areas of arid valleys can be utterly destroyed by poor livestock management. Such widely dispersed, biologically diverse wetlands are crucial to wildlife inhabiting cool desert ecosystems. The deplorable condition of this site clearly meets the PFC standard of nonfunctioning. Excessive grazing and trampling reduces the frequency and duration of ponding; ruins the soil; promotes erosion, impairs water quality; eliminates critical wildlife habitat; and aids and abets nonnative plants.

Appendix 1.1. National Wetland Inventory Major Wetlands, Lakes, Reservoirs, Rivers, and Playas in Nevada.

These data are extracted from the NWI inventory for Nevada. "Major"features were mapped as 1,000 acres or larger. Surface areas of water bodies fluctuate, and these estimates may differ from others arrived at under drier or wetter periods.

Place Name	Type	Area (acres)
Colorado River	Major River	4,226
Virgin River	Major River	1,724
Colorado River	Major River	1,205
Swan Lake Reservoir	Major Inundation Area	1,201
Lake Mead	Major Inundation Area	1,074
Grass Valley	Major Mud Playa	15,481
Mud Lake	Major Mud Playa	12,790
Edwards Creek Valley	Major Mud Playa	12,740
Newark Lake	Major Mud Playa	12,084
Labou Flat	Major Mud Playa	3,526
Kawich Valley	Major Mud Playa	2,690
Yelland Dry Lake	Major Mud Playa	2,605
Papoose Lake	Major Mud Playa	1,738
Dry Lake	Major Mud Playa	1,703
Mud Lake	Major Mud Playa	1,031
Big Smoky Valley	Major Salt Playa	30,928
Columbus Salt Marsh	Major Salt Playa	19,764
Clayton Valley	Major Salt Playa	17,313
Gabbs Valley	Major Salt Playa	12,958
Humboldt Salt Marsh	Major Salt Playa	9,848
Teels Marsh	Major Salt Playa	3,439
Rhodes Salt Marsh	Major Salt Playa	1,782
Continental Lake	Major Salt Playa	1,430
Salt Wells Marsh	Major Salt Playa	1,180
Carson Sink	Major Playa	272,887
Black Rock Desert	Major Playa	108,830
Smoke Creek Desert	Major Playa	61,825
Coal Valley	Major Playa	55,377
Diamond Valley	Major Playa	45,390
Winnemucca Lake	Major Playa	37,181
Butterfield Marsh	Major Playa	35,845
Buena Vista Valley	Major Playa	34,293
Dry Lake Flat	Major Playa	28,324
Salt Wells Basin	Major Playa	19,909
Blue Wing Flat	Major Playa	14,735
Bonneville Basin	Major Playa	13,406
Smith Lake	Major Playa	11,954
Jungo Flat	Major Playa	11,703
Ivanpah Lake	Major Playa	10,603
Ruby Valley	Major Playa	10,451
Desert Lake	Major Playa	9,482

Place Name	Type	Area (acres)
Lower Lake	Major Playa	9,280
Humboldt Sink	Major Playa	8,755
Dry Lake Valley	Major Playa	8,522
Carson Lake Pasture	Major Playa	8,119
Churchill Valley	Major Playa	8,108
Indian Springs Valley	Major Playa	7,701
Buffalo Valley	Major Playa	7,084
Independence Valley	Major Playa	7,033
Honey Lake Valley	Major Playa	6,217
Kumiva Valley	Major Playa	5,775
Ruby Lake North Marsh	Major Playa	5,686
Dog Bone Lake	Major Playa	5,667
Groom Lake	Major Playa	5,544
Bass Flat	Major Playa	5,033
Hualapai Flat	Major Playa	4,814
Duck Lake	Major Playa	4,391
Three Lakes Valley	Major Playa	4,388
Goshute Lake	Major Playa	4,326
Alkali Lake	Major Playa	4,001
Alkali Lake	Major Playa	3,828
Stewart Valley	Major Playa	3,825
Yucca Lake	Major Playa	3,599
Frenchman Lake	Major Playa	3,517
Roach Lake	Major Playa	3,472
Big Smoky Valley	Major Playa	3,260
Massacre Lake	Major Playa	2,974
Hidden Valley	Major Playa	2,935
Snow Water Lake	Major Playa	2,747
Turupah Flat	Major Playa	2,730
Delamar Lake	Major Playa	2,677
Rawhide Flats	Major Playa	2,594
Black Rock Desert	Major Playa	2,507
Kibby Flat	Major Playa	2,409
Dry Lake	Major Playa	2,286
Amargosa Flat	Major Playa	2,242
Antelope Lake	Major Playa	1,999
Lida Valley	Major Playa	1,986
Sand Spring Valley	Major Playa	1,835
Lunar Lake	Major Playa	1,811
Misfits Flat	Major Playa	1,809
Black Rock Desert	Major Playa	1,596
Bonneville Basin	Major Playa	1,552
Dry Lake	Major Playa	1,459
West Lake	Major Playa	1,417
Stillwater Point playa	Major Playa	1,403
Calcutta Lake	Major Playa	1,310
Jean Lake	Major Playa	1,282

Place Name	Type	Area (acres)
Big Smoky Valley	Major Playa	1,225
Middle Lake	Major Playa	1,160
White Lake	Major Playa	1,122
Smith Lake	Major Playa	1,109
Bonneville Basin	Major Wetland	6,726
Franklin Marsh	Major Wetland	4,303
Butte Valley marsh	Major Wetland	2,147
Carson Lake	Major Wetland	2,004
Fish Lake Valley Marsh	Major Wetland	1,837
Harmon Reservoir marsh	Major Wetland	1,279
Steptoe Slough	Major Wetland	1,248
Lake Mead	Major Reservoir	150,717
Lake Mohave	Major Reservoir	23,591
Lahontan Reservoir	Major Reservoir	14,162
Rye Patch Reservoir	Major Reservoir	11,167
McGill Tailings Pond	Major Reservoir	3,432
Sheckler Reservoir	Major Reservoir	2,777
Pitt-Taylor Reservoir	Major Reservoir	2,536
Wild Horse Reservoir	Major Reservoir	2,217
Chimney Reservoir	Major Reservoir	2,177
Upper Pitt-Taylor Reservoir	Major Reservoir	2,023
Stillwater Point Reservoir	Major Reservoir	1,875
Quinn River Lakes	Minor Reservoir	1,369
Lake Tahoe	Major Lake	122,920
Pyramid Lake	Major Lake	109,330
Walker Lake	Major Lake	35,520
Stillwater Marsh	Major Lake	8,521
Ruby Lake South Marsh	Major Lake	6,505
Big Water	Major Lake	5,978
Washoe Lake	Major Lake	5,603
Humboldt Lake	Major Lake	4,474
Fernley Sink	Major Lake	3,752
Carson Lake	Major Lake	3,354
Topaz Lake	Major Lake	2,196
Artesia Lake	Major Lake	2,171
North Nutgrass	Major Lake	1,790
Crooks Lake	Major Lake	1,341
Swan Lake	Major Lake	1,242
Pintail Bay	Major Lake	1,156

Appendix 1.2. NVWETIS Field Data Form Recommended for Use in Developing a Classified Inventory of Wetlands in Nevada

Overview

The NVWET is based on the Cowardin System integrated with a landform/hydrogeomorphic classification system, with additional defining attributes, including hydrology and water regime, plant species and vegetative stratum, soil profile characteristics, ecosystem functions, socioeconomic values, disturbance, and land use. The NVWET is intended to be a standard protocol for wetland site characterization used by scientists and specialists with appropriate expertise. Ideally, agencies, conservancies, and consulting specialist will use the field data form and appropriate field data collection protocol to document wetland characteristics.

The NVWET is a tool intended to assist agencies and conservancies in reaching their wetland and associated resource planning, protection, restoration, and conservation objectives. The specific objectives which the NNHP are pursuing are:

- Infill the Nevada Wetland Information System with data collected under a standard protocol with quality controls.
- Develop a geospatial database of wetland plant communities for use in land use and water development planning.
- Indicate the conservation status of sensitive or rare wetland habitats.
- Assist in the prioritization of wetlands for the updates of the state Wetland Priority Conservation Plan required every five years by the NPS, as well as other conservation planning programs.
- Provide wetland data services to agencies, conservancies, planning agencies, consultants, educators, and other entities engaged in protection, research, inventory, mitigation, restoration, and conservation planning for wetlands and related resources, including fishes, birds, amphibians, aquatic invertebrates, water quality, watershed function, outdoor recreation, and other valued natural resources.

To achieve these objectives, the NNHP will continue to develop and eventually become the operator of the Nevada Wetland Information System and GIS.

The status of the NVWETIS Field Data Form is provisional. It was field tested as part of its design and development to classify and map wetlands in Carson City. However, we feel additional use by various wetland ecologists in a range of settings is desirable to determine if the protocol is a good fit with the wetland classification work of agencies and other organizations that are interested in using the NVWETIS.

Field Data Form

Site Name: _____ **Quad Map:** _____

County: _____ **State:** _____ **4/4S** _____ **/4S** _____ **S** _____ **T** _____ **R** _____

Date: _____ **UTM Northing:** _____ **Easting:** _____

Investigator(s): _____ **Hydrogeographic Region:** _____ **Hydrogeographic Area:** _____

Investigation/Agency: _____ **% Slope:** _____ **Aspect:** _____

Plot ID #: _____ **Elevation:** _____

Site Description: _____

Site Photo(s): Roll #: _____

Frame #(s): _____

Previous Wetland Delineation Determination:

No Yes (describe) _____

Landuse: _____

Land Owner: _____

Current Wetland Determination:

Wetland Riparian Upland

Microrelief: Concave Convex

LANDFORM//HYDROGEOMORPHIC UNIT

Riverine

1. Pools, Riffles, Springs:
   - A. Pools:
     - a. Main Channel
     - b. Scour
     - c. Backwater
   - B. Riffles
     - a. Rapids (agitated, swift water with obstructions/standing waves)
     - b. Riffles (shallow rapids, standing waves absent)
     - c. Cascades (stepped drops, exposed rock)
     - d. Runs (swift uniform flow @ equal to river gradient)
     - e. Falls (water drop)
   - C. Springs:
     - a. Cold
     - b. Hot

2. Channels/Drainages:
   - A. Channels:
     - a. Main Channel (river or stream)
       - i. Sinuous
       - ii. Linear
     - b. Distributory (braided) Channel
     - c. Back Bar Channel
   - B. Drainages:
     - a. Artificial (irrigation/nuisance water)
     - b. Modified Natural (storm water)

3A. Shores 3B. Banks

Palustrine

1. Pools, Riffles:
   - A. Pools:
     - a. Main Channel
     - b. Scour
     - c. Backwater
   - B. Riffles
     - a. Rapids (agitated, swift water with obstructions/standing waves)
     - b. Riffles (shallow rapids, standing waves absent)
     - c. Cascades (stepped drops, exposed rock)
     - d. Runs (swift uniform flow @ equal to river gradient)
     - e. Falls (water drop)

2. Channels/Drainages:
   - A. Channels:
     - a. Main Channel (river or stream)
       - i. Sinuous
       - ii. Linear
     - b. Distributory (braided) channel
     - c. Back Bar Channel
   - B. Drainages:
     - a. Artificial (irrigation/nuisance water)
     - b. Modified Natural (storm water)

3A. Shores 3B. Banks

4A. Beds 4B. Bars

5A. Flats 5B. Washes 5C. Floodplains 5D. Drainageways 5E. Terraces 5F. Deltas

6A. Slopes 6B. Alluvial Fans

7. Seeps/Springs:
   - A. Seeps
     - a. Cold
     - b. Hot
   - B. Springs
     - a: Cold
     - b. Hot

8. Basins:
   - A. Pools:
     - a. Vernal
     - b. Ephemeral
   - B. Ponds:
     - a. Agricultural
     - b. Recreation
     - c. Wastewater Treatment
     - d. Natural
     - e. Other
   - C. Meadows:
     - a. Montane
     - b. Alkaline
     - c. Other
   - D. Swales:
     - a. Vernal
     - b. Ephemeral
   - E. Lakes
   - F. Reservoirs
   - G. Playas
   - H. Marshes

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Field Data Form

PLOT ID #: _____

LANDFORM/HYDROGEOMORPHIC UNIT (cont.)

Lacustrine

1. Water Bodies:
   A. Lakes B. Reservoirs

2A. Shores 2B. Banks 2C. Margins

3A. Beds 3B. Bottoms 3C. Bars

4. Deltas

5. Springs

VEGETATION ABIOTIC (substrate < 30%) BIOTIC (substrate > or = 30%)

Percent	Plant Species	Stratum	Indicator	Percent	Plant Species	Stratum	Indicator
1.				16.			
2.				17.			
3.				18.			
4.				19.			
5.				20.			
6.				21.			
7.				22.			
8.				23.			
9.				24.			
10.				25.			
11.				26.			
12.				27.			
13.				28.			
14.				29.			
15.				30.			

Percent of Species that are OBL, FACW or FAC (excluding FAC-) _____ OBL to FAC % _____ X _____ % BV = _____ % Substrate

Ground Cover (% area):	Percent		Percent
Bare Soil	_____	Wood	_____
Gravel	_____	Moss	_____
Rock	_____	Basal Vegetation (BV)	_____
Litter	_____	Other (typically water)	_____

Veg. Remarks: _____

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Field Data Form

PLOT ID #: _____

SOILS

Profile Description (0-18" depth):

Hydric Soils Non-hydric Soils Unknown

Soil Characteristics:

Depth	Matrix Color	Texture	Mottling

Oxidized Root Channels	Yes	No	Sulfide Odor	Yes	No
High Organic Matter In Surface Layer In Sandy Soils	Yes	No	Organic Subsurface Layers In Sandy Soils	Yes	No

Soil Remarks: _____

HYDROLOGY

Depth of Surface Water: _____ (in.) **Horizontal Distance from Water:** _____

Depth to Free Water: _____ (in.) **Surface Water % Cover:** _____

Depth to Saturated Soil: _____ (in.) **Water Depth:** _____

Water Regime (nontidal): terms apply to all wetland systems

a. Permanently Flooded b. Intermittently Exposed c. Semi-permanently Flooded d. Seasonally Flooded

e. Temporarily Flooded f. Ephemeral g. Saturated (palustrine only) h. Unknown

Riparian Features:

Channel Entrenchment:	Sinuous	Linear	**Water Conveyance:**	Natural	Altered	Unknown
Channel Benching:	Yes	No	**Water Source:**	Natural	Altered	Unknown
Channel Shape:	"U"	"V"	**Run-on?**	Yes	No	
Channel Depth:	Shallow	Deep				
Floodplain Presence:	Yes	No				

Hydrology Remarks: _____

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Field Data Form

PLOT ID #: _____

DISTURBANCE

Not Assessed

Fire	Yes	No	Unknown	Urban Development	Yes	No	Unknown
Flood	Yes	No	Unknown	Passive Use	Yes	No	Unknown
Logging	Yes	No	Unknown	Noxious Weed(s)	Yes	No	Unknown
Grazing	Yes	No	Unknown	Non-noxious Weed(s)	Yes	No	Unknown
Mining	Yes	No	Unknown	Accelerated Erosion	Yes	No	Unknown
				Construction Fill	Yes	No	Unknown

Disturbance Remarks: _____

ECOSYSTEM FUNCTION

Not Assessed

Food Chain/Nutrient Cycling:	Primary Production	Decomposition	Nutrient Export	Nutrient Stabilization				
Habitat:	TES & Rare Species	Invertebrates	Fisheries	Birds	Mammals	Herpetofauna	Plants	
Hydrology:	Flood Conveyance	Sediment Control	Ground Water Recharge & Discharge					
Water Quality:	Water Supply	Wastewater Treatment	Detoxification	Modification of Pollution from Nutrient Enrichment				

Function Remarks: _____

SOCIOECONOMIC VALUES

Not Assessed

Consumptive:	Water	Mining	Petro Chemicals	Urban Development	Biotic Resources:	Fisheries	Lumber	Crops	Game Species	Grazing
Non-consumptive:	Aesthetic (scenic resource)		Passive Use (hiking, camping, picnicking, bird watching, etc.)							
Nevada Natural Heritage Data:	Yes	No	Unknown					Historical Value:	Yes	No
Native American Heritage:	Food	Fiber	Medicine	Unknown	Other _____				Unknown	

Socioeconomic Remarks: _____

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Field Data Form

PLOT ID #: _____

CLASSIFICATION

SYSTEM R	Natural												Altered													
SUBSYSTEM*	Perennial Lower												Perennial Mid/Upper												Intermittent L/M/U	Ephemral L/M/U
CLASS	RB	UB	AB	RS	US	EM							RB	UB	AB	RS	US	EM							SB	SB
SUBCLASS	BE	CG	AL	BE	CG	NP							BE	CG	AL	BE	CG	NP							BE	BE
	RU	SA	AM	RU	SA								RU	SA	AM	RU	SA								RU	RU
		MU	RV		MU									MU	RV		MU								CG	CG
		OR	FV		OR									OR	FV		OR								SA	SA
					VE												VE								MU	MU
																									OR	OR
																									VE	VE

Lower (L) = gradient <1.5%
Mid (M) = 1.5% - 4%
Upper (U) - gradient >4%

SYSTEM P	Natural						Altered	
CLASS	RB	UB	AB	US	ML	EM	SS	FO
SUBCLASS	BE	CG	AL	CG	MO	NP	BLD	BLD
	RU	SA	AM	SA	LI	PE	NLD	NLD
		MU	RV	MU			BLE	BLE
		OR	FV	OR			NLE	NLE
				VE			DEA	DEA

SYSTEM L	Natural				Altered							
SUBSYSTEM	LIM (>2m deep)				SUBSYSTEM	LIT (<2m deep)						
CLASS	RB	UB	AB	OW	CLASS	RB	UB	AB	RS	US	EM	OW
SUBCLASS	BE	CG	AL		SUBCLASS	BE	CG	AL	BE	CG	NP	
	RU	SA	AM			RU	SA	AM	RU	SA		
		MU	RV				MU	RV		MU		
		OR	FV				OR	FV		OR		

SUBSTRATE/DOMINANCE/CHARACTERISTICS

Abiotic: _____ Dicot Vascular _____

Algal _____ Monocot Vascular _____

Moss-Lichen, Fungi _____ Mixed Vascular _____

Pteridophyte _____ Unknown

WATER/SOIL CHEMISTRY

Not Assessed

Fresh Water (Acidic) Fresh Water (Circumneutral) Alkaline Petroleum Affected

Hypersaline Eusaline Brackish (Mixosaline) Sulfur Affected

WETLANDS CREATION/ENHANCEMENT POTENTIAL*

Not Assessed

0 Unknown Potential 1 Low Potential

2 Medium Potential 3 High Potential

*NOTE:
Criteria to consider:
Existing wetland condition
Land and Soils
Wetland Status

Remarks: _____

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PART 2. WETLAND QUALITY – ECOSYSTEM FUNCTIONS AND SOCIOECONOMIC SERVICES OF THE WETLANDS OF NEVADA

Overview

Maintaining and enhancing the *quality* of our wetland resources fits hand in glove with the imperative to save and recover acreage and distribution. Wetland quality refers to the set of ecological functions and socioeconomic services a wetland may provide, inclusive of natural characteristics (e.g., climate, biology, biogeochemistry, soil, landform, and hydrology) that support the functions and services. Ecological functions associated with wetlands of Nevada include the hydrological cycle, primary production, food chain support, wildlife habitat, diversity of species and communities, biogeochemical cycling of nutrients, decomposition of organic matter, floodwater storage and release, soil development, sediment distribution, and erosion control. Socioeconomic services are an extension of ecosystem functions viewed as goods or services that improve environmental, economic, or social circumstances for people (e.g., floodwater retention, drinking water quality, outdoor recreation). Since wetland protection or development usually involves tradeoffs, we have become aware of wetland values. The term "value" refers to a measure of importance (relative or quantified) assigned to a wetland based on functions and services performed.

Desert Wetland Values in 1859

T. Schweich photo (www.schweich.com)

In 1.2 miles more, [we] *come to a sulphur spring, where there is an abundance of water and grass, and where we encamped. It being Sunday, and the animals and party requiring rest, we have made this short march to get to feed and water. The water, though sulphurous, is quite palatable to man and beast.*

The shrill whistle of the curlew and harsh croaking of the sand-hill crane indicate that we are in a better region than that we have been passing over for a few days back. The view from this camp, in contrast with that we have witnessed…is quite refreshing.

Captain J.H. Simpson
U.S. Army, Engineer Department. 1876.

An early portrait of the qualities of Nevada wetlands comes from Captain Simpson, the leader of an 1859 trans-Great Basin survey expedition, after his party survived a crossing of the Great Salt Lake desert. Extolling the recuperative powers of a spring-fed marshland in eastern Nevada, the Captain's journal notes both utilitarian and pleasurable qualities: water palatable to man and beast; nutritious forage; the companionship (and perhaps nourishment) of wildlife; refreshingly lush scenery; and, a restful setting for contemplation and spiritual renewal (U.S. Army, Engineer Department, 1876). These virtues are esteemed today and underlie the motivation to conserve and improve the remaining resource base for nourishment, beauty, even survival.

What people need they will protect. However, the connection between people and their habitat has been disregarded or discouraged outright as Nevada becomes more settled. The term settled has various meanings: inhabited by colonists, not changeable, or established in a desired position. Wetland and associated water resources have been transformed into settled spaces, the result of the creeping confinement permitted in developed landscapes and the reinvention of wetland shapes, features, and vegetation in working and naturalized landscapes. The consequences of manipulation are deterioration and elimination of the manifold capacities of wetlands. Peoples' needs will not be met if wetlands, altered and degraded, lose their abilities to magnify, moderate, buffer, dissipate, adsorb, absorb, oxidize, reduce, transform, store, transmit, release, nourish, decompose, shelter, nurse, migrate, shrink, swell, meander, interact, attract, reveal, bloom, and yield – in cadence with the seasons, drought cycles, rain-on-

snow events, and the population curves of native species. However, a wetland quality information gap exists. Citizens, businesses, local government, and agencies usually do not have as clear and full an understanding of the benefits and value of wetlands as they do the economic benefits of land use and development. Ideally, decisions about wetland protection or use reflect the values society places on them. Estimating that value requires scientific knowledge of wetland functions and the many ways society benefits. A challenge the natural resource science community in Nevada might choose to address in a coordinated fashion is the development of a systematic method for the assessment and monitoring of wetland functions and services, as well as data management and distribution processes. The absence of such might be a reason that publicly funded research and governmental institutions are reluctant to make various databases available. Of course putting high quality data in the hands of policy makers, local officials, conservation organizations, and citizens is an essential step so these people can connect their interests in environmental quality, public health, property protection, public infrastructure, fiscal responsibility, sustainable economic development, drought water supply, ecosystem health, and outdoor recreation with choices made about the use and management of wetlands.

Deciding the fate of a wetland requires a full understanding of its natural functions and products and how the needs of people living near and far away will be affected. Knowing the spectrum and exchange rate of tradeoffs is not straightforward. Beneficial ecological outcomes and outputs vary depending on the type of wetland and location. Also, wetland functions and services are elastic in time and space, changing in response to differences in water, wildlife use, or weather. The totality of benefits and values are much greater than observed at any one point in time. Therefore, integrating information about the economic, sociological, and ecological values of wetland functions in decision-making requires data from scientific assessments. Applications for data on functions and service include land use planning, regulatory permitting and mitigation, land acquisition for conservation, water use permitting, wetland conservation prioritization, environmental impact analysis, and management of wetland-associated resources (e.g., water quality, wildlife habitat, at-risk species, sediment retention, floodplain, water supply). In general, wetland qualities infrequently are used to inform decisions. One reason is resource managers, planners, and regulators have limited time and resources to gather data. Also, the cases when an evaluation of wetland qualities is required (e.g., federal environmental assessment) are few. The lack of assessment methods is not a limitation, since various methods have been developed for rapid, comprehensive, or focused (e.g., for wildlife resources) assessments. Federal policies require FWS, ACOE, and NRCS to conduct functional assessments for habitat quality and hydrogeomorphic and hydrologic functions. In some states the ACOE employs a comprehensive assessment method known as WET to evaluate these key functions: groundwater recharge and discharge, flood flow alteration, shoreline and sediment stabilization, sediment and toxicant retention, nutrient removal and transformation, food chain support and export of production, wildlife diversity and abundance, and recreational uses (National Academy Press, 1995). The Natural Heritage Program plans to set-up a state wetland quality database in the future.

To conform to guidance in the National Wetlands Priority Conservation Plan (FWS, 1989), the state's prioritization process must evaluate wetland ecosystem and socioeconomic benefits. The NvWP list shown below represents the ecological functions and socioeconomic services frequently referenced in the wetland resource plans reviewed in the preparation of the NvWP (see Part 4, Wetland Resources Conservation Plans and Priorities).

- Hydrology and Water Supply
- Erosion and Sediment Control
- Flood Control
- Water Quality
- Wildlife Habitat, Biodiversity and Food Web Support
- Compatible Economic Uses
- Outdoor Recreation, Research, and Education

Hydrology and Water Resources

In the context of hydrological systems, the network of wetlands that occur along streams and in saturated depressions throughout a watershed exert a strong influence on the annual water budget or balance of a watershed, from the bounding ridgeline of the catchment to the basin floor and underlying aquifers. Any study of basin and range hydrology from a water supply perspective, begins with a water balance for a discrete watershed, or water catchment that collects precipitation, evaporates and transpires water, and yields the difference as streamflow, underflow, or groundwater recharge. The water balance sets the stage for analysis to estimate annual water yield, to study alternatives to enhance water supplies, to avoid mining groundwater, to reduce erosion or flooding, or to control nutrient pollution. The ideal set of hydrologic characteristics in a Nevada watershed would extend the frequency and duration of surface flow in ephemeral and perennial drainages, and expand the area of saturated soils so that more water percolates into zones of groundwater recharge. Ephemeral wetlands are important during periods of precipitation and snowmelt, because they are part of the "variable source areas," or temporary extensions of the hydrologic system. Wetlands, permanent and ephemeral, occupy a small portion of a watershed, which probably explains the lack of attention given to their influence on water supplies. Most effective precipitation and snow pack occurs in steep, rugged, high elevation watersheds on public lands. While wetland fragmentation is less widespread than in lower valleys, agencies permit land and resource uses (e.g., roads, heavy grazing, mining exploration) that directly and indirectly impair the hydrologic properties of riparian zones and meadows.

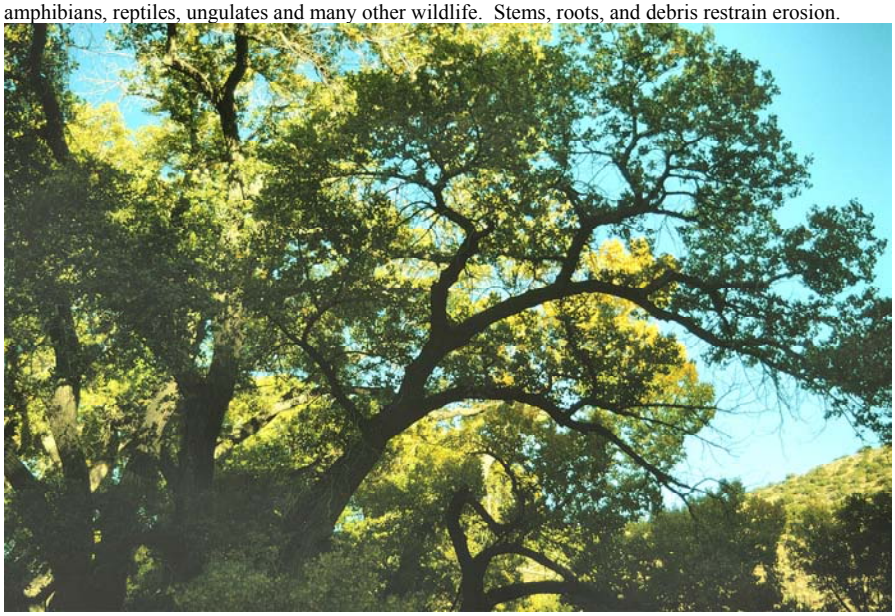
Salt Marsh and Contributing Watersheds, Monitor Valley

Eric Peterson photo

The water supply benefits of wetland continue as stream channels exit upper watershed drainages typically onto alluvial fans. Alluvial fans consist of coarse-grained materials that are more prone to erosion due to the sparser plant density and cover and moderate gradient. The volume of flow carried in the channel flowing on fans normally decreases as more water seeps into the unconsolidated deposits and evaporates on the warmer slopes. The riparian and meadow vegetation in middle and lower elevation watersheds restrain channels from widening and incising. Field studies have found water tables of incised channel reaches several meters lower than adjacent vegetated reaches. The canopy of trees and shrubs shade and cool water and soil surfaces, typically reducing evaporative loss substantially more than transpiration. Vegetation also enables more water to enter the subsurface through the macro-pores created by roots and by burrowing wildlife and insect inhabitants. Vegetation stabilizes lower elevation stream zone landforms, which spread floodwaters and increases alluvial groundwater recharge. Conversely, removal of vegetation that allows a stream channel to widen or braid increases runoff and evaporative loss. Additionally, disturbed wetland vegetation and landform increases the chances for plants with higher transpiration rates (e.g., salt cedar, Russian olive) to invade.

The influence of eliminated or improperly functioning wetland is not factored into calculations to estimate annual water supplies or groundwater basin yield. The estimation method used by water resource engineers to calculate the perennial yield of a groundwater basin factors includes evapotranspiration losses by upland vegetative cover, but does not account for the potential effectiveness of wetlands retaining water throughout the watershed. The reduction in streamflow and groundwater replenishment

Fremont cottonwood (*Populus fremontii*) canopy. Fremont cottonwoods occur in riparian zones alongside rivers, streams, springs, and irrigation works. Prime germination habitat consists of sandy deposits within the active floodplain kept moist throughout the growing season by underflow. In addition to providing breeding habitat for great blue heron, cottonwood dominated communities provide cover, nesting, and foraging habitats for hawks, eagles, woodpeckers, squirrels, ringtail cats, beavers, rodents, amphibians, reptiles, ungulates and many other wildlife. Stems, roots, and debris restrain erosion.



Canopy cover moderates the summer temperature of streams and spring pools, a critical factor in the viability of fish communities in desert streams. People and livestock enjoy loafing in the cool shade, although not necessarily together. The occurrence of Fremont cottonwood communities are declining primarily from activities that induce drought stress on riparian communities (e.g., stream regulation or diversions), channel modification and incision that alter natural flooding patterns, introduction of salt cedar and Russian olive, and upland drainage changes that accelerate stream erosion. Only 158 of the 32,500 linear wetland miles in Nevada mapped by the NWI are classified as riparian forest ('palustrine forested') and less than ten percent is mapped as forested/shrub scrub. Jim Morefield photo.

resulting from the loss, fragmentation, and degradation of wetlands and riparian corridors can be substantial; or conversely, water flow can be augmented appreciably with healthy wetland vegetation. A case in point (for some reason there are not many wetland hydrology field studies) is a riparian recovery project conducted in eastern Oregon. A temporary cessation and later moderation of grazing sufficiently relaxed stress on the riparian vegetation so that stream morphology returned to proper functioning condition. Project scientists reported that the recovered riparian zone generated a substantially larger volume of water, both surface and underflow, and higher flow rates were sustained for a longer duration. If such hydrologic studies are being conducted in Nevada, the data are not readily available. As the gap between water supply and demand narrows and the price of water rights rise (recent news articles report forty to fifty thousand dollars per acre-foot in Reno/Sparks), there may be increased interest in quantifying the hydrologic benefits of wetlands and the cost/benefit ratio of wetland restoration.

Erosion and Sediment Control

Water in motion is a relentless and deceptively powerful force. Above ground plant parts of wetland vegetation dissipates energy by reducing the velocity of flow along the banks. Root mass and the accumulation of woody and leafy debris imparts structural strength to soils and sediment deposits of channels, shorelines, and floodplains. Reducing erosion lowers sediment loads. By holding large volumes of water over the short term or long term, wetlands further dampen erosion. Various wetland attributes enhance water storage. The stems of woody and herbaceous plants slow and spread runoff, which enhances the potential for infiltration. Roots facilitate

Riparian Zone in Fort Churchill State Park (left) and Carson Valley (right)

Eric Peterson photo

Pat Sollberger photo

infiltration and percolation, as do the burrowing of the many species of burrowing animals and insects that live in wetland ecosystems. Most wetlands have depressional features where water ponds or slowly drains. Riparian corridors typically are underlain by porous matrixes of coarse sediments and organic and stony debris that give wetlands their sponge-like quality. When overland flow encounters the dense vegetation, debris, and depressional surface of wetlands and riparian corridors, flow becomes turbulent, velocity drops, and sediment settles. Overland flow running off developed and working landscapes accelerates erosion, which unfortunately are the same locations where wetland vegetation frequently has been removed or depleted.

In addition to dampening erosion, wetlands are involved in sediment transport and deposition in patterns that support other functions, such as floodwater storage, channel maintenance, and nutrient reduction. Sediment in an undisturbed stream is cycled back and forth between the channel, the banks, and floodplains. In well functioning stream systems, floodplains accumulate fine-grained sediment from overbank flow during snowmelt peak and summer storm events – otherwise, fine sand and silt blankets collects on the bed of the channel, which may promote bank erosion as the bed aggrades. Riparian vegetation along the banks and in the floodplain creates turbulence that results in sediment capture. Fluvial landforms, such as meanders, riffles, pools, and point bars are constantly adjusting as a result of sediment transport and deposition, but changes in streamflow due to the operation of diversions and reservoirs and increased runoff from developed uplands. In rivers and streams where sediment routing is out of balance, the mechanical clearance of sediment from channel and ditches is a frequent and costly activity, often required to avoid flood damage and accelerated channel migration or erosion. Wetlands assist in reducing the frequency of public infrastructure maintenance and flooding by naturally distributing sediment to lower energy environments. Less sediment carpeting stream channels favors reproduction of fishes and aquatic insects. Sediment deposition patterns also influence the regeneration and progression of vegetation communities, which are important to fish and wildlife.

Flood Control

Natural flood controls, wetlands up and down the watershed detain overland flow and streamflow generated by intense summer storms or the combined runoff from a rain-on-snow event. The water holding capacity of wetland vegetation, depressed landscape position, hummocky landform, and deep soils and sediment deposits if left substantially intact is enormous. The same characteristics also slow the transmission of water from upper to lower watersheds, which stagger the convergence of runoff from multiple source areas, thereby lowering peak flow in successively lower stream reaches. During a prolonged flood event, the ephemeral wetlands in upper drainages are reactivated into flood abatement service, becoming part of the variable source network or saturated zones spreading upward and outward in the drainage network. Beyond canyon mouths, the flattened gradient and wider reach of valley floodplains hold a system of riparian zones, marshes, meadows, oxbows, and ponds. As flood flow rises and overtops channel banks, water spreads across the flood plain and into wetland depressions. Unless the wetlands and riparian zones have been filled, leveled, or stripped of native plant communities, floodplains effectively modulate the volume and dissipate the force of moving water, as well as sediment and debris, thereby avoiding or vastly reducing flood damage.

Floods are not a problem except where land development encroaches into a stream's working space. The center point of wetland losses historically has been the mid-elevation valleys where the largest, but by no means expansive, floodplains formerly soaked up much of the peak runoff during snowmelt or summer convective storms. The flattening and filling of wetland and floodplain topography, removal of wetland vegetation, and covering and compacting soils diminishes a watershed's flood control function. Engineering efforts to control rivers, most often reservoirs and levees, work temporarily, but eventually water forces its way back to its natural course and overwhelm even the best-designed projects. Restoring permanent and ephemeral wetlands in tributary drainages could enhance the effectiveness of some flood

control reservoirs. Stream environment zones are dynamic places that are accustomed to having sufficient space to sway and swell according to the vagaries of snowmelt and storm events, as well as periods of low flow. Constructing buildings, roads, pipes, concrete walls, or rock armor in floodplain wetlands, as well as straightening channel reaches, makes for an inelastic riparian zone that tends to break rather then bend. In altered floodplains, each large flood aggravates and amplifies undesirable conditions, increasing the risk of damage to property and loss of lives. The costs of recovering wetland functions and repairing the damages to private property and public infrastructure can be enormous. The cost of damages in the Truckee Meadows resulting from the 1997 rain on snow flood event was estimated at $650 million. In the small town of Mesquite, the Virgin River flood of 2005 caused an estimated $2 million in damage to public infrastructure. The monetary and personal cost associated with the loss of eighty homes will be much higher. One of the mysteries of modern civilization is why people are willing to suffer the consequences of floods and pay the cost of flood damage again and again. Surely any objective analysis of the ecological, sociological, and private and public economic costs of floodplain wetland development would prove people and nature would be better off by retaining the water rather than continually paying for flood damage and restoring stream courses.

Two Views of the Truckee River Floodplain, Upstream of and Within Urban Development

NNHP Staff photo

Water Quality Maintenance and Improvement

Wetlands possess the means and processes for intercepting and reprocessing all sorts of solid and dissolved materials, including source and nonpoint source pollutants, and thereby improving the quality of water resources. The ability to keep pollution from entering and to remove pollution in water bodies protects public and ecosystem health, lowers water treatment costs, and maintains biodiversity. The morphology and vegetation of wetlands controls the velocity of stream flow and accordingly distributes sediments and suspended solids on channel beds, banks, and in the floodplain. Biogeochemical reactions may occur in wetlands that transform an array of nutrients, organic compounds, metals, trace elements (e.g., boron, arsenic, selenium), and organic wastes, provided environmental quality, moisture, and biomass conditions are ripe for the presence of microscopic flora and fauna, fungi, bacteria, lichen, insects, crustaceans, land snails, and other minute life forms.

Water pollution control functions of wetlands are particularly crucial in riparian zones around and downstream of centers of urban and agricultural development. Large volumes of irrigation tailwater and urban and industrial storm runoff directly enter water bodies and aquifers without passing through wetland pollutant filters. Unfortunately, this is precisely where wetland losses are greatest. The USGS has conducted studies of the water quality effects of urban and agricultural land uses, and has found

exceptionally high concentrations and loads of nutrients, particularly nitrogen, phosphorous, and iron, as well as various manufactured compounds that may be toxic, such as chemical fertilizer, pesticides, and petrochemicals. With few exceptions, the elevated pollution levels in Nevada water bodies, both surface and underground, occur down gradient of agricultural, industrial, mining, and urban centers and are the result of unregulated nonpoint source discharges. Biennially, the Nevada Division of Environmental Protection assesses the status of water quality in monitored streams. The recent assessments list hundreds of river and streams as impaired, or exceeding water quality standards. Impairment issues include physical water quality conditions such as elevated temperature, low dissolved oxygen, and high turbidity and total suspended solids. An effective means for removing pollutants from nonpoint pollution sources are wetlands. Were these watercourses and adjacent floodplains buffered from diffuse discharges and erosive overland flow by riparian forests, marshes, and meadows, there would be sufficient shading and stability to improve undesirable conditions.

Wildlife Habitat, Food Web Support, and Biodiversity

Relatively few of the fauna of Nevada do not depend on wetland sites or resources. Some dwell almost exclusively in wetlands and adjacent water bodies. These include fishes, amphibians, various mammals, some birds, and a large number of invertebrates (e.g., insects, springsnails, mussels, crustaceans). Many species of birds, including some upland inhabitants, mammals – large and small, and reptiles require the food, water, and cover resources of wetlands for nesting, breeding to complete other life stages. Still others return frequently or during certain seasons to meet basic needs that ensure their survival. In addition, riparian zones and isolated wetlands are important corridors for movement or migration of flying, swimming, or walking animals. Wetlands also favorably influence the habitat qualities of surrounding ecosystems as food resources, plant materials, nutrients, and organic matter are exported. Biologists identify habitat loss as the greatest factor behind declines in the abundance and viability of species of fishes, amphibians, birds, mammals, reptiles, and invertebrates, and commonly the critical habitat of concern are wetlands and riparian zones. Biological surveys estimate 75 to 85 percent of all the wildlife inhabiting Basin and Range ecologic systems use wetland and riparian areas for survival.

Aspen and Mule Ears. From crown to root hairs, the multi-layered canopy of aspen groves provide goods and services, e.g., wildlife diversity; game animal habitat; erosion, pollution and flood control; groundwater recharge; cool shade; and fence rails.

Barbara Rhodes photo, courtesy of Nevada Biodiversity Initiative

Food web support is a taken-for-granted ecological function of wetlands, yet most socioeconomic service benefits are curtailed or absent in degraded wetlands lacking a full complement of robust food webs. The herbivore-carnivore, prey-predator, and decomposition food webs occur above and below the surface of both the ground and water. Great quantities of food are produced in wetlands involving complex, dynamic feeding and decomposition relationships that rise or fall on the fortunes of biodiversity. The most basic food web interactions occur out of sight of the casual observer, in the substrate of inundated and saturated areas. The profusion of plants, or primary production, is central to wetland food webs. Most of the biomass produced

in undisturbed wetlands accumulates. Dead and decaying plants, and animals, provide the organic materials on which detritivores, decomposers, saprobes, and scavengers subsist. The microscopic flora and fauna, fungi, and bacteria, along with assemblages of minute invertebrates (insects, annelids, mollusks, and crustaceans) consume and convert organic as well as inorganic matter, releasing nutrients essential to wetland plants. Invertebrates also feed on the microscopic flora, fauna, and detritus, which in turn become a food resource for birds, fishes, amphibians, reptiles, mammals, and invertebrates. At the macroscopic scale, each taxonomic group includes species that are herbivores, carnivores, omnivores, or scavengers. People that use natural wetlands to hunt, fish, or gather plants for nourishment are part of the food web. Conversely, introductions of nonnative animal and plant species for outdoor recreation and agricultural purposes that cause a reduction in the biodiversity of wetlands can lead to the unraveling of food webs, with ramifications for the abundance and variety of wildlife in other ecological systems. Because food webs are so complex and dynamic, especially given the natural variation of the extreme environments of Nevada, natural resource scientists and managers have difficulty discerning year-to-year changes in feeding relationships, unless populations are surveyed. Predator-prey relationships are examined for game species, but little survey work is conducted to assess the composition and structure of the lower trophic level food webs.

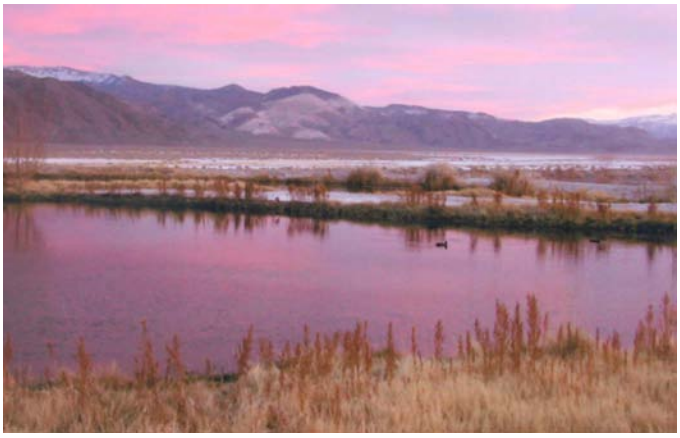
Lichens and mosses such as these on Anaho Island usually are left out of biodiversity statistics. Lichens are tiny symbiotic colonies of fungi, algae and/or cyanobacteria (fungi take in water and minerals, algae produce food photosynthetically). Their jobs in the ecosystem include microbiotic crust formation, soil development, moderation of soil temperature and evaporation, erosion control, nutrient cycle interactions, and food web relationships. Eric Peterson photo.

Biodiversity. Simple characterizations of Nevada as desert or a sea of sagebrush are misleading. The plant and animal communities of the state consist of varying combinations of more than 4,600 species and subspecies of plants and animals (exclusive of invertebrates and non-vascular plants). A state-by-state biodiversity assessment performed by NatureServe, the parent organization of the Natural Heritage network, illustrates the variability and vulnerability of biota in Nevada compared to other states (NatureServe, 2002). Nevada ranked eleventh in species diversity, third in rarity and risk level, and, sixth in endemism. Internationally renowned Ash Meadows National Wildlife Refuge contains aquatic-wetland and wetland-upland ecosystems that harbor a greater concentration of endemic life forms than any other locality in the nation (second greatest in North America). This globally rare desert wetland complex harbors twenty-eight plants and animals found nowhere else in the world, and as such are internationally recognized in the Ramsar Convention on Wetlands. Species receiving special conservation attention under the treaty include the Ash Meadows speckled dace, Ash Meadows montane vole, Devil's Hole pupfish, Ash Meadows ivesia, Ash Meadows sunray, and the Springloving centaury.

Wetlands and associated aquatic habitats are essential to a disproportionately large share of the plant and animal diversity. The NNHP, which tracks and distributes data on the distribution and conservation status of the state's most sensitive and rare species, estimates that almost one third of the seven hundred taxa monitored are wetland dependent. Unfortunately, Nevada has already experienced the extinction or extirpation of seventeen endemic taxa dependent on wetlands: eleven fishes, one amphibian, and five aquatic invertebrates. Nevada ranks third in the nation for at-risk amphibian species and fourth for at-risk fish species (Stein, 2002). The growth of population and increased land and water development does not have to push more rare and imperiled wetland dependent species to the brink of extinction, but averting such outcomes requires a policy that commits our state to the adoption of an intentional and actionable strategy that will protect and restore wetland ecosystems.

Wetland wildlife is much richer than the ducks, fishes, and frogs that usually come to mind. A huge assortment of birds, mammals, reptiles, and invertebrates (e.g., insects, mollusks, crustaceans, annelids, and protozoa) also use wetlands as a primary residence or frequent visits to satisfy basic needs. The loss of a wetland eliminates an entire community and impoverishes the food chain and web of life in surrounding ecosystems. Nationally, about thirty-five percent of all plants and animals on the federal Endangered Species List depend on wetlands for survival. In Nevada, that ratio is much higher. Currently, the FWS lists 37 animal species as threatened, endangered or as candidates for listing; thirty-six depend upon wetlands or wetland-aquatic habitats, including twenty-five species of fishes, three amphibians, five birds, and three aquatic invertebrates.

Wintering Ducks at Developed Thermal Spring, Fish Lake Valley Marsh



Stan White photo, courtesy of Nevada Biodiversity Initiative

Birds. In the Coordinated Implementation Plan for Bird Conservation in Nevada (see Part 4), wetland and riparian habitats are the top habitat protection and restoration priorities. Critical migratory waterfowl stopovers along the Nevada stretch of the Pacific Flyway include the larger riparian and wetland areas in western (lower reaches and terminal basins of the Truckee, Carson, and Humboldt rivers) and eastern (Ruby Valley and Franklin Lake) regions of the state. Many species of ducks, along with geese, grebes, gulls, ibis, herons, pelicans, cranes, egrets, curlews, avocets, terns, and bald eagles are visitors to these internationally important wetlands. The far-flung, isolated marshes, spring pools, riparian mesquite stands, and playa lakes, undoubtedly also contribute to the successful passage of migratory birds flying across the wide arid reaches of the Basin and Range ecoregions. During drought or severe weather, the thousands of small, scattered wetlands look like welcome shelter to migrating or wintering waterfowl.

Because the state is so dry and water resources are so widely scattered, the diverse flora and fauna of the small, isolated wetlands and riparian attract many birds. The Coordinated Implementation Plan for Bird Conservation in Nevada identifies over one hundred species as conservation priorities, seventy percent of which use wetland and riparian ecosystems for breeding, during migration, as winter habitat, or for feeding (Intermountain West Joint Venture, 2002). In addition to waterfowl and waterbirds, populations of various hawks, owls, hummingbirds, flycatchers, sparrows, warblers, and many others are being closely watched due to the loss of meadows, marshes, riparian zones, and ephemeral playa lakes.

Table 2.1 Rare and Sensitive Wetland Dependent Birds in Nevada

Scientific Name	Common Name
Agelaius tricolor	Tricolored Blackbird
Charadrius alexandrinus nivosus	Western Snowy Plover
Chlidonias niger	Black Tern
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo
Cygnus buccinator	Trumpeter Swan
Dendroica petechia	Yellow Warbler
Empidonax traillii adastus	Mountain Willow Flycatcher
Empidonax traillii extimus	Southwestern Willow Flycatcher
Gavia immer	Common Loon
Geothlypis trichas	Common Yellowthroat
Haliaeetus leucocephalus	Bald Eagle
Ixobrychus exilis hesperis	Western Least Bittern
Numenius americanus	Long-billed Curlew
Pandion haliaetus	Osprey
Pelecanus erythrorhynchos	American White Pelican
Plegadis chihi	White-faced Ibis
Rallus longirostris yumanensis	Yuma Clapper Rail
Sterna antillarum	Least Tern
Vireo bellii arizonae	Arizona Bell's Vireo
Wilsonia pusilla	Wilson's Warbler
Source: NNHP web page http://heritage.nv.gov/wetland.htm, March 2004	

Species of wetland dependent birds that are assessed as sensitive by the NNHP are listed in Table 2.1. Also, other species of birds formerly thought of as common, such as the Greater Sage-grouse, are declining in part due to the loss and fragmentation of riparian areas and meadows. In the case of sage grouse, riparian meadows abutting shrublands provide critical brood rearing habitat. For many bird species, richly vegetated wetlands juxtaposed between native upland and aquatic habitats are essential for fulfillment of breeding, feeding, and escape cover needs.

Table 2.2 Native Amphibians and NNHP Conservation Status Rank

Scientific Name	Common Name	NNHP Rank
Bufo boreas boreas	Boreal toad	S3S4
Bufo boreas halophilus	California toad	S2S3
Bufo cognatus	Great Plains toad	S3
Bufo microscaphus	Southwestern toad	S1S2
Bufo nelsoni	Amargosa toad	S1S2
Bufo punctatus	Red-spotted toad	S5
Bufo sp 1	Dixie Hot Springs toad	S1
Bufo sp 2	Fish Lake Valley toad	S1
Bufo woodhousei woodhousei	Western woodhouse toad	S5
Hyla regilla	Pacific treefrog	S5
Rana fisheri	Vegas Valley leopard frog	SX
Rana luteiventris pop 3	Columbia spotted frog (Great Basin population)	S2S3
Rana muscosa	Mountain yellow-legged frog	SH
Rana onca	Relict leopard frog	S1
Rana pipiens	Northern leopard frog	S3
Spea intermontana	Great Basin spadefoot	S4

Source: http://heritage.nv.gov/lists/amphibs.html (NNHP website), 6/18/02.
Notes: These amphibian taxa are known to occur presently, historically, or temporarily in Nevada. The list reflects NNHP taxonomic opinions and interpretations, which may differ from lists originating elsewhere.

Amphibians. Frogs, toads, and salamanders require both aquatic and adjacent terrestrial habitats to complete their life cycle. Water bodies experience wide seasonal and inter-annual fluctuations, which are compounded by diversions. Water-land habitat continuity and the duration, seasonality, and depth of inundation in aquatic habitats are key determinants in amphibian presence. Taxa that require water for extended periods to breed will not be successful at a site where drought or water diversion shortens the period of inundation. Of the state's sixteen native amphibians, five species are ranked as imperiled (S2) or critically imperiled (S1) by the NNHP (Table 2.2). They are the Southwestern toad and Amargosa toad; and, the Columbia spotted frog, Mountain yellow-legged frog, and relict leopard frog. One native amphibian, the Vegas Valley leopard frog, is presumed extinct. The bull frog (*Rana catesbeiana*), a nonnative introduced into and invading wetlands statewide, has an enormous appetite that upsets native food webs. It feeds on tadpoles and young of native amphibians as well as fishes. Another introduced nonnative amphibian is the tiger salamander (*Ambystoma tigrinum ssp*), which occurs in isolated springs in southern Nevada.

Possible causes for declines in the occurrences of populations or size of populations of amphibian taxa (and the extinction of the Vegas Valley leopard frog) include the loss and extensive alteration of wetland and aquatic habitat for urban, agricultural, and water developments; the diversion of surface and underground water; and the introduction of nonnative predators or competitors, including game fishes, crayfish, and the American bullfrog. Another possible factor in the decline of frogs is pesticides, which probably accumulate in lower riparian areas and wetlands of closed valleys and basins receiving urban and agricultural runoff. Amphibians are an important component of the aquatic and wetland food web and also consume insects considered as pests (e.g., mosquitoes). The vulnerable conservation status of so many species indicates widespread wetland ecosystem distress.

The introduction and stocking of trout was found to be a determining factor in the absence of mountain yellow-legged frogs in Sierra Nevada water bodies where populations historically lived. Researchers experimented with the removal of all fishes from selected frogless lakes in the California Sierras, and shortly thereafter reproducing frog populations appeared (Young, et.al, 2004). Overall, ninety-three taxa of nonindigenous fish (e.g., species and subspecies introduced or transplanted into water bodies outside their historic or natural range) have been placed in Nevada water bodies – the fifth highest among all states (Fuller, et.al, 1999). The release of any fish or aquatic wildlife is prohibited without a permit from

the NDOW. Stocking rivers, streams, lakes, and reservoirs with nonnative trout for sport fishing must be carefully managed in drainages inhabited by at risk amphibians. Numerous isolated springs and spring systems in eastern and southern Nevada inhabited by rare, endemic fishes and amphibians have been contaminated with exotic fishes.

Reptiles. The reptile group includes snakes, turtles, and lizards. One reptile that exists solely in aquatic-wetland habitats is the Northwestern pond turtle (*Emys marmorata marmorata*). It inhabits calm water bodies with vegetated banks and eats plant material and carrion, but prefers live prey such as fishes and insects. The range of the pond turtle in Nevada is limited to the western watersheds. It may have been transplanted from outside the region. Also, many species of snakes dwell in or frequent wetland and riparian areas, such as the rubber boa (*Charina bottae bottae*) and garter snakes (*Thamnophis* spp.). The western red-tailed skink (*Eumeces gilberti rubricaudatus*) is one species of lizard that occurs in the vicinity of intermittent or permanent streams and springs of southern Nevada. Lizards and snakes generally are associated with upland ecosystems, but seek food and cover in wetland habitats. Some reptiles prefer wetland complexes, where the mix of uplands and wetlands meet special habitat requirements during reproductive stages in their life cycle.

Mammals. Large grazers, primarily mule deer and elk, frequent meadows and riparian corridors to browse, drink, shelter offspring, and pose for photographers. Less charismatic and obvious, but much more abundant in and around wetlands, are the myriad small mammals, such as shrews, moles, gophers, mice, voles, squirrels, rabbits, and bats. Beaver (*Castor canadensis*), muskrat, mink, raccoon, weasel, and otter keep a rather low profile in wetlands and adjacent waters. At-risk wetland dependent mammals include the Mono Basin mountain beaver (*Aplodontia rufa californica*), river otter (*Lontra canadensis*), Pahranagat Valley montane vole (*Microtus montanus fucosus*), and Ash Meadows montane vole (*Microtus montanus nevadensis*). The activities of small mammals inhabiting or frequenting wetlands support various ecosystem functions. Burrowing enhances water storage and peak flow attenuation in floodplains and foraging affects vegetation changes that influence plant community changes and biodiversity. Tree-felling and dam-building beavers occupy some northern Nevada streams systems, influencing riparian vegetation, stream hydrology, sedimentation and water quality. Mammals as a class fill high- and low-profile herbivore, carnivore, omnivore, or scavenger positions in wetland food webs.

Perhaps less obvious and under-rated are the connections between wetlands and bats and people. Some of the twenty-three species of bats occurring in Nevada are obligatory inhabitants of wetland habitats, while others are considered opportunistic. Since bats are built to drink on the fly, proximity to open water sources (natural or artificial) can be a determining factor in their choice of habitat. All bat species living here are insectivorous and, therefore, frequent the insect prolific riparian zones of springs, rivers, streams, ephemeral pools, and lakes. Studies have shown bat activity to be forty times greater at riparian zones compared to upland areas. During the hottest and driest time of the year, bats are birthing and raising young, so ephemeral and perennial water must be accessible then. Riparian woodlands with mature trees are used for foraging, roosting, and/or migration. All kinds of bats found here are tracked by the NNHP, some actively as at-risk species and others passively on the agency's watch list. No bat species in Nevada are federally listed as endangered or threatened (Altenbach et al, 2002). The consumption of enormous quantities of insects,

Table 2.3. Bat Species Managed as Protected Species in Nevada

Common Name	***Scientific Name***	Conservation Status
fringed myotis	*Myotis thysanoides*	protected
pallid bat	*Antrozous pallidus*	protected
Allen's lappet-browed bat	*Idionycteris phyllotis*	protected
Brazilian free-tailed bat	*Tadarida brasiliensis*	protected
spotted bat	*Euderma macalatum*	protected threatened
California leaf-nosed bat	*Macrotus californicus*	protected sensitive
western red bat	*Lasiurus blossevillii*	protected sensitive
Townsend's big-eared bat	*Corynorbinus townsendii*	protected sensitive
western mastiff bat	*Eumops perotis*	protected sensitive

Source: Nevada Administrative Code (NAC) 503.030.

some considered pests (e.g., mosquitoes, scorpions, centipedes, Mormon and Jerusalem crickets, rootworms) gives bats a favored status in the ecology of naturalized, and developed areas. Herbivorous bats aid in pollination and seed dispersal of native and cultivated plants, but do not occur in Nevada.

Fishes and Other Aquatic Biota. Wetlands exert a strong influence on the physical, chemical, and biological integrity of aquatic ecosystems and community composition. For instance, riparian vegetation shades the water surface, traps fine turbidity-inducing particles, and absorbs nutrients, thereby moderating temperature, algal production, and dissolved oxygen sags during the warmest months. Naturally functioning wetlands in lotic (flowing) and lentic (standing water) systems induce the waxing and waning of saturated or inundated conditions to which native fish, amphibians, and myriad invertebrates have acclimated. Permanently and intermittently inundated areas of vegetated wetlands dominated by submergent and/or emergent plants possess exceptional biological productivity and diversity. Though small and variable in extent, aquatic-wetland habitats, where well managed, transpire an abundance of aquatic life.

Aquatic macroinvertebrate groups encompass an enormous number of species, including gastropods (snails) and bivalves (mussels, clams), crustacean (fairy shrimp, crayfish); aquatic beetles, bugs, true flies, and worms; stoneflies, mayflies, caddisflies, dragonflies, and damselflies; plus, the lowly planarians. Much remains to be learned about the biological composition and ecology of aquatic-wetland habitats in Nevada, but biologists are well aware of the far-reaching food web support. Wetland-aquatic macro-invertebrates spend part or all of their life in water, on the surface, on emergent vegetation, throughout the water column or bottom sediments. At a smaller scale yet are aquatic arthropods, such as copepods, cladocerans, and daphnia. All are part of the aquatic detrital (consume dead and decaying plant and animal matter), grazing (consume aquatic vegetation and algae), and carnivorous (consume other invertebrates) food chains. This profuse up- and out-welling of living things feeds fish, amphibians, birds, bats and more. The interest in the richness and habitat needs of aquatic invertebrate species has grown in recent years. Urban water development plans have inspired heightened interest in describing the rich biota and fragile ecology of spring systems and spring-controlled minor rivers in southern and eastern valleys. Ongoing taxonomic work has resulted in the description of seventy species of gastropods. Intermittent and ephemeral aquatic ecotypes also sustain invertebrates that exemplify survival strategies life forms evolve in highly variable and harsh environmental conditions. Irregularly inundated or saturated playa lakes, seasonal pools, and local spring are revival sites for aquatic insects, zooplankton, crustaceans and amphibians with life cycles adapted to fickle high desert water regimes and alkaline or saline water quality conditions.

Ephemeral Aquatic Crustaceans

Fairy shrimp are tiny crustacea adapted to fresh or saline playa lakes and ephemeral pools. *Artemia salina*, found in the Great Salt Lake Basin, outlived dinosaurs by 100 million years. The secret to longevity is reproductive variation. Reproduction occurs sexually or asexually (unfertilized egg may develop into new individual when males absent). Eggs develop into swimming larvae released by the mother (live birth); or a shell forms around the egg (the cyst) when the pool shrinks or salinity increases. While in diapause (state of suspended development), cysts are released. Cysts hatch as water and sunlight stimulate growth of plankton and protozoa. Durable cysts survive many dry years. Fairy shrimp are a food source for insects, amphibians, and waterfowl. Primary playa lake wetland vulnerabilities are water developments and pollutants released from agricultural and urban nonpoint sources. J. Fitzgerald photo (http://www.greatbasinnaturalhistory.org/)

Fishes native to Nevada's water bodies have evolved in and adapted to the boom and bust hydrological cycle, and how it is manifested in wetland resources that creates or augments the aquatic habitat conditions essential to survival in difficult circumstances.

Ninety-one native fish taxa occur in Nevada. Native fishes occupy a range of aquatic ecosystems: alkaline and freshwater lakes, thermal and cool springs, isolated stream systems, and major river basins. Much of the diversity entails rare, restricted-range, endemics that live in isolated spring or spring/stream systems. Sixty-two are ranked as at-risk, and twenty-five are federally listed as threatened or endangered by the FWS. Eleven fishes that formerly occupied spring or river systems have been extinguished or extirpated. Extant native trout species, once widespread in all major river systems, are imperiled and subject to regulated conservation activities.

Wetland Vegetation. Native plant communities profoundly influence the capacity of a wetland to maintain its hydrological and ecological potential. Maintenance of geomorphology, flood storage capacity, food webs, nutrient cycling and soil fertility, primary productivity, forage abundance and nutrition, and recreation appeal are all influenced by vegetation. Because the environmental conditions surrounding wetlands are extreme, volatile, and harsh, maintaining vegetation ecology is a critical management objective. Obviously plant species and communities have evolved and adapted to the variable conditions. Table 2.4 lists at risk native wetland species. The large diversity of plant communities and species reflects the remarkably variable physical conditions and faunal diversity. With assistance from the NNHP, NatureServe has described nearly one hundred vegetation alliances (e.g., *Populus angustifolia* Temporarily Flooded Woodland Alliance) and about three times as many plant associations (*Populus angustifolia* / *Cornus sericea* Woodland) (Appendix 1, Part 2). Undisturbed wetland habitats hold the reproductive materials of a much larger number of species than seen at any one time. The reservoir of biotic potential is crucial to a wetland possessing the vegetative plasticity and elasticity necessary to adapt to the episodic nature of water abundance and drought conditions, as well as other natural disturbances, such as flood, fire, disease, insects, and wildlife use. A large component of the wetland base consists of ephemeral wetlands, some of which vary between barren and profusely vegetated. Upkeep of the ecological integrity of periodically vegetated zones of playas, seasonal pools, intermittently flowing channels is vital.

Table 2.4 At-Risk Wetland Dependent Plant Species in Nevada

Scientific Name	Common Name
Bryophytes (moss allies)	
Meesia triquetra	three-ranked humpmoss
Pteridophytes (fern allies)	
Botrychium ascendens	upswept moonwort
Botrychium crenulatum	dainty moonwort
Botrychium lineare	slender moonwort
Flowering Dicots	
Angelica scabrida	rough angelica
Antennaria arcuata	meadow pussytoes
Astragalus diversifolius	meadow milkvetch
Astragalus lemmonii	Lemmon milkvetch
Astragalus lentiginosus var. sesquimetralis	Sodaville milkvetch
Astragalus pterocarpus	winged milkvetch
Astragalus robbinsii var. occidentalis	Lamoille Canyon milkvetch
Castilleja salsuginosa	Monte Neva paintbrush
Centaurium namophilum	spring-loving centaury
Cirsium virginense	Virgin River thistle
Cordylanthus tecopensis	Tecopa birdbeak
Draba brachystylis	Wasatch draba
Draba paucifructa	Charleston draba
Eriogonum ampullaceum	Mono buckwheat
Eriogonum argophyllum	Sulphur Springs buckwheat
Eriogonum ovalifolium var. williamsiae	Steamboat buckwheat
Eustoma exaltatum	catchfly gentian
Grindelia fraxinopratensis	Ash Meadows gumplant
Ivesia aperta var. aperta	Sierra Valley mousetails
Ivesia kingii var. eremica	Ash Meadows mousetails
Ivesia pityocharis	Pine Nut Mountains mousetails
Lepidium davisii	Davis peppercress
Nitrophila mohavensis	Amargosa niterwort
Penstemon procerus var. modestus	Ruby Mountains beardtongue
Phacelia inundata	playa phacelia
Phacelia minutissima	least phacelia
Phacelia parishii	Parish phacelia
Plagiobothrys salsus	salt marsh allocarya
Polyctenium williamsiae	Williams combleaf
Potentilla basaltica	Soldier Meadow cinquefoil
Primula capillaries	Ruby Mountains primrose
Rorippa subumbellata	Tahoe yellowcress
Synthyris ranunculina	Charleston kittentails
Trifolium eriocephalum var. villiferum	woolly clover
Flowering Monocots	
Elodea nevadensis	Nevada waterweed
Sisyrinchium funereum	Death Valley blue-eyed grass
Sisyrinchium radicatum	St. George blue-eyed grass
Spiranthes diluvialis	Ute lady's tresses
Spiranthes infernalis	Ash Meadows lady's tresses

Source: NNHP Website (http://heritage.nv.gov/wetland.htm), 3/18/04 update

A Few of the Rare Endemic Plant Species Associated with the Distinctive Wetland Habitats of Nevada

Potentilla basaltica (Soldier Meadow cinquefoil, top left photo, UNR BRRC); *Ivesia pityocharis* (Pine Nut Mountains ivesia, top right photo, Jim Morefield); *Spiranthes diluvialis* (Ute Ladies' Tresses, center left photo, Bonnie Heidel); *Botrychium crenulatum* (dainty moonwort, center photo, Steve Wirt); *Phacelia minutissima* (least phacelia, center right photo, Jim Morefield); and *Nitrophila mohavensis* (Amargosa niterwort, bottom left photo, Glenn Clemmer). Bottom right photo displays dry season habitat of a population of the least phacelia. Ephemeral linear wetlands carry water seasonally or periodically from a spring, perched water table, or snowmelt or rainfall runoff. These species persist under extreme wet-dry cycles, but water diversions or drainage alterations put them at risk. Done carelessly, grazing, motorized vehicle use, hiking, or spring development also threaten rare species that occupy ephemeral wetlands.







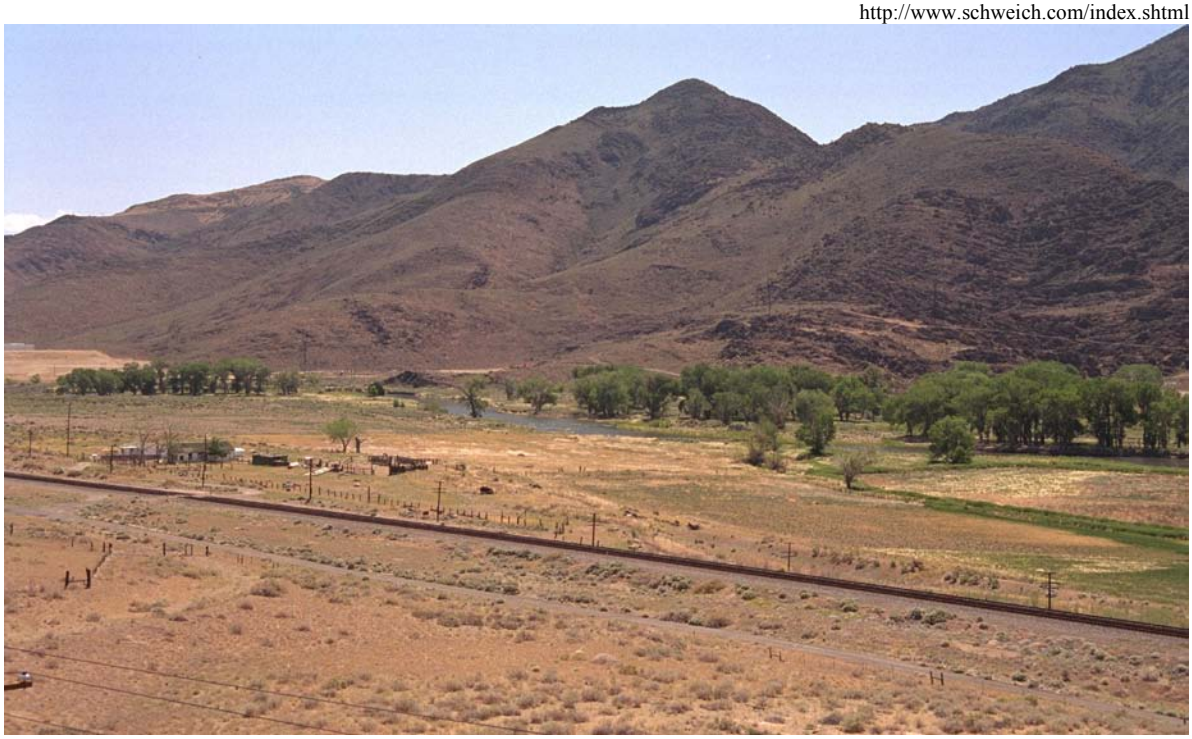
Wetland-Compatible Economic Uses

Wetlands have provided important resources throughout the history of Nevada and long before. The peoples living in the region before Euro-American colonization were hunters and gatherers who sometimes dwelt near marshes, lakes, spring complexes, and streams. They drew a portion of their subsistence from wetland, since the plants, fish and wildlife provided food and materials for tools, clothing, and equipment. Archeological evidence indicates native predecessors also manipulated wetland and aquatic environments to attract game, gather fish, and grow crops. Utilization, such as temporary stream diversions and burning riparian vegetation, was localized and intermittent, presumably having small, transient effects on wetland quantity and quality. Their low numbers, simpler technology, and worldview that held natural creation as sacred were circumstances quite different than those of Euro-American colonists.

Riparian Forest Land, Lower Truckee River

From Reno to Wadsworth, I-80 continues to follow the course of the Truckee River. The landscape is a bit different here, as just a few feet from the river is desert, just as though the water wasn't there.

Tom Schweich
Field Notes
http://www.schweich.com/index.shtml



The lower elevation riparian forest ecotype is an at-risk plant community in Nevada. Rivers and floodplains once lined with corridors of cottonwood and willow for the most part retain work-worn and tattered remnants. One reason is that the flow of the large fluvial systems are regulated almost exclusively for offstream uses, with little intentional accommodation for aquatic or wetland ecosystems. Built features in the lower Truckee floodplain include clearings for crops, hay pasture for livestock, highways and railroads, urban and industrial developments, quarries and mine waste dumps, ditches and levees, dams and reservoirs, and linear utility structures (pipe, wire, access roads). Society and landowners benefit from these activities, but the ecological downsides provoke serious challenges. Public water purveyors, irrigation districts, and private owners of water rights and floodplains virtually control riparian ecosystems. Accountability for stewardship is one of the difficult challenges. A dysfunctional riparian ecosystem imposes large economic burdens on society. Technological fixes to repair or replace wetland functions and services are costly and less effective. Alternatives, such as native vegetation buffer strips left to grow along the river could alleviate several environmental and natural resource concerns. Estimates from studies of the historic change in riparian vegetation between Sparks and Pyramid Lake indicate that the riparian forest and shrub-scrub cover decreased from 7,700 to 628 acres. The condition of the remaining small woodlands is described as degraded, due primarily to a declining water table. Below Wadsworth, the width of the riparian corridor ranged from 1,200 to 2,000 feet in 1938, but now averages about 230 feet (USDOI, 2004). Palustrine forested wetlands make up only one half of one percent of the linear wetlands mapped by the NWI for Nevada. In recent "wet" years, the federal water master in cooperation with municipal, irrigation district, and other water users have adjusted springtime reservoir releases to aid recovery of cottonwood communities along the Truckee River. Tom Schweich photo.

The affects of immigration and colonization were immediate and significant. Immigrants traveled river corridors because the essentials were relatively abundant here and nowhere else. Wetlands supplied wood for fuel, shelter, and implements; plants and animals for sustenance; and, shady recesses with decent, cool water. As more people traveled through and settled down, the use of stream courses and water resources increased. Soon, watercourses were partitioned by diversion dams and irrigation ditches that conveyed water to transport logs, sluice placer gold, operate mills, and grow crops and forage. Farms, ranches, and the towns and industries expanded along river corridors. All sorts of wetlands were converted far and wide by these activities, such that few if any wetlands now resemble conditions prior to settlement. Saying yes to use and development was equivalent to saying no to wetlands, and the economic benefits of wetlands – the fish populations, riparian vegetation, waterfowl, and other "products" – dwindled and sometimes disappeared.

Since this is a plan about conserving wetlands, we characterize economic uses as those that do not destroy or substantially alter wetlands in the course of that use. Another viewpoint is that some economic uses may result in wetland losses, but mitigation may compensate for the lost functions and values. However, according to the ACOE's own assessment of its approach to and implementation of mitigation has not been a successful no net wetland loss strategy. Practically speaking, any form of land use or development that obliterates or substantially degrades wetland quality cannot be an economic use. A stream of goods or services will not flow from a factory, supermarket, power plant, or wastewater treatment system (i.e., a wetland) that has been dismantled or leveled. Of greater interest, rather, are the economic activities that make use of wetland processes and products without subtracting from their other beneficial qualities. Thus, most urban, mining, industrial, or other developments that displace wetland acreage cannot be categorized as economic uses.

Meadow Pasture in McCan Canyon

Some sod-carpeted wet meadows are naturalized wetlands established primarily for grazing. Creating a meadow pasture out of a gentle shrub-covered slope does not necessitate mechanical removal of vegetation or site grading. Favorable mesic soils and slopes, for instance at a canyon mouth, can be transformed into relatively lush meadow within a growing season or two by diverting and spreading flow from nearby springs or streams. As saturated conditions drown xerophytic plants, other species spread. Naturalized meadows occur in large (Washoe Valley) and small (McCan Canyon) patches, often in the midst of sagebrush or greasewood dominated communities, on gentle slopes of alluvial fans, in drainageway floodplains and troughs, and on stream terraces. Fenced meadow pastures are an alternative to open grazing in riparian areas, but management obligations may be incurred to avert soil compaction, excess runoff, gully or channel erosion, and water quality degradation by concentrated animal waste. Also, if too much water is diverted, the change in hydrology may degrade adjacent aquatic and wetland ecosystems and threaten wildlife populations. Enhanced habitat diversity might improve living conditions for resident wildlife (e.g., rodents and raptors), or alternatively attract animals not customarily found in the area and capable of altering ecosystem dynamics (e.g. large herbivores, invasive nonnative weeds). The NWI maps for Nevada do not differentiate between naturally occurring (Palustrine emergent/scrub shrub) and created wet meadows. Eric Peterson photo.

Some activities that may fit within a conservation-oriented perspective of economic use are carefully managed agricultural activities and outdoor recreation. Farming and ranching are mainstream economic activities throughout Nevada. Implementation of livestock grazing systems and allotment management practices intended to alleviate riparian

ecosystem stress appears to be making headway in some areas throughout the state. The results of some riparian restoration and recovery initiatives supported by federal agencies and willing ranchers indicate grazing may be managed without significant ecological damage, especially if the meadows and riparian areas get occasional rest. Farming requires intensive manipulation of vegetation and soils and water resources, so an enormous amount of wetlands in floodplains have been converted to cropland. However, farming in floodplains, compared to structure-based forms of development, is more amenable to wetland conservation. However, stewardship for public benefits usually incurs opportunity costs and requires changes in practices, for example maintaining a corridor for riparian vegetation and buffer strip. All federal agencies, especially the NRCS, offer incentive programs to meet expectations for compensation. Growing pasture hay crops on sites requiring minimal irrigation can be a low-impact alternative. Some pasture meadows are readily created by diverting a portion of the flow from streams or springs across slopes with soil, landscape, and hydrologic properties conducive to holding water and hosting wetland grasses and shrubs.

Trapping fur-bearing mammals (beaver, mink, otter, and muskrat), aquaculture, tree harvest, and salt extraction are other wetland dependent commercial activities that occur in scattered locations throughout the state. The impacts tend to be localized and may be impermanent, but still require substantial alteration of wetland features. Aquaculture projects located at natural spring systems or marshlands usually require substantial earthwork to create ponds and/or sloughs appropriate to efficient production of fish or shellfish. Tree harvesting rarely occurs, since forests suitable for commercial harvest are small and widely scattered. Logging in riparian zones is regulated to protect ecosystem and watershed functions. Several playas in the state have supported salt extraction businesses. Complete recovery of wetlands may be hindered by the concentrated salt minerals on the surface as the result of commercial activities.

Outdoor Recreation, Research, and Education

Wetlands capture the interests of casual and enthusiastic outdoor recreationists because their characteristics are varied, fascinating, lush, and cooler compared to the surrounding landscape. Rivers, lakes and reservoirs, marshes, riparian woodlands, desert springs, and mountain meadows are precious outdoor recreation attractions in Nevada. The 2003 Statewide Comprehensive Outdoor Recreation Plan (SCORP) reports that more Nevadans (54.8 percent) participate in water related recreation activities (various forms of fishing, boating, skiing, and swimming) than other types. With the exception of small, high altitude lakes and reservoirs, all are managed as premier outdoor recreation locations by federal and/or state

Las Vegas Springs Preserve, Big Cauldron Spring Pool (circa 1904)

The good old days, when the style of swimwear and water consumption were modest. In 1905 the Las Vegas townsite and railroad station was established. The Las Vegas Springs provided water for steam engines and a growing population. The groundwater system that fed the artesian springs began loosing pressure as many wells were left uncapped. The State Engineer designated the aquifer as overdrawn by 1945. Still, more groundwater withdrawals were allowed for domestic, municipal, and industrial uses. The rate of water table depletion by 1960 had reached two to four feet per year. Spring flow ceased in 1962. Many thermal and cool springs have been altered to accommodate bathing, fishing, hunting, and wildlife watching. Photo from http://www.springspreserve.org/html.

agencies. Lake Tahoe, Stillwater Marsh, Pyramid Lake, and Lakes Mead and Mohave are internationally recognized outdoor recreation resources.

Though the 2003 SCORP survey did not explore how the presence and quality of wetland resources influence outdoor recreation choices, clearly it does. Federal or state parks, campgrounds, wilderness areas, recreation areas, and wildlife management areas are designed to bring people into contact with water bodies, marshlands, or riparian corridors. Old and new trails in urban, rural, and remote areas intentionally align or cross paths with streams, shorezones, marshes, and meadows, because just as past explorers and travelers of the desert and rugged mountains experienced relief and delight when encountering the water, wildlife, and luxuriant scenery of wetlands, so do the hundreds of thousands of resident and visiting hikers, backpackers, bikers, and horse riders. Enormous sums of public funding are committed to securing and conserving outdoor recreation resources. Grant programs prominent in Nevada include the Southern Nevada Public Lands Management Act, the Nevada Conservation and Resource Protection Bond Issue (a.k.a. The Q1 Grant Program), and the Land and Water Conservation Fund. These and others implemented by wildlife and water quality protection agencies meet society's need to know and conserve natural habitats by encouraging and supporting the acquisition of water and/or wetland resources for public recreation access.

Fishing, hunting, and wildlife watching are prominent activities, actively supported by many conservation and sport organizations. The NDOW has focused its wildlife management area program, which includes twelve areas, on the acquisition, protection, and rehabilitation of water and wetland resources. Total water acreage in the Nevada State Park System approaches 30,000 acres, although almost twenty-four thousand is jointly managed at the two major Bureau of Reclamation reservoirs in the state, Lahontan and Rye Patch. Seven park units are sited adjacent to or encompass major water bodies. In addition to Lake Tahoe Nevada State Park, Lahontan State Recreation Area and Rye Patch SRA, there are Washoe Lake State Park and Walker Lake, South Fork and Wild Horse State Recreation Areas.

Carson Lake Birdwatching in Winter

Birdwatching in Lahontan Valley is a year round pleasure, but would not be if water rights had not been purchased to maintain marshes and playa lakes. Some enthusiasts choose the solitude of January. Even then Marsh Wrens, Snowy Plovers, Tundra Swans, Rough-legged Hawks, Peregrine Falcons, and other resident and wintering migratory birds may be observed at Carson Lake marshland. A Pacific Flyway mainstay and a Western Hemisphere Shorebird Reserve, the Lahontan Valley wetland complexes are internationally important. May is the month for gregarious birders who flock to the Spring Wings Festival with hundreds of thousands of birds. Birdwatchers across the country descend on Fallon to attend workshops, tours, and field trips at Stillwater Wildlife Refuge, Carson Lake, Pyramid Lake, and the lower reaches of the Truckee, Carson, and Humboldt rivers. More rural communities are seeking the economic benefits of similar ecotourism events. Photo by Don McIvor

According to the NDOW, sport fishing access is available at two hundred ponds, lakes, and reservoirs that provide nearly four hundred thousand surface acres of angling opportunity. More than five hundred streams and rivers are said to offer almost three thousand miles of fishable habitat (Nevada Division of Wildlife, 2001). The 2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation Survey for Nevada, reports that the average angler, of which there are 119,000, goes fishing nine days each year and spends $1,116 per year on travel and equipment expenses. According to the survey, fishing at ponds, lakes, and reservoirs is twice as popular as river or stream fishing. Migratory bird hunters number thirty-two thousand, making up sixty-five

percent of the hunter population in the state (USDOI, 2003). Over three hundred thousand people reportedly participate in wildlife watching near their homes, and an estimated 543 thousand did so at locations more than a mile distant from their home. Presumably, aquatic and wetland habitats are among the most popular wildlife observation and photography locations.

Resource managers are still learning how to deal with the challenges of balancing consumptive and nonconsumptive uses of water resources as more people seek water and wetland based recreation opportunities. Deepwater recreation activities such as boating, canoeing/kayaking, and skiing require certain amenities, which include an adequate supply of appropriately clean water. Wetlands attract large numbers of visitors to certain camping, hiking, and picnicking areas, and the presence of water influences recreation choices and the enjoyment of the experience. An increasing number of wetland areas are managed for sport fishing, waterfowl hunting, wildlife watching, or water trails, made possible with state natural resource conservation bonds that enable wildlife and park agencies to acquire reservoirs and water rights formerly used for agriculture. Federal and state planning for and management of water resources have limited administrative capacity and authority to work on the development of new strategies or to promote water use and conservation practices that might make more water available for public purposes.

Natural Resource Management Challenges in State Parklands

A vegetated riparian reach at Fort Churchill State Park State has canoe-side appeal, but a closer look reveals degenerating ecological and hydrological conditions that devalue recreational experiences and may eventually limit outdoor recreation options. Invasive nonnative plants (tall white top and salt cedar) are shouldering native understory plants out of the cottonwood grove. The river appears to have lost its former taut shape and no longer experiences the snowmelt surge needed to spill its load of fine-grained sediment overland. The even-aged stand of cottonwoods also indicates floodplain geomorphic processes are out-of-kilter. Dynamic fluvial systems turned flaccid tend to become bland, lacking diversity of substrates, vegetation, wildlife, and recreational interest. As more riparian and wetland properties are placed in public ownership, state and federal parkland managers also must be given the wherewithal for restoration of derelict conditions and for upkeep of native communities. Eric Peterson photo.

The 2003 SCORP delves into the matter of protecting water resources as vital components of the state's recreation base, drawing information from the recreational survey conducted in preparation of the Nevada outdoor recreation plan. The discussion revolves around on the facts that Nevada is the driest state with rapid population and industrial growth, and therefore, conservation of water resources for multiple uses is essential to our social and economic well-being. The Nevada State Water Plan (NDWP, 1999), identified maintenance of recreational values as a priority issue because recreation is an important beneficial use of the states water resources, and the demands for outdoor recreation sited with water and wetland resources is destined to increase. The SCORP issue analysis highlights the growth in public interest in maintaining the quantity and quality of water in streams, lakes, and reservoirs sufficient to support riparian and wetland habitats. The NDWR comments acknowledge that a water right must be acquired to keep water for recreation uses, but do not convey information on strategies to acquire water rights or to encourage water conservation to meet objectives, legally and operationally, of managing water both for economic and outdoor recreation related beneficial uses. Rivers, streams, and reservoirs are fully allocated, so during ordinary seasonal and prolonged periods of drought, wetland and related recreation activities are lost or curtailed. More innovative water allocation approaches are needed to keep water and wetland-based recreation values intact.

Wetland resources provide natural sciences education opportunities and are an area of interest to a number of university, federal agency, and nonprofit natural science research organizations. Many elementary, middle, and high schools visit or study wetlands to learn more about ecology, environmental

quality, and natural resources of the state. In Nevada, topical areas of research include restoration of stream and spring riparian zones; desert springs ecology and biodiversity; nonpoint source pollution abatement through wetlands; impacts of livestock grazing; impacts of dewatering open pit mines; groundwater to surface water interactions at isolated spring systems; invasive nonnative plants on wildlife and at risk species; nonnative fish and wildlife introductions on native biota and aquatic ecosystems; the conservation status of threatened and endangered species; and ecosystem management of public lands.

Wetlands of the past and present hold special interest for scientists studying the anthropological, archeological, and paleontological resources of Nevada's prehistoric inhabitants. It is from this research that we learn about past climatologic and environmental conditions, biotic and hydrologic resources, and human behaviors. Our views on resource use and management today, and in consideration of the future, are influenced by what is learned by the interpretation of archeological sites and assemblages of artifacts and fossils. For example, we have deeper insight into the potential magnitude of climate shifts, most notably drought; hydrologic and geomorphic changes in water resources; the use of fire to alter wetland vegetation for food and fiber; and the integral and varied ways that human occupation depended upon aquatic and wetland resources in the arid west. The results of archeological and paleontological field research are most credible and informative if the studies can be conducted where sediments and landforms of wetland sites are little or not disturbed. Invasive land use and management practices in wetlands reduce the limited opportunities available to learn about the past and envision the future.

Agencies Involved In Maintaining Wetland Ecosystem Functions And Socioeconomic Services. The responsibility for maintenance of wetland quality falls on the shoulders of state and federal agencies. We provide a brief outline of the agencies involved and their responsibilities.

Water Quality
ACOE/NDEP – permit to dredge or discharge fill into a wetland
NDEP – permit to discharge pollutants at a point source; promote/support best management practices to control nonpoint source pollution; monitor water quality and plan for improvement
BLM, USFS, NPS, and FWS – manage land use and land cover to control nonpoint source pollution

Wildlife and Habitat
NDOW – permits to hunt and fish; establishment of wildlife management areas; wildlife population management and habitat management
FWS – permission to hunt and fish on national wildlife refuge or range; manage land use and land cover for wildlife benefit
BLM, USFS, NPS, and FWS – manage the use and ecology of public lands

Biodiversity – Threatened, Endangered, and At-Risk Plant and Animal Species
FWS – officially list species threatened or endangered; permission to take and plan to recover threatened or endangered species; manage national wildlife refuges and ranges to protect threatened and endangered species populations and habitats
BLM, USFS, NPS – manage land use and land cover to maintain survival of species of concern
NDF – permits to conduct land use such that state fully protected species of native flora are not threatened
NNHP – track, distribute information on, and advise on the conservation of sensitive and rare species

Water Resources/Watershed
NDWR – permission to appropriate water and to transfer a water right; monitor and assess the use of groundwater; permission to construct or modify a dam
BLM, USFS, NPS – manage land use and land cover for watershed function
ACOE – permission to dredge or drain a wetland
Watershed Management Planning groups – local collaboratives, e.g., Carson River Coalition

Outdoor Recreation
NDSP – state park system units with aquatic-wetland ecosystems
NDOW – state wildlife management areas with aquatic-wetland ecosystems
FWS – national refuges and ranges
BOR – artificial and natural aquatic-wetland sites associated with BOR reservoirs, impoundments, canals, ditches, drains
USFS, BLM – campgrounds and other developed outdoor recreation amenities on public land; dispersed activities throughout the state; special event permits

Floodplain
FEMA – support of state and local programs to control development in floodplain; mapping and monitoring floodplain development; funds to restore flood damaged channels and dams/reservoirs
NDWR – state liaison to FEMA
Counties – Ordinances to manage development in floodplain

Land Development and Use
Local Government – master land use plan; zoning ordinance; open space plan
Conservation Districts – natural resource conservation plan
NRCS – permits to convert or alter wetland on private farmland; deploy conservation incentive programs
ACOE – permission to develop wetland that requires placement of fill, dredging, or drainage
BLM, USFS, NPS – permits to graze livestock, mine, or utilize resources within wetlands
ACOE/NDEP – permission to develop wetland that requires placement of fill, dredging, or drainage
NDEP – permit to discharge pollutants to waters of the state from point sources

Appendix 2.1. List of Wetland and Riparian Plant Alliances and Associations in Nevada

Table __. Wetland and Riparian Plant Associations in Nevada, Compiled by NatureServe, with Provisional Conservation Status Ranks		
ALLIANCE **Association**	**Global Rank**	**State Rank**
(POTAMOGETON DIVERSIFOLIUS, STUCKENIA FILIFORMIS) PERMANENTLY FLOODED HERBACEOUS ALLIANCE		
Stuckenia filiformis Herbaceous Vegetation	GU	SP
(SARCOCORNIA UTAHENSIS) - (ARTHROCNEMUM SUBTERMINALE) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE		
(Sarcocornia utahensis) - (Arthrocnemum subterminale) Seasonally Flooded Herbaceous Vegetation [Placeholder]	G?	SP
ABIES CONCOLOR - POPULUS TREMULOIDES FOREST ALLIANCE		
Populus tremuloides - Abies concolor / Poa pratensis Semi-natural Forest	GW	S?
ABIES CONCOLOR FOREST ALLIANCE		
Abies concolor - Pseudotsuga menziesii / Acer glabrum Forest	G4	SP
ABIES LASIOCARPA FOREST ALLIANCE		
Abies lasiocarpa / Arnica cordifolia Forest	G5	S?
ABIES MAGNIFICA FOREST ALLIANCE		
Abies magnifica / Ribes viscosissimum Forest	G3?	S?
ACACIA GREGGII SHRUBLAND ALLIANCE		
Acacia greggii - Parkinsonia microphylla Shrubland	G4G5	SP
ALLENROLFEA OCCIDENTALIS SHRUBLAND ALLIANCE		
Allenrolfea occidentalis Shrubland	G3	SR
ALNUS INCANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE		
Alnus incana / Cornus sericea Shrubland	G3Q	SP
Alnus incana / Mesic Forbs Shrubland	G3	S?
Alnus incana / Mesic Graminoids Shrubland	G3	S?
AMELANCHIER UTAHENSIS SHRUBLAND ALLIANCE		
Amelanchier utahensis - Cercocarpus montanus Shrubland	G2?	S2?
ARTEMISIA CANA (SSP. BOLANDERI, SSP. VISCIDULA) SHRUB HERBACEOUS ALLIANCE		
Artemisia cana (ssp. bolanderi, ssp. viscidula) - Artemisia tridentata ssp. vaseyana / Poa cusickii Shrub Herbaceous Vegetation [Provisional]	G2	SP
Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa fendleriana ssp. fendleriana Shrub Herbaceous Vegetation	G2	SP
Artemisia cana ssp. bolanderi / Muhlenbergia richardsonis Shrub Herbaceous Vegetation	G3	S1
ARTEMISIA CANA (SSP. BOLANDERI, SSP. VISCIDULA) SHRUBLAND ALLIANCE		
Artemisia cana ssp. bolanderi / Eleocharis palustris Shrubland [Provisional]	GU	SP
ARTEMISIA TRIDENTATA SSP. VASEYANA SHRUB HERBACEOUS ALLIANCE		
Artemisia tridentata ssp. vaseyana / Carex geyeri Shrub Herbaceous Vegetation	G3	SP
ARTEMISIA TRIDENTATA SSP. VASEYANA SHRUBLAND ALLIANCE		
Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Elymus trachycaulus ssp. trachycaulus Shrubland	G3G4	S3S4
Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Hesperostipa comata Shrubland	G3?	S3?
BACCHARIS SERGILOIDES INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE		
Baccharis sergiloides Shrubland [Placeholder]	G?	S?
BACOPA EISENII PERMANENTLY FLOODED HERBACEOUS ALLIANCE		
Bacopa eisenii Herbaceous Vegetation	G?	S?
BETULA OCCIDENTALIS SEASONALLY FLOODED SHRUBLAND ALLIANCE		
Betula occidentalis / Mesic Graminoids Shrubland	G3	S?
Betula occidentalis Shrubland	G3Q	SP
BETULA OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE		
Betula occidentalis / Cornus sericea Shrubland	G3	S2?
Betula occidentalis / Maianthemum stellatum Shrubland	G4?	S4?
CAREX (ROSTRATA, UTRICULATA) SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Carex utriculata Herbaceous Vegetation	G5	S?
CAREX AQUATILIS SEASONALLY FLOODED HERBACEOUS ALLIANCE		

Table __. Wetland and Riparian Plant Associations in Nevada, Compiled by NatureServe, with Provisional Conservation Status Ranks		
ALLIANCE **Association**	**Global Rank**	**State Rank**
Carex aquatilis Herbaceous Vegetation	G5	S?
CAREX NEBRASCENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Carex nebrascensis - Carex microptera Herbaceous Vegetation	G3G4	SR
Carex nebrascensis Herbaceous Vegetation	G4	SR
CAREX SCOPULORUM SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Carex scopulorum - Eleocharis quinqueflora Herbaceous Vegetation	G3?	S?
Carex scopulorum Herbaceous Vegetation	G5	SP
CAREX SIMULATA SATURATED HERBACEOUS ALLIANCE		
Carex simulata Herbaceous Vegetation	G4	S?
CAREX STRAMINIFORMIS HERBACEOUS ALLIANCE		
Carex straminiformis Herbaceous Vegetation	G3?	S3?
CAREX VERNACULA HERBACEOUS ALLIANCE		
Carex vernacula - Poa fendleriana Herbaceous Vegetation	G2G3	S2S3
CAREX VESICARIA SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Carex vesicaria Herbaceous Vegetation	G4Q	SP
CHILOPSIS LINEARIS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE		
Chilopsis linearis Shrubland	G3	S3?
CHRYSOTHAMNUS ALBIDUS SHRUBLAND ALLIANCE		
Chrysothamnus albidus / Puccinellia nuttalliana Shrubland	G3	S3
CORNUS SERICEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE		
Cornus sericea Shrubland	G4Q	SR
DESCHAMPSIA CAESPITOSA SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Deschampsia caespitosa Herbaceous Vegetation	G4	SP
DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE		
Distichlis spicata - (Scirpus nevadensis) Herbaceous Vegetation	G4	SP
Distichlis spicata Herbaceous Vegetation	G5	S?
Distichlis spicata Mixed Herb Herbaceous Vegetation	G3G5	SP
DODECATHEON REDOLENS SATURATED HERBACEOUS ALLIANCE		
Dodecatheon redolens - Aquilegia formosa Herbaceous Vegetation	G2?	S2?
ELEOCHARIS (MONTEVIDENSIS, PALUSTRIS, QUINQUEFLORA) SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Eleocharis (montevidensis, palustris, quinqueflora) Seasonally Flooded Herbaceous Vegetation [Placeholder]	G5	S2?
ELEOCHARIS (QUINQUEFLORA, ROSTELLATA) SATURATED HERBACEOUS ALLIANCE		
Eleocharis quinqueflora - Carex scopulorum Herbaceous Vegetation	G3G4	S3S4
Eleocharis quinqueflora Herbaceous Vegetation	G4	SP
ELEOCHARIS ACICULARIS SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Eleocharis acicularis Herbaceous Vegetation	G4?	S3?
ELEOCHARIS PALUSTRIS SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Eleocharis palustris Herbaceous Vegetation	G5	SR
ERICAMERIA PANICULATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE		
Ericameria paniculata Shrubland [Placeholder]	G4G5	S?
FESTUCA IDAHOENSIS HERBACEOUS ALLIANCE		
Festuca idahoensis - Carex hoodii Herbaceous Vegetation	G3G4	S3S4
GEUM ROSSII HERBACEOUS ALLIANCE		
Geum rossii Herbaceous Vegetation	G4G5Q	S?
HORDEUM BRACHYANTHERUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE		
Hordeum brachyantherum Herbaceous Vegetation	G2	S2
IVESIA CRYPTOCAULIS SPARSELY VEGETATED ALLIANCE		
Ivesia cryptocaulis Alpine Sparse Vegetation	G1	S1?
JUNCUS BALTICUS SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Juncus balticus Herbaceous Vegetation	G5	S?

Table __. Wetland and Riparian Plant Associations in Nevada, Compiled by NatureServe, with Provisional Conservation Status Ranks		
ALLIANCE **Association**	**Global Rank**	**State Rank**
JUNIPERUS SCOPULORUM TEMPORARILY FLOODED WOODLAND ALLIANCE		
Juniperus scopulorum Temporarily Flooded Woodland [Placeholder]	G1	S1
LEDUM GLANDULOSUM SATURATED SHRUBLAND ALLIANCE		
Ledum glandulosum Shrubland [Placeholder]	G4	S4
LEYMUS CINEREUS INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE		
Leymus cinereus - Distichlis spicata Herbaceous Vegetation	G3	S?
LEYMUS TRITICOIDES TEMPORARILY FLOODED HERBACEOUS ALLIANCE		
Leymus triticoides - Carex spp. Herbaceous Vegetation	G4?	S4?
Leymus triticoides - Poa secunda Herbaceous Vegetation	G2	SP
MUHLENBERGIA ASPERIFOLIA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE		
Muhlenbergia asperifolia Herbaceous Vegetation	GU	S?
NOLINA BIGELOVII SHRUBLAND ALLIANCE		
Nolina bigelovii Shrubland [Placeholder]	G3?	SP
NOLINA PARRYI SHRUBLAND ALLIANCE		
Nolina parryi Shrubland [Placeholder]	G?	SP
PHRAGMITES AUSTRALIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE		
Phragmites australis Western North America Temperate Semi-natural Herbaceous Vegetation	G5	S?
PINUS CONTORTA FOREST ALLIANCE		
Pinus contorta var. murrayana / Sparse Understory Forest	G4?	S?
PINUS FLEXILIS - POPULUS TREMULOIDES FOREST ALLIANCE		
Populus tremuloides - Pinus flexilis Forest	G3	S3
PINUS PONDEROSA TEMPORARILY FLOODED WOODLAND ALLIANCE		
Pinus ponderosa Temporarily Flooded Woodland [Placeholder]	G3	S?
PLEURAPHIS JAMESII HERBACEOUS ALLIANCE		
Pleuraphis jamesii Herbaceous Vegetation	G2G4	S?
POA FENDLERIANA HERBACEOUS ALLIANCE		
Poa fendleriana ssp. fendleriana Herbaceous Vegetation	G2	S?
POA SECUNDA SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Poa secunda - Muhlenbergia richardsonis Herbaceous Vegetation	G?	S?
POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED FOREST ALLIANCE		
Populus angustifolia / Rosa woodsii Forest	G2G3	S?
POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND ALLIANCE		
Populus angustifolia - Pseudotsuga menziesii Woodland	G3	SP
Populus angustifolia / Betula occidentalis Woodland	G3	S2
Populus angustifolia / Cornus sericea Woodland	G4	SP
Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland	G3	S?
POPULUS BALSAMIFERA SSP. TRICHOCARPA TEMPORARILY FLOODED FOREST ALLIANCE		
Populus balsamifera ssp. trichocarpa / Mixed Herbs Forest	G3?	S3?
Populus balsamifera ssp. trichocarpa / Salix exigua Forest	G1	SP
POPULUS FREMONTII SEASONALLY FLOODED WOODLAND ALLIANCE		
Populus fremontii / Leymus triticoides Woodland	G?	S?
Populus fremontii / Salix geyeriana Woodland	G3?	S3?
POPULUS FREMONTII TEMPORARILY FLOODED FOREST ALLIANCE		
Populus fremontii / Acer negundo Forest	G2Q	SP
POPULUS TREMULOIDES - PSEUDOTSUGA MENZIESII FOREST ALLIANCE		
Populus tremuloides - Pseudotsuga menziesii / Symphoricarpos oreophilus Forest	G4	S4
POPULUS TREMULOIDES FOREST ALLIANCE		
Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Tall Forbs Forest	G5	S?
Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Thalictrum fendleri Forest	G5	S?
Populus tremuloides / Amelanchier alnifolia / Tall Forbs Forest	G3G5	S?

Table __. Wetland and Riparian Plant Associations in Nevada, Compiled by NatureServe, with Provisional Conservation Status Ranks		
ALLIANCE **Association**	**Global Rank**	**State Rank**
Populus tremuloides / Amelanchier alnifolia / Thalictrum fendleri Forest	G3G4	S?
Populus tremuloides / Artemisia tridentata Forest	G3G4	S?
Populus tremuloides / Symphoricarpos oreophilus / Carex rossii Forest	G3G4	S?
Populus tremuloides / Symphoricarpos oreophilus / Tall Forbs Forest	G3G5	S?
Populus tremuloides / Symphoricarpos oreophilus / Wyethia amplexicaulis Forest	G4Q	S3S4
Populus tremuloides / Wyethia amplexicaulis Forest	G3	S?
POPULUS TREMULOIDES TEMPORARILY FLOODED FOREST ALLIANCE		
Populus tremuloides / Betula occidentalis Forest	G3	S?
Populus tremuloides / Carex pellita Forest	G2	SP
Populus tremuloides / Veratrum californicum Forest	G3?	S?
PRIMULA PARRYI TEMPORARILY FLOODED HERBACEOUS ALLIANCE		
Primula parryi Herbaceous Vegetation	G?	SP
PROSOPIS GLANDULOSA SHRUBLAND ALLIANCE		
Prosopis glandulosa var. torreyana Shrubland	G3	S3
PRUNUS VIRGINIANA SHRUBLAND ALLIANCE		
Prunus virginiana - (Prunus americana) Shrubland	G4Q	SP
PSEUDOTSUGA MENZIESII TEMPORARILY FLOODED WOODLAND ALLIANCE		
Pseudotsuga menziesii / Betula occidentalis Woodland	G3?	SP
PSOROTHAMNUS SPINOSUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE		
Psorothamnus spinosus Shrubland [Placeholder]	G4G5	SP
PUCCINELLIA NUTTALLIANA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE		
Puccinellia nuttalliana Herbaceous Vegetation	G3?	SP
RUPPIA (CIRRHOSA, MARITIMA) PERMANENTLY FLOODED HERBACEOUS ALLIANCE		
Ruppia (cirrhosa, maritima) Permanently Flooded Herbaceous Vegetation [Placeholder]	G1G3	SP
SALICORNIA RUBRA SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Salicornia rubra Herbaceous Vegetation	G2G3	SP
SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE		
Salix exigua / Mesic Forbs Shrubland	G2	S?
SALIX ARCTICA SATURATED DWARF-SHRUBLAND ALLIANCE		
Salix arctica / Caltha leptosepala Dwarf-shrubland	G2G3	S2S3
SALIX BOOTHII SEASONALLY FLOODED SHRUBLAND ALLIANCE		
Salix boothii / Calamagrostis canadensis Shrubland	G3G4Q	S?
SALIX BOOTHII TEMPORARILY FLOODED SHRUBLAND ALLIANCE		
Salix boothii - Salix eastwoodiae / Carex nigricans Shrubland	G3	SP
Salix boothii - Salix lemmonii Shrubland	G3	SP
Salix boothii / Mesic Forbs Shrubland	G3	S3
SALIX ERIOCEPHALA TEMPORARILY FLOODED SHRUBLAND ALLIANCE		
Salix eriocephala / Ribes aureum - Rosa woodsii Shrubland	G3	S?Q
SALIX GEYERIANA SEASONALLY FLOODED SHRUBLAND ALLIANCE		
Salix geyeriana / Carex utriculata Shrubland	G5	SR
SALIX GEYERIANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE		
Salix geyeriana - Salix eriocephala Shrubland	GU	SP
Salix geyeriana - Salix lemmonii / Carex aquatilis var. dives Shrubland	G3	SP
Salix geyeriana / Mesic Graminoids Shrubland	G3?	S?
SALIX GOODDINGII TEMPORARILY FLOODED WOODLAND ALLIANCE		
Salix gooddingii Woodland [Placeholder]	G3	S3?
SALIX LASIOLEPIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE		
Salix lasiolepis / Barren Ground Shrubland	G3?	S?
Salix lasiolepis / Rosa woodsii / Mixed Herbs Shrubland	G3Q	S3
SALIX LEMMONII SEASONALLY FLOODED SHRUBLAND ALLIANCE		

Table __. Wetland and Riparian Plant Associations in Nevada, Compiled by NatureServe, with Provisional Conservation Status Ranks		
ALLIANCE **Association**	**Global Rank**	**State Rank**
Salix lemmonii / Mesic-Tall Forb Shrubland	G3?	S3?
Salix lemmonii / Rosa woodsii Shrubland	G3	S?
SALIX LUTEA SEASONALLY FLOODED SHRUBLAND ALLIANCE		
Salix lutea / Carex utriculata Shrubland	G4	S?
SALIX LUTEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE		
Salix lutea / Rosa woodsii Shrubland	G3	S3?
SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE		
Sarcobatus vermiculatus - Atriplex parryi / Distichlis spicata Shrubland	G?	S?
Sarcobatus vermiculatus - Psorothamnus polydenius Shrubland	G?	S?
Sarcobatus vermiculatus / Distichlis spicata Shrubland	G4	SP
Sarcobatus vermiculatus / Leymus cinereus Shrubland	G3	SP
SCHOENOPLECTUS ACUTUS - (SCHOENOPLECTUS TABERNAEMONTANI) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE		
Schoenoplectus acutus Herbaceous Vegetation	G5	S?
SCHOENOPLECTUS AMERICANUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE		
Schoenoplectus americanus - Eleocharis palustris Herbaceous Vegetation	G4	SP
SCHOENOPLECTUS MARITIMUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE		
Schoenoplectus maritimus Herbaceous Vegetation	G4	S?
SCHOENOPLECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE		
Schoenoplectus pungens Herbaceous Vegetation	G3G4	S?
SPARTINA GRACILIS SEASONALLY FLOODED HERBACEOUS ALLIANCE		
Spartina gracilis Herbaceous Vegetation	GU	SU
SUAEDA MOQUINII INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE		
Suaeda moquinii Shrubland	G5	S5
TAMARIX SPP. SEMI-NATURAL TEMPORARILY FLOODED SHRUBLAND ALLIANCE		
Tamarix spp. Temporarily Flooded Shrubland	GW	SW
TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE		
Typha latifolia Western Herbaceous Vegetation	G5	S?
TYPHA DOMINGENSIS SEASONALLY FLOODED TEMPERATE HERBACEOUS ALLIANCE		
Typha domingensis Western Herbaceous Vegetation	G5?	S5?
VERATRUM CALIFORNICUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE		
Veratrum californicum - Juncus nevadensis Herbaceous Vegetation	G3G4	S3S4
VIGUIERA PARISHII SHRUBLAND ALLIANCE		
Viguiera parishii Shrubland [Placeholder]	G4	S?

Source: Conservation status means the rarity or sensitivity of the vegetation association evaluated as a function of biological significance, protection urgency, and management urgency. The list is modified by NNHP, but has not been the subject of intensive field survey (http://www.heritage.nv.gov/ecology/nv_nvc.htm, 1/22/04). It was originally compiled from a NatureServe database search (http://www.natureserve.org/explorer/index.htm, 9/26/03). Vegetation associations follow the National Vegetation Classification. This is not a complete list of wetland plant communities, only those for which NatureServe holds records of occurrences.

Code Notes:

G – Global rank indicator, based on worldwide distribution
S – State rank indicator, based on distribution within the state
1 - Critically imperiled due to extreme rarity, imminent threats, or and/or biological factors
2 - Imperiled due to rarity and/or other demonstrable factors
3 - Rare and local throughout its range, or with very restricted range, or otherwise vulnerable to extinction
4 - Apparently secure, though frequently quite rare in parts of its range, especially at its periphery
5 - Demonstrably secure, though frequently quite rare in parts of its range, especially at its periphery
P - Potential in the state, but not yet reported or documented
X - Eliminated at the scale indicated (G or S) with no restoration potential, usually due to extinction of a component species
H - Historical occurrence(s) only, presumed eliminated but with restoration potential
? - Not yet assessed for rank at the scale indicated (G or S)
U - Unrankable with current data at the scale indicated (G or S)
Q - Taxonomic status Questionable or uncertain
#_# - Range of uncertainty in a numeric rank (e.g., G2G4 or S1S2)

PART 3. THREATS TO THE WETLANDS OF NEVADA

Overview

In the context of the NvWP, the term "threat" refers to the use, development, or management of wetland resources that leads directly or indirectly to the loss or degradation of wetland and aquatic habitats. In general, threats entail the extraction or harvesting of renewable or nonrenewable resource, the development of land or water, or even more broadly the removal or introduction of plant and animal species in ways that impairs or contributes to the impairment of wetland ecosystems. Clearly not all resource uses and management activities identified as threats in all cases cause additional wetland loss or degradation. Established grazing, farming, land development, wildlife habitat management and many other resource uses are conducted without further impact. Wetlands are, however, vulnerable to modifications or expansion of these activities if potential impacts are ignored or inappropriate measures implemented to avoid damage or degradation. Threats may also include upland or deep-water uses that cumulatively alter wetland conditions and resources. "Wetland resources" is a catchall phrase referring to the full spectrum of living things, abiotic components, physical features, and ecological processes occurring both in aquatic and terrestrial zones of wetlands.

Overall, the agencies that have conducted various assessments of the history of wetland resource use identify irrigation water diversions, farming, livestock grazing, mining, and urban and rural developments as common and widespread factors leading to the loss and degradation of Nevada's wetland resources. In general, the same set of land use activities continue in this vein today. An additional factor that gets relatively little attention is the matter of cumulative effects. Cumulative effect in this context refers to the combination of actions (or omission of protective actions or best management practices) and conditions occurring on and/or offsite that are contributing factors in the attrition, obliteration, or alteration of a wetland site. Wetlands loss and degradation occurs with changes in hydrologic regimes (i.e., duration, frequency, and intensity of stream flow, surface runoff, groundwater recharge and discharge); physical and chemical soil properties and soil-water interactions; the delivery and characteristics of sediment and organic materials; the composition, structure, and coverage of plant communities;

Nevada, where rain-shadow rain falls in desert rations…in a glance, take in a million acres with nothing taller than the bunchgrass, the buffalo grass, the shad scale, the white and the black sage in tawny, desiccated boulevards between the high ranges…A daisy-wheel windmill, a cluster of cottonwoods – tens of miles apart – speak of settlement in some of the most austere and beautiful landscapes between the oceans. A country held together by concealed water…To the subsurface, the amount of fresh supply is essentially zero…Remains of that Pleistocene rainfall rest beneath the saturated valleys…and emerge in small, sustaining quantities as spring creeks and seeps…In Nevada, you can buy groundwater and, within the law, transport it from one basin to another, provided that the transfer does not impinge upon existing rights and is in the public interest…Mountain sheep, antelope, deer, coyotes, eagles, badgers, bobcats will forever disappear as permanent springs go permanently dry…

John McPhee, 1993

Isolated Rain-Shadowed Valleys. Outside Nevada's two metropolitan areas lay scores of remote valleys where chance water supplies support dry land ranches. Patches of crops and pasture are stitched together with conveyances carrying water taken from isolated sources – strands of melt water, sprinklings of springs or water table seeps, or basin fill aquifers. Range-to-basin hydrology consists of a spare weave of saturated zones threading down from snow-capped ridges to mid-slope and valley bottom discharge zones or underground storage zones. Where small in-basin diversions are done thoughtfully, i.e., hydrologic continuity is minimally modified, aquatic and wetland ecosystems and wildlife may not be significantly impacted. But, where large-volume interbasin diversions are allowed, the resource impacts, actual and possible, are huge. So far, the unforeseen scope and scale of damages are generating a stream of economic, fiscal, environmental, and ecological costs running unforeseeably into the future. Eric Peterson photo.

and, the shape and connectivity of landforms and geologic formations over or through which surface and subsurface water moves or collects. Since animal species also affect the physics, chemistry, and biology of wetlands, introductions of non-native species and human-caused decreases in wildlife diversity also degrade wetland resources.

Nationwide wetland status surveys prepared by the FWS and the NRCS concur that enormous quantities of wetland acreage were converted to agricultural uses in the past, but today urban and rural development ranks as the leading factor in additional wetland losses. In the FWS survey, urban and rural development accounted for thirty and twenty-one percent of all wetland losses during the 1986 – 1997 period. Urban development pertains to cities and towns, transportation and utility infrastructure, public recreation sites, and industrial and commercial centers. Rural development is equivalent to urban development but in sparsely settled or isolated areas, with the addition of mining. Agricultural land development contributed to twenty-six percent of the 633,600 acres estimated loss during the survey period. Agriculture includes all (public and private) land use and development directly associated with farming and ranching. (Twenty-three percent of the losses were attributed to silviculture, not a common land use in Nevada.) An important aside is that national surveys do not report on the effects of water development and consumption with respect to the decline of wetland resources.

The DOI submitted a report to Congress in 1994 describing the role of federal agencies in the status of western riparian wetlands. The geographic scope of the report entailed the Carson, Humboldt, Truckee, Walker and the Snake, Columbia, and Rio Grande River systems (USDOI, 1994). The vast majority of land in Nevada is public. Within public rangeland (i.e., shrub and grasslands subject to livestock grazing) and forestland, most riparian ecosystems were unhealthy and under-functioning. Land use activities found to have impaired riparian and wetland areas were:

- Poorly managed livestock grazing;
- Construction, management, and maintenance of water projects (e.g., reservoirs, small hydroelectric, and irrigation diversions);
- Multipurpose water projects constructed by the BOR, ACOE and NRCS that altered water regimes and caused major changes in water flows that affect riparian areas and plant communities;
- Vegetation management (removal of wetland trees and shrubs) to maintain floodways, expand pasture and cropland, and to conserve irrigation water (The report notes that studies have cast doubt on the water savings derived by wetland vegetation removal, and the BOR had abandoned such practices.);
- On public lands, the BLM and USFS had permitted grazing intensity that exceeded carrying capacity of rangelands, including riparian wetlands;
- Federal land management and water resources development agencies had not adequately protected riparian areas due to conflicting responsibilities regarding grazing, agricultural irrigation, electrical power supply, and mineral extraction;
- According to a General Accounting Office study, ranchers generally resisted efforts to improve riparian areas and opposed restrictions on livestock access to riparian areas. Federal agencies particularly at the management level showed a bias toward ranching and against riparian protection.
- Timber harvesting and associated road construction, mining, and sand and gravel extraction were additional factors identified.

Federal lawmakers and executives responded to the findings of this assessment and other similar policy and program studies with significant redirection of federal agency administrative policies and enhanced proactive decision-making protocol, such as environmental analysis of proposed use permits, beefed up resource utilization monitoring, and resource planning for management units. Refining wetland resources management to achieve the no net loss goals in balance with multiple use policies is a tough row to hoe. Recently, concerns have flared over administrative policy shifts that appear to allow regulatory

backsliding, thereby weakening protections wetlands on federal and nonfederal lands. Notwithstanding setbacks, after the federal program review agencies are better positioned than states to protect wetlands.

The resource conservation plans reviewed as part of NvWP preparation identify threats to wetland resources. The following list presents a composite itemization of threats identified by government agencies and conservation organizations.

- Diversions of surface flow, primarily for irrigation of farmed land, but increasingly for municipal and various industrial use;
- Groundwater withdrawals that deplete aquifers that discharge at springs, seeps, and streams;
- Drainage ditches and other excavations undertaken to dewater saturated soils;
- Water developments (storage, diversion, and flood control dams/reservoirs) and the water storage/delivery procedures that alter seasonal flow patterns;
- Full allocation of river and stream systems and lack of water rights for *in situ* (e.g., instream) beneficial uses;
- Overgrazing primarily for livestock production, but may include native or introduced ungulates;
- Farmland encroachment for crop and livestock forage production;
- Modifications to the geomorphology and flow regimes of streams, springs, shorezones, and floodplains that generate and perpetuate accelerated erosion and unstable conditions;
- Nonpoint source pollutants carried from irrigated farmland, feedlots, mines, and urbanized areas;
- Mine development, including abandoned mines, and sand and gravel extraction in floodplains;
- Urban and rural development;
- Highway construction and utility corridors;
- Geothermal energy and water development;
- Outdoor recreation, including water based recreation developments and activities, foot and vehicle trails, golf courses, and manipulation of habitat for particular wildlife species;
- Off-highway vehicle misuse;
- Introduction and spread of invasive/nonnative plant species;
- Land use planning and major project review without adequate wetland, watershed and floodplain analyses;
- Incomplete federal and state agency oversight of wetlands, insufficient data management (collection, sharing, analysis, dissemination);
- Fire suppression strategies that interfere with natural succession of fire adapted wetland and riparian ecosystems (e.g., aspen), and
- Improper/inadequate control of stormwater runoff from urban, rural, agricultural, mineral, and transportation developments.

Conventionally, wetland threats are portrayed as individual types of land uses or particular resource management strategies. Actually, however, multiple stressors precipitate wetland declines, and do so through direct and indirect ways. Oversimplified approaches to the identification and assessment of wetland threats (the Nevada Wetland Priority Conservation Plan is no exception) tends to mislead people into thinking solutions or strategies are straightforward. In reality, the effects of human activities on natural attributes and processes that lead to wetland loss and degradation arise from multiple sources of disturbance, both direct and indirect. We are tuned into the obvious wetland losses, such as those that disappear under the blade of a backhoe, but the means to protect those that slowly expire due to cumulative effects requires a kind of coordinated monitoring or assessment process that does not exist. Without the mechanisms to discern unlooked for losses that come about "incidentally," we cannot ascertain what proportion of the wetland resource base may be succumbing to cumulative effects.

A cumulative effects scenario that has far-reaching ramifications for the decline in wetland quantity and quality throughout Nevada involves channel entrenchment. Incision lowers the elevation of the water table, the diversity and density of plants, and floodplain water storage. Erosional forces accelerate due to on- and offsite factors, such as channelization, levees, or bank armoring; clearing the channel of materials that increase roughness and dissipate energy; flash floods from subwatersheds where agricultural and urban land use reduces vegetative cover or soils permeability; or, dams and reservoirs that alter sediment and flow patterns, thereby upsetting fluvial processes that maintain proper functioning fluvial landforms. A deeper channel reduces the frequency and duration of overbank flooding and flushing flows, which, eliminates aquatic habitats in the now-isolated floodplain and allows salts to accumulate. Tamarisk, Russion olive, and other nonnative species replace native vegetation in salt enriched riparian zones. Salt build-up is exacerbated by the number of times diverted water is used and returned to the stream system from farms and ranches, cities and towns, mines, and industrial properties. Extraordinary loads of boron, selenium, arsenic, chemical fertilizers, pesticides and other potentially harmful contaminants can be entrained downstream of developed valleys, according to USGS water quality investigations. The continuous input of pollutants into lower riparian areas and terminal marshes create conditions deleterious to invertebrate and plant species, affecting the food web, wildlife diversity. Cumulative threats, in effect, represent a downward spiral in wetland ecosystem functions and services. Knowing more about negative cumulative effects is crucial to designing successful conservation strategies and restoration projects.

Water Resource Use and Development

The disruption of natural flow patterns for land and water developments is a leading factor in wetland losses of the past and is expected to be so in the future. The rapid pace of growth in population and economic development is not matched with technical and policy innovations to ameliorate wetland water supply problems. As consumptive water use rises, the threat to wetlands will increase without enhanced intervention and incentives to balance losses with equivalent gains. Flows in the river and stream systems of Nevada are essentially fully allocated. Wetlands adjacent to surface water bodies located in mid to low elevation valleys and terminal basins where agriculture, urban development, and open pit mining are dominant land uses are especially vulnerable. By enlarging the volume of water captured, detained, and delivered to streams, rivers, and springs, wetlands directly affect the water supply outlook of the state. Allowing wetlands associated with intermittent and perennial watercourses to disappear or fall into disrepair ramifies the unpredictability of water resource yields in the short and long term.

Walker Lake Shoreline

The barren shore zone reflects regressing water levels and increasing salinity. Since the 1880s, the surface of Walker Lake dropped 140 feet and total dissolved solids (parts per million) rose from 2,500 to 13,000. Diversions, reservoirs, and impaired stream zones reduce annual inflow and increase dissolved minerals from the Walker River, which rises in the Sierra Nevada Range. Many years the river does not reach the lake, but in wet years large volumes can descend. The lake deepened twelve feet between 1995 and 1999, a temporary gain. Diversions exceed normal runoff yields, and by 2002, the lake lost fifteen feet. Dissolved salts approach a threshold lethal to aquatic life. The native fish community is important to the local recreation tourism economy, and migratory waterfowl, notably Common Loons. Tamarisk invades the riparian zone above the lake. Jim Morefield photo.

Similarly, groundwater withdrawals reduce water supplies

that maintain wetlands. Water tables and aquifers have declined in many groundwater basins of the state, requiring the State Engineer to place them under special status to preclude illegitimate groundwater depletion. The complex geomorphology and geology of our mountains and valleys provide the forces and various pathways for groundwater to rise to the surface and discharge into streams, lakes, springs, and seeps. Spring resources are of particular concern, since in large areas of the state they provide the only supply of surface water. Notable instances of spring flow impacts include agricultural withdrawals that lowered the aquifer feeding springs at Ash Meadows; open pit mine dewatering in the Humboldt River Basin, and wells may be lowering spring flow in Moapa Valley. Shallow wells developed in alluvial fill for supplemental irrigation are suspected of periodically depleting groundwater tables that discharge into streams and at springs. Almost half (109) of the groundwater basins in the state are "designated," suggesting that many major aquifers are or may be vulnerable to drawdown rates that exceed perennial recharge. Pumping groundwater is the primary supply option for municipal and industrial water purveyors, power plant projects, and to supplement irrigation. Enormous precious metal reserves have been identified that are economical to mine by open pit methods, and the implication is the yet to be revealed impacts of regionally large groundwater withdrawals will expand. A statewide study into the observed effects of pumping in designated basins and in fully appropriated stream systems on the hydrology of springs and streams could shed light on the scope of extant and future tradeoffs of "fully" utilizing groundwater resources.

A comparison of the statistics presented in Table 3.1 shows the uneven division of wetland resources among the hydrographic regions of Nevada. Hydrographic regions also differ markedly with respect to the "designated" status of groundwater basins, an indirect marker for the measure of groundwater development. Aquifers in designated basins are at or nearing a point of depletion, and therefore the State Engineer may place limits on additional groundwater pumping. The fate of certain wetland resources in a groundwater basin that has been designated may become uncertain, to the extent that springs, streams, and high water tables are influenced by the hydraulics of unconfined or confined aquifers from which large

Table 3.1 Distribution of NWI Wetland Types by Hydrographic Region and Proportion of Designated Basins

Hydrogeographic Region	Basins in Region / Designated Basins (Count)	Portion of Area in Region Designated (Acre / acre)	Linear Wetland (Miles)	Wetlands < 40 Acres (Count)	Playas (Acres)	Open Waters (Acres)	Large Vegetated Wetlands (Acres)
Northwest Region	0 / 16	0%	1,030	1,752	6,287	289	29,997
Black Rock Desert Region	7 / 17	46%	2,784	2,920	210,602	1,233	26,311
Snake River Basin	1 / 8	23%	3,827	5,026	0	6,225	53,577
Humboldt River Basin	26 / 33	69%	9,441	8,466	12,110	16,128	328,917
West Central Region	2 / 5	19%	407	189	27,636	0	1,876
Truckee River Basin	9 / 12	51%	670	856	44,674	148,008	6,434
Western Region	6 / 9	77%	87	145	7,026	0	2,030
Carson River Basin	5 / 5	100%	982	1,345	154,943	12,602	90,908
Walker River Basin	4 / 5	53%	1,394	1,128	808	37,809	34,756
Central Region	31 / 77	45%	7,838	8,024	450,058	773	197,760
Great Salt Lake Basin	2 / 8	46%	1,029	802	7,723	153	7,731
Escalante Desert Basin	0 / 1	0%	0	4	0	0	0
Colorado River Basin	14 / 27	56%	2,842	1,008	8,764	95,794	28,178
Death Valley Basin	2 / 8	41%	186	236	4,171	255	4,541

Notes: Basins in Region refers to administrative groundwater basins delineated by the Division of Water Resources. Designated Basins refers to the groundwater basins for which the State Engineer has issued an administrative order that specifies appropriation and use limitations of groundwater resources to avoid exacerbating an extant or potential long-term reduction in perennial yield that is impacting or might impact existing water rights or preferred beneficial uses.

volumes of water may be withdrawn. In the Humboldt Region, about two-thirds of the groundwater basins are designated, indicating many aquifers are vulnerable to over-draft. Furthermore, the Humboldt River Basin, compared to other hydrographic regions, contains more wetlands smaller than forty acres (8,466, includes springs and seeps) and more acreage of large, vegetated wetland types (328,917 acres, substantial riparian wetlands) than any other hydrographic region. Combining this information, even with consideration of other groundwater resources stresses in the basin (e.g., open pit mine dewatering) is a precursor to developing a method for identifying areas in Nevada of elevated wetland conservation concern. Other factors must be part of an evaluation of regions or basins in which hydrologic changes may exacerbate wetland vulnerability and therefore heightened management urgency. One may be the occurrences of special status species. Take, for instance, the Colorado River Basin, in which fifty-six percent of the hydrographic region has been classified as designated for groundwater supply conservation. The river basin contains a small portion of the state's surface water and wetland resources, but the springs and spring fed streams contain a large number of at risk fish and amphibian species. The trend in groundwater supply demand and water purveyor supply plans also might be a criterion that influences wetland vulnerability. Withdrawing more groundwater for municipal and industrial supply in Clark County may be another wetland loss risk factor used to assess wetland priorities as well as the need for study and possibly protection strategies.

Dry Winnemucca Lake Valley

Seventy years ago Winnemucca Lake Valley held a large shallow lake and marshland. Today's desert aspect testifies against the interbasin transfer of water without due deference to thrift and foresight. The 1902 Newlands Project allocated 400,000 acre-feet annually of Carson and Truckee river flow to create farms and ranches in Lahontan Valley. After Winnemucca Lake desiccated, Pyramid Lake became the terminus of the Truckee and became destined to a similar fate. Now, there are signs of progress toward aquatic and wetland ecosystem recovery. After decades of watching Pyramid Lake and wetland shrink, people with seemingly divergent interests designed a long range plan to resuccitate native fishes, riparian forests, and the lake, doing so within the confines of state water law. Tribes, agencies, municipal and irrigation water suppliers, cities, counties, and conservation and agriculture groups negotiated an agreement (the 1990 Truckee-Carson-Pyramid Lake Water Rights Settlement Act authored by Senator Reid) to reduce water use, restore riparian areas, buy and transfer water rights for instream use. The Truckee has evolved into a multiple use resource. Fallon still is the center of a thriving agricultural district and a growing urban area. The Truckee River Negotiated Settlement may or may not be a model transferable to other contested stream systems, but it is a testament that some communities will work together to find mutually beneficial ways of equitably distributing scarce water. Kevin Gaw photo.

The modification of the hydrology and geomorphology of water bodies is widespread. Few streams are without dam structures built either to divert water to offstream uses or to store water and control flow rates to supply cities and farms with water and to control floods. Dams, levees, channelization, armoring, are some of the hydro-modifications prevalent on rivers and streams that negatively impact wetland resources. In addition to the loss of wetland area to the footprint of storage dams and reservoirs, the shorezones provide poor sites for wetland establishment due to fluctuating water levels. The operation of diversion dams alters the flow regime and consequently native aquatic and wetland ecosystems. Typically, the management of stream diversions is based on utilitarian criteria with little or no consideration of the effects on water temperature, water quality, sediment transport, native vegetation community composition, and channel maintenance. Severe riparian losses have occurred in the middle and lower reaches of the major and minor stream systems where diversion and storage/release operations magnify fluctuations during the growing season and base flow period. Fresh ideas are needed to adapt water storage and diversion schedules so that needs of both offstream users and aquatic/wetland ecosystems might be met. In the Truckee River Basin, water users and managers are coordinating efforts to conserve water, adjust reservoir releases to mimic natural flow pattern, and acquire water rights for instream uses. One early success has been the regeneration of riparian woodland patches. This joint venture exemplifies the innovative ideas and cooperation needed to plan for the multiple use management of the states water and wetland resources.

Urban and Rural Land Use and Development

Even though vegetated wetlands and riparian areas occupy such a small portion of the landscape (about 0.9 percent), a large number of development projects are proposed for wetland sites each year. The ACOE from 1998 to 2003 took administrative action on 2154 individual permit applications and a larger number of nationwide permit applications, mostly for activities associated with some form of urban or rural land development. In the Reno-Carson City area, fourteen percent of the wetland resource base was lost to urban development during the 1980 – 1999 period. Urban and rural land use includes the construction of roads and highways, residential and commercial subdivisions, industrial sites, linear utility facilities, airfields, mining operations, irrigation ditches,

Marsh Wetland – Urban Encroachment

The Federal Emergency Management Agency administers a nationwide program that encourages and offers incentives to local governments that employ regulations, floodplain management ordinances, or local master land use or open space plans to avoid or minimize floodplain development. Counties through floodplain zoning ordinances specify the kinds of development permissible and conditions that must be met to obtain permission. Such ordinances may be an appropriate mechanism for local government to protect wetlands. The control of flooding and water pollution and the provision of outdoor recreation are valued wetland functions in urban floodplains. This marshland in Carson City occurs in a floodplain at the confluence of drainages conveying perennial flow from small springs and large sub-watersheds altered by wildfire, cheat grass, gully erosion, roads, mining, and residential and industrial subdivisions. Ongoing construction of a highway and stormwater interceptor will consume a third of the remaining wetlands. Section 404 approval to fill the marsh complex for a series of industrial, residential, and highway projects specified mitigation both onsite, which entailed a stormwater detention basin, and offsite, which expanded ponds and marsh in Washoe Valley. Eagle Valley will experience a net loss in acreage and function. Attrition of the marsh may abate since The Nature Conservancy acquired and donated the property to the Carson City Open Space Program. Ed Skudlarek photo.

Table 3.2 Population Change, Nevada Counties, 2003 – 2004			
County	Population Change %	Vegetated Wetland Acres	Linear Wetland Miles
Carson City	1.2	350	50
Churchill	0.4	27,150	750
Clark	4.8	11,500	750
Douglas	2.8	27,950	350
Elko	0.9	181,900	8,790
Esmeralda	-2.6	5,700	180
Eureka	-4.9	37,700	1,560
Humboldt	2.0	134,350	3,380
Lander	0.8	79,400	1,490
Lincoln	0.2	11,650	1,240
Lyon	7.2	16,950	840
Mineral	2.6	9,750	1,160
Nye	5.3	30,800	2,750
Pershing	-0.7	19,450	1,650
Storey	5.8	100	40
Washoe	2.6	22,200	1,800
White Pine	-0.2	49,200	1,600
Nevada	4.1	666,100	29,800
Sources: Population data from U.S. Census Bureau. Wetland data from NWI, Wetlands of Nevada.			

dams/reservoirs, channel realignment or relocation, water recreation, and bridges and other water passage structures. Federal wetland fill and dredge regulations, which in most of the state is the only wetland protection program, pertain to all of these forms of urban and rural development, although their applicability is limited if the acreage affected is not large enough to trigger provisions requiring an individual permit.

Planning and approval of urban and rural development projects is under the regulatory purview of counties and municipalities. Conservation districts may also influence land use decisions with their authority to plan and act on the conservation of natural resources within district boundaries. Urbanization is a comparatively new phenomenon in rural counties, and local governments might not be prepared with master land use plans, zoning ordinances, or other planning tools to elevate wetland protection. New development encroaching into wetlands as depicted in the photo inset above is a common scene replayed in cities, towns, and satellite subdivisions popping up in surrounding valleys. Table 3.2 shows the recent population growth rates in Nevada counties along with NWI wetland statistics. Rural counties now experiencing rapid rates of growth include Nye, Storey, and Lyon. Given that population growth accelerates residential, commercial, and industrial land development, counties must be prepared to avert wetland losses related to land development practices in floodplains and on slopes that can profoundly affect watershed hydrology and riparian vegetation. Without appropriate regulations, there is a tendency for private and public development projects to remove excessive amounts of vegetation and soil disturbance that impairs watershed conditions and increases overland flow. With the expansion of impervious coverage brought on by buildings, roads, and compacted soils, less water infiltrates and recharges groundwater bodies, which intensifies local and downstream flooding but diminishes subsurface water reaching local waterways. The altered hydrology of urbanized watersheds concentrates runoff, which impacts stream channel stability and water quality. Sediment loads typically increase, as do the levels of nutrients, pesticides, petrochemical products, heavy metals, harmful bacteria, and salts.

Similar to other places in the West experiencing rapidly expanding populations and urban development, land use planning authorities in Nevada are confronted with the issue of effective use of land resources. With respect to wetlands and water resources, a major concern is the widespread practice of allowing extensive construction of residential, commercial, and industrial subdivisions in floodplains, followed by the need to build a series of costly flood control structures to protect property and lives. To some extent, urban development is occurring on land already intensively used in the past for production of crops, livestock, and wood materials. The additional layer of urban sprawl compounds the cumulative effects that contribute to the environmental stresses incrementally wearing down the wetland resource base. Federal land management agencies have identified over a million acres of public land suitable for acquisition by private or local entities for urban and rural development. However, federal agencies analyze land disposal plans in an environmental assessment process, which generally results in conservation of land resources rich in ecological and public interest values. Still, a variety of land use activities occur on public lands to meet urban or rural development infrastructure needs with potential wetland impacts. The most common cases are those involving rights-of-way to build conveyance systems: e.g., roads, electricity, liquid and gaseous fuels, water supply, floodwater, wastewater. The

extraction of rock, sand, and gravel and expansion of developed parkland are additional types of projects built in response to urban growth that may intersect wetland resources. The impact on wetlands due to urban growth-driven developments on public land are probably minimized in most cases, since agency regulations and Section 404 wetland protection regulations apply.

Agriculture and Floodplain Riparian Areas

This pastoral stretch of Pahranagat Valley is both typical and atypical of fluvial landscapes in Nevada. Vast floodplain stretches in major and minor river systems were converted to crop, hay, or livestock fields long ago. A less common site are the riparian buffers, indicated by the belts of willows and cottonwoods, which reduce pollutants in runoff, control erosion, and provide wildlife habitat. Clearing riparian vegetation, leveling the floodplain, diverting stream flow, and channel modifications were necessary to establish farms and ranches. We now know that removing riparian habitat and separating the stream from its floodplain lowers the natural fertility, moisture content, stability, and productivity of the soil. Near the end of the White River system, springs feed Pahranagat Creek, which is used to irrigate fields and fill reservoirs and marshlands. The aquatic and wetland communities are in peril. The endangered Pahranagat roundtail chub population nears extinction, and two taxa of endemic White River springfishes are at risk. Pahranagat National Wildlife Refuge marshes host migratory waterfowl, endangered Southwestern Willow Flycatcher, sensitive Yellow-billed Cuckoo, and many other bird populations declining with desert riparian losses. The valley also hosts the rare, endemic Pahranagat Valley montane vole. Due to the occurrence of many at risk taxa and the need for management action, the valley is a NNHP Highest Priority Conservation Site.

Agriculture

Ranching and farming practices that change the types of plants and their coverage influence how soil and water stay with the land. Historically, riparian and meadow livestock grazing and the conversion of floodplains to cropland caused enormous losses and damages to the quantity and quality of wetland resources, a problem exacerbated by upland grazing and deteriorating watershed conditions. It is clear in some areas of the state that renewable resource utilization is being aligned with the natural productive and ecological potential of rangeland and floodplain landscapes. Recovery and in some instances restoration efforts are working, but progress is far from universal. Table __ provides irrigated farming and livestock production statistics for the counties in Nevada. These data illustrate the relative extent of irrigated farming and livestock grazing throughout the state. Larger amounts of wetland acreage may be at risk in counties with more irrigated farms and livestock, but other factors must be evaluated.

Allowing too many livestock to graze riparian or meadow areas or for too long, or at times that prevent recovery of wetland vegetation also produces dry and compacted soil, an overload of nutrients and sediment, and populations of nonnative plants. Such degraded conditions intensify runoff, limit infiltration, reduce water-holding capacity, enhance wildfire frequency and severity, accelerate erosion, and interfere with wetland plant establishment, reproduction, and community succession. Overgrazing in nearby upland plant communities leads to the disintegration of the geomorphology and hydrology of adjacent wetlands. The BLM measures the hydrologic integrity of riparian areas and wetlands using the Proper Functioning Conditions (PFC) Assessment method. Recent results reported by the Nevada office of the BLM indicate about fifty percent of riparian areas and nearly forty percent of the wetlands within grazing allotments are in a nonfunctioning or functioning-at-risk condition. Similar data is not available from the NRCS or HTNF, although both agencies are part of the federal interagency riparian restoration initiative. More information about PFC is presented in the Public Land Management section of Part 5.

The impacts of cropland practices on wetlands are related to vegetation clearing, land leveling, soil tillage, draining zones of saturation, stream modifications, and surface and groundwater withdrawal. The

Table 3.2 Irrigated Cropland and Livestock Production Statistics by County

County	Land in Irrigated Farms	Harvested Cropland	Irrigated Hay	Cattle and Calves	Sheep and Lambs
Carson City	4,249	924	920	757	0
Churchill	98,858	38,939	33,309	47,136	810
Clark	65,206	Undisclosed	5,241	Undisclosed	631
Douglas	87,544	16,068	13,614	14,173	697
Elko	2,309,506	130,361	130,514	135,554	19,627
Esmeralda	25,134	11,441	10,875	Undisclosed	0
Eureka	243,365	29,115	28,879	17,207	Undisclosed
Humboldt	643,846	111,905	91,338	54,327	8,792
Lander	583,520	41,941	41,236	30,161	2,686
Lincoln	Undisclosed	Undisclosed	16,116	13,703	99
Lyon	152,656	45,846	40,477	36,273	13,050
Mineral	Undisclosed	Undisclosed	8,219	1,422	57
Nye	86,144	22,561	17,099	27,657	1,010
Pershing	106,983	29,436	26,465	19,161	Undisclosed
Storey	Undisclosed	0	?	176	0
Washoe	767,849	20,235	18,515	23,004	Undisclosed
White Pine	126,904	19,985	18,329	24,940	19,302
Nevada	5,584,482	549,046	501,146	460,263	77,913

Source: 2002 Census of Agriculture, USDA, National Agricultural Statistics Service

effects of these practices include: higher volumes of surface runoff and sediment delivered to streams; lowering of water tables and base flow; exposure of channel embankments and erosion prone floodplain soils to erosion; increased flood damage onsite and downstream; aggradation and/or widening of stream channel and accumulation of more sediment on the bed of the channel. Crop production ordinarily entails the use of chemical fertilizers and pesticides in floodplains. If riparian buffers or wetland depressions are not retained for their capacity to reduce nutrients and chemical compounds washed offsite, stream and groundwater quality and aquatic biota will be negatively altered. Irrigated native hay pastures that are not leveled or tilled may not exhibit any of these hydrologic impacts under normal conditions. However, livestock grazing in irrigated pastures may impact riparian ecosystems if not properly managed. A variety of native and introduced game wildlife species will inhabit irrigated cropland and pasture; however, generalist species are more likely to thrive, to the detriment of natives. The decline in native species that accompanies the conversion of natural wetland habitats may also be detrimental to agricultural productivity. Inferior habitat reduces the richness and abundance of raptor, songbird, and bat species. A frayed food chain enables insects and rodents to proliferate to pest-levels. The wildlife-vegetation-soil-water-nutrient-microbiota relationships are more robust where riparian buffers are maintained along waterways and irrigation works, which works to the advantage of commodity and ecosystem productivity.

Mining

Mining hillslopes and valleys to extract minerals and earth materials typically involves substantial land disturbance for exploration, production, and storage of overburden, dump materials, and processed tailings, as well as roads and buildings constructed for mine operation. Both surface and underground water bodies may be

Mining May Affect Fluctuation in Humboldt River Flow

Humboldt River flow fluctuates widely (October 1992 and June 1999, near Valmy) mainly with irrigation diversions and weather conditions. Mining may also play a role. Hills and valleys in the midsection of the river basin host huge ore deposits, most mined by open pit methods. Groundwater pumping to access ore hundreds of feet down may alter spring and stream flow. Groundwater supplies meet various water uses: irrigated agriculture, sprawling ranches, a coal-burning power plant, towns, and springs with at risk fishes and wildlife. The USGS is leading a cooperative study, the Humboldt River Basin Water Resources Assessment. Since 1995, government agencies and mining companies have collected data on the area's hydrology and wetlands. Models are being developed to characterize hydrological and ecological changes. Twenty-six of 33 groundwater basins in the Humboldt River Basin are designated by the State Engineer to avert aquifer depletion. USGS photos at http://nevada.usgs.gov/humb/.

Table 3.3 Mining Claims and Wetland Acreage by County

County	Number of Claims	Acres Claimed	Acres Large Vegetated Wetlands	Number of Wetlands < 40 Acres
Elko	19,766	406,054	181,900	11,556
Eureka	16,992	339,197	37,700	1,675
Nye	14,011	311,342	30,800	2,770
Lander	15,376	307,326	79,400	1,460
Humboldt	14,317	300,397	134,350	3,522
Clark	3,321	185,988	11,500	369
Pershing	6,565	149,851	19,450	965
White Pine	7,563	149,222	49,200	2,392
Esmeralda	3,725	96,563	5,700	341
Mineral	3,925	78,665	9,750	693
Churchill	2,663	70,379	27,150	1,374
Washoe	1,351	51,853	22,200	2,840
Lincoln	1,243	29,520	11,650	679
Lyon	1,107	24,797	16,950	879
Douglas	189	4,317	27,950	328
Storey	111	2,558	100	36
Carson City	20	257	350	38
Nevada	112,245	2,508,286	666,100	31,917

Source: Environmental Working Group (EWG) analysis of Bureau of Land Management's Land and Mineral Records 2000 (LR2000) data system. Acres Claimed, the product of number of claims and maximum allowed claim size (20 acres/lode claim, 160 acres/placer claim). Data from http://www.ewg.org/mining/claims/counties; accessed April 2005.

developed for use or depleted in correspondence with water management to access ore bodies or to quarry earth materials. The potential for riparian and wetland disturbances is great. Nevada led the nation during 2004 in the production of gold, barite, gypsum, lithium carbonate (from brine), and magnesite, second in silver and diatomite production, and ninth in sand and gravel extraction. The Nevada Division of Minerals reported about twenty-two percent of Nevada's gold production in 2004 came from underground mines, suggesting about seventy-eight percent was extracted using open pit methods. Most open pit mines are located in the Humboldt River Basin portions of Elko, Eureka, Lander, and Humboldt counties. Approximately fifty-two percent of the 2.5 million acres held claimed for mineral development are located in Nevada. The mining industry also develops energy resources, mainly geothermal and oil. Ten geothermal electric generating stations are located throughout northern Nevada, and oil operations occur mainly in Eureka and Nye counties. A comparison of mining claims and wetland resources by county in Nevada is shown in Table 3.3.

Open pit methods of mining precious metal ore bodies has become common as a cost effective approach to extracting large volumes of bedrock infused with low concentrations of gold, silver, and accessory metals. Typically the ore body can be accessed after removing massive volumes of overlying soil, rock, and vegetation. Some open pit mines can move almost two million tons of earthen material per month. In addition to the area excavated, mining operations create large barren areas to dispose of overburden and the various forms of waste rock. Substantial increases in overland flow and sediment production can occur. Stormwater and sediment detention facilities assist in controlling erosion and sedimentation in intermittent drainages and streams, but do not mitigate all watershed impacts associated with denuded slopes and lands disturbed for haulage and operations.

In the 1999 National Research Council report, Hardrock Mining on Federal Lands, the research committee cites studies that found mining activities withdrawing extensive quantities of groundwater have the potential to consume most of the locally available water, which may affect surface flows and shallow valley fill aquifers. Thus, some mines may intercept the deep water table, potentially disrupting regional aquifers and reducing stream and spring flows, and groundwater withdrawal can affect riparian vegetation some distance from the mine. Reduced flows and lower alluvial aquifer water tables directly affect phreatophytic riparian vegetation. A drop in the water table will stress riparian vegetation, causing either mortality or reduced vigor. Lowered shallow alluvial aquifers may not maintain riparian vegetation, with replacement of riparian species with upland species.

Abandoned mine lands (AML) typically entail mine workings, ore processing sites, and waste rock dumps, or tailing piles processed with mercury or cyanide. The BLM estimates that thousands of historic

AML sites are located within or in close proximity to streams and springs. As Figure __ shows, AML sites represent the loss of isolated wetland and riparian areas. Water draining from many AML sites entrains deleterious pollutants that impair the quality of soil and water. Acid mine drainage, toxic metals (e.g., arsenic, lead, zinc, cadmium, mercury, and/or cyanide) leaching from AML sites can cause serious ecological damage. The sites range in size from dozens to hundreds of acres. Since 1999, the Nevada BLM has led the Interagency Abandoned Mine Land Environmental Task Force (IAMLET), consisting of agency and industry representatives. The group selects sites and arranges for the remediation of abandoned mine land (AML). The primary objective is protecting and improving watershed values. Nevada is pocked with 200,000 to 500,000 AML features. Perhaps one to three percent (2,000 to 15,000) may impact ground or surface waters. Funding is limited. Six sites have been rehabilitated according to the 2004 IAMLET report.

Abandoned Mine Site, Independence Range

The Rip Van Winkle Mine is a high priority rehabilitation site. Mining activity spanned 1866 to 1966. Five tailings dams were built in Coon Creek. Waste rock was placed along the south side of the stream. Tailing impoundments cover three acres and contain acid-generating materials, (the pH of puddled water tested about 1.9). Seepage carries acid drainage and heavy metals into Coon Creek, a tributary of Maggie Creek. Maggie Creek hosts Lahontan Cutthroat trout (LCT) and joins the Humboldt River near Elko. The NDOW recently found LCT in Lone Mountain Creek, nearby Coon Creek. Reclamation may cost $500,000. Photos from http://www.nv.blm.gov/AML/.

Invasive Non-Native Plants

A growing number of aggressive nonnative species are being introduced into Nevada. Widespread deterioration and the frequency and intensity of human disturbances in wetland and riparian areas make these communities easy victims for invasions.
Some, like cheatgrass (*Bromus tectorum*) and tall white top (*Lepidium latifolium*) have come to utterly dominate native plant communities. Cheatgrass continues to spread across the valley slopes and bottoms throughout the Central Basin and Range, entirely displacing native grasses and forbs and blocking the establishment of shrub and woodlands on burned sites for many years after wildfire. Its prevalence severely alters the conditions and functions of watersheds. Several million acres are substantially infested with cheatgrass, with as yet unmeasured consequences for hydrologic damages to intermittent and perennial riparian and meadow wetlands. Tall white top (or perennial pepperweed) eventually forms a monoculture where it invades wetland and riparian areas. Like cheatgrass, it has spread throughout northern Nevada and dramatically impacts biodiversity, fluvial system hydrology, floodplain and channel stability, and productivity of farmland. Another serious invader is saltcedar (*Tamarix ramosissima*). It has replaced riparian trees and shrubs in portions of all the major and minor river basins. One particular obnoxious characteristic of saltcedar is the plants ability to increase soil salinity, thereby creating conditions that most riparian natives cannot tolerate. Other invasive plant species frequenting Nevada wetlands are Russian olive (*Elaeagnus angustifolia)*, purple loosestrife (*Lythrum salicaria)*, diffuse knapweed (*Centaurea diffusa)*, Russian knapweed (*Centaurea repens)*, and hoary cress (*Cardaria draba)*.

Riparian areas are especially vulnerable to nonnative plant invasions because of the frequency of natural disturbances and widespread human disturbances. Periodic flooding and wildfire creates openings for invasive species, a circumstance exacerbated by poor ecological and altered hydrological conditions.

Tall White Top in Truckee River Floodplain at Tracy

Farming, grazing, irrigation, recreation, and proximity to roads and highways are prominent land uses that abet the spread of seeds or reproductive plant parts and raise the likelihood of riparian encroachment.

Nonnative plant invasions do more than displace a few native species. The total loss of native plant communities can be seen stretching across entire valleys and ranges of hills. Most nonnative species are generalists – they survive in a wide variety of habitats and also form plant communities. In a survey of nonnative populations occurring in the Stillwater NWR, Stillwater WMA, and Fallon NWR, the FWS found seven of thirty-eight described plant communities were considered nonnative dominated. A noteworthy finding is that the seven communities converted to nonnative dominant formed a large share of the wetland habitat. Furthermore, significant populations of nonnative plants were found in a majority of the native communities. Native species are still present in the Lahontan Valley, but the survey indicated they no longer occur in numbers to constitute plant communities. Ten species of invasive plants are currently found throughout the area, three that require immediate attention (saltcedar, Russian olive, and tall whitetop).

Wetlands and riparian ecosystems are negatively impacted by nonnative invasions in a number of ways. Changes at the bottom of the food chain, cycling of nutrients, accumulation of organic material, and the structure and composition of plant communities make for unlivable conditions for native fishes, amphibians, and small mammals. Studies have shown bird species richness and diversity is lower in nonnative communities where saltcedar or Russian olive pushes out species of cottonwood, willow, or mesquite. Some aquatic species, such as purple loosestrife, may eliminate open water, and others such as saltcedar transpire much larger volumes of water than native species. Nonnative annual grasses and forbs with different plant structures and growing seasons possess lower capacities to bind soil, intercept precipitation, immobilize pollutants, and trap sediment and water. Thus, floodplain functions and flow regimes may be impaired as nonnative plant populations spread.

Outdoor Recreation

River corridors, lakes, and meadows attract recreationists more frequently than other types of parks and natural areas. Recreation oriented developments in wetland and riparian habitats are increasing in number and extent to accommodate the widening range of recreation activities and growing population. Boat landings, fishing access, portage paths, urban parks, golf courses, campgrounds, and trails are commonly located within or nearby riparian and wetland areas. Some federal, state, and local recreation developments are located, designed, and maintained with environmental quality and ecosystem integrity in mind, but many are not. Recreation use impacts in wetlands may not be much different than those associated with urban and rural development (placement of fill, drainage, building, pavement, artificial landscaping, pollutant stormwater runoff); grazing (removal and trampling of vegetation, compaction of soil, elevated nutrient and pathogen concentrations); farming (replacement of native plants adapted to conditions with nonnatives, spread of invasive exotic plant species); and transportation (nonpoint source

Recreation at Lake Tahoe

pollution; erosion from concentrated overland flow). What is different about recreation developments and activities associated with wetlands and riparian areas compared to other areas is the concentration of people, structures, and vehicles in small, environmentally sensitive habitats.

Most of the fishing and hunting of wildlife that occupy wetland habitats occurs on public land under the management of federal or state agencies. In some refuges and management areas, special water resource and habitat management objectives are implemented that give preference to games species. Plant communities and water resources may be manipulated to accommodate select species and access for the recreating public. The use of irrigation return flow at some wetlands has been found to create conditions toxic to fish and waterfowl. Manipulating water supplies and wetland habitats to favor a select group of wildlife or fishes constitutes a change in the ecology of the site, thereby altering food webs and habitat attributes essential to other native inhabitants. As more water resources and wetlands are managed for particular wildlife products, habitat settings, or forms of outdoor recreation use, surveys and studies of a site's biological resources should be conducted and monitored to ensure undesirable or harmful changes in biodiversity or ecosystem function do not arise.

Motorized and mechanized forms of recreation in and surrounding aquatic and wetland habitats can be especially damaging. The use of motorboats and personal watercraft stirs up bottom sediment and introduces pollutants, thereby degrading water quality and negatively impacting plant growth and species composition in the littoral zone. Boat landings, access roads, and travel routes require the removal of vegetation and result in soil compaction, excess overland flow, and erosion. Frequently used wetland recreation areas may be rendered unsuitable for wetland dependent wildlife. During nesting and breeding periods, native wildlife species are especially sensitive to human intrusion, which is all the more invasive when motorized vehicles are operated.

Accelerated Climate Change. Climate change modelers estimate by 2100 temperatures in Nevada could increase by 3-4°F in spring and fall and by 5-6°F in winter and summer. Precipitation is estimated to decrease in summer by ten percent, to increase by fifteen percent in spring, to increase by about thirty percent in fall, and to increase by about forty percent in winter (with a range of 20-70%). Other climate models may show different results, especially regarding estimated changes in precipitation. The amount of precipitation on extreme wet or snowy days in winter is likely to increase. The frequency of hot summer days would increase, along with evaporation from water and soil surfaces. An increase in the frequency and intensity of winter storms is possible. The inherently variable and unpredictable climate and hydrology could become even more so. Wetland losses today will put additional stress on aquatic ecosystems and water supplies. The streams and rivers in Nevada are maintained by groundwater discharges or extensive unconfined water tables during summer low flow; but the favorable hydrological conditions that prolong spring flow and seepage into channels are likely to diminish. Higher evaporative forces would exacerbate wildfire risk and possible extend the fire season later in the autumn. Coupled with increasing human demands on water resources, climate change influences on wetland biota may be

more dramatic and occur more quickly than models suggest. Most susceptible to the accelerated climate change effects are rare endemic fishes and amphibians, and possibly migratory shorebirds and songbirds. Many desert wetland-adapted plants already live near their tolerance limits, and could disappear.

A warmer climate could lead to more winter rainfall and an earlier, more rapid snowmelt. This could result in higher winter and spring flows, but the ability to store floodwaters for use later in the summer is limited. Building more reservoirs would have consequences for aquatic-wetland habitats and wild inhabitants. Additionally, without large increases in rainfall, higher temperatures and increased evaporation could lower lake level, streamflow, and water tables during summer. In western Nevada, the Truckee and Carson rivers serve the rapidly growing population as well as irrigated agriculture. In north-central Nevada, competition for water is acute on the Humboldt River, and mining groundwater withdrawals could cause unforeseen impacts on the river and tributaries. When snowpacks are meager, demand for irrigation exceeds supply. The expanding metropolitan area of Las Vegas uses a large share of Nevada's portion of the Colorado River. In some basins that are intensively developed for urban and/or agricultural uses, groundwater is withdrawn at rates that exceed natural replenishment, and groundwater levels have declined. Reduction in the volume of snowmelt recharging aquifers could exacerbate groundwater mining as competition for water between municipal, agricultural, industrial, and ecological uses intensify. To counter these troubling changes, enhanced strategies are needed to encourage and support conservation and reuse of water; to manage development and restore impaired areas in areas of watersheds where recharge and erosion occurs, and to control the spread of invasive nonnative plants in stream environment zones that do not provide vegetative cover and soil retention characteristics of native plant communities.

What Might the Effects of Accelerated Climate Change Look Like in Nevada

I shall speak, therefore, of a Mycenaean cultural decline… [D]isintegration of the Mycenaean age [1200 B.C.] *is to be understood as having been due, not to destruction at the violent hands of outsiders, but as engendered from within by local conditions that compelled the abandonment of most of the smaller communities and instigated a sacking of the palaces of the ruling caste, with the result that a hitherto prosperous countryside was left virtually unoccupied, to remain at the lowest endurable subsistence level for the better part of two centuries…For some reason and from some cause over which they had no control they found life in Greece and the southern Aegean so unendurable that they could not remain…[T]he Ionian migration from the Greek to the Asiatic mainland may be understood as nothing more mysterious than a flight from a drought-ridden to a better-watered land…But the interior plateau of Asia Minor beyond the rainshed of the broken Phrygian upland would have fared no better than the Peloponnese for rain – or perhaps even more poorly, because the high mountain walls shutting it off on either hand, north and south, would have contributed to turning the heart of Asia Minor into desert wasteland.*

Rhys Carpenter
Discontinuity in Greek Civilization. 1968
NNHP Staff photo

Lower streamflow and higher temperature could also impair water quality by concentrating pollutant levels and reducing the assimilative capacity of wetlands and riparian zones. Pollutants from agricultural, mining, and/or urban runoff are concerns in the Truckee, Carson, Humboldt, and Walker rivers, Lake Tahoe, and Lake Mead. Sediment and urban runoff from Las Vegas have affected the water quality of portions of Lake Mead. Fertilizer and pesticide runoff from urban and agricultural lands has adversely affected water quality of the Truckee,

Carson, Humboldt and Walker rivers. More intense rain on snow events and earlier, more rapid snowmelts could contribute to winter and spring flooding, and more intense summer storms could increase the likelihood of flash floods. Population centers, industrial developments, and croplands are clustered along alluvial floodplains and near canyon mouths on alluvial fans where riparian zones have been eliminated or altered. These landscape elements are especially vulnerable to changes in precipitation.

Climate change modelers and paleo-ecologists both point to the likelihood of sweeping changes in the distribution of dominant plant species. Large-scale shifts likely will favor the spread of woody vegetation over herbaceous. Climate change simulations suggest woodland and forest would expand into grassland, steppe, and shrubland in the intermountain region. The USDA Rocky Mountain Research Station studies show a steady expansion of pinyon-juniper woodlands in the mountains of central Nevada and increasing frequency of crown fires. The invasion of cheatgrass follows fires at these elevations in the Great Basin, and already millions of acres of steppe, shrub, and woodland are dominated by *Bromus tectorum*. Paleoecology research suggests herbaceous species of riparian communities would experience substantial change in response to more extreme fluctuations in water table depth. In the eastern Sierras, ecologists note past and current incursions of conifer species into higher elevation meadows and riparian zones. The implications of accelerated climate change will be difficult to separate from the effects of increasing development and use of water, vegetation, and land resources. The negative impacts of, for example groundwater pumping, are likely to be magnified and hasten changes in biological and hydrological resources at local and regional scales.

PART 4. PLANS AND PRIORTIES FOR THE CONSERVATION OF THE WETLANDS OF NEVADA

Overview

The core component of the NvWP, in conformance with the guidance of the National Wetland Priority Conservation Plan, consists of an assessment of the conservation status of wetland resources, the resulting information from which is used to identify and rank wetland conservation priorities. The basic criteria used to select and evaluate priorities are historic losses, threats of further losses, and functions and values. Part 4 presents information relevant to these criteria from wetland and related management or conservation plans prepared by agencies and nongovernmental organizations. The index of priority wetland areas and sites (pp. 34-44) reflect the priorities in plans addressing wildlife, biodiversity, rare and threatened species, ecosystem diversity, outdoor recreation, water quality, and water resources. The following plans are summarized in Part 4.

- Nevada's Wetlands – An Element of Recreation in Nevada, 1987. Statewide Comprehensive Outdoor Recreation Plan. Nevada Division of State Lands, 1988.
- Wetland Conservation Plan Applicable to Nine State of Nevada Wildlife Management Areas. Nevada Division of Wildlife, 1998.
- Nevada 305(b) Report and 303(d) Assessment, Nevada Division of Environmental Protection, 2002.
- Nevada State Water Plan. Nevada Division of Water Planning, 1999.
- Coordinated Implementation Plan for Bird Conservation in Nevada. Nevada Steering Committee of the Intermountain West Joint Venture (IWJV), 2002.
- Regional Wetlands Concept Plan. FWS Pacific Region Office, August 1990.
- Plans and Agreements to Protect Threatened and Endangered Species and Habitats, FWS.
- Lahontan Cutthroat Trout (LCT) Recovery Implementation Team Plans and Others. FWS.
- Mojave and Great Basin Ecoregional Conservation Plans. The Nature Conservancy, 2002.
- Southern Nevada Public Lands Management Act – Environmentally Sensitive Land Acquisition Program.
- Wetlands Reconnaissance/Inventory Mid-Pacific Region. Bureau of Reclamation, Lahontan Basin Area Office, 1993.
- Scorecard 2000: Highest Priority Conservation Sites. NNHP, 2000.
- Nevada Comprehensive Wildlife Conservation Strategy. NDOW, 2005.

A “research and report” approach was used to compile the draft NvWP, but preparation of the final NvWP will involve public participation. The referenced conservation plan documents were prepared over a period of time, and may not represent current priorities of the respective agencies. However, the task of soliciting input from affected agencies and organizations should generate updated information. A multi-interest technical advisory group will be convened to accomplish this task. We intend and hope the formation of a technical advisory group will, in addition to helping rank wetland priorities, evolve into an ongoing collaboration. Such advisory groups exist for other valued natural resources, and a mechanism to enhance data quality, quantity, distribution, and applications is sorely needed.

The plan summaries (below) present information pertinent to the process of identifying and ranking priority wetlands, consistent with guidance in the National Wetlands Priority Conservation Plan. The national plan specifies the minimum evaluation criteria to use in the prioritization process: the status and trend of losses and gains; an assessment of the threats of future losses; and the functions and services of the wetlands selected. Loss refers to a reduction in the land coverage of wetlands (acreage) or in the occurrence of wetland types considered rare, declining, or possessing exceptional values in an ecoregion or other planning region. Consideration must be given to the full spectrum of wetland values – the

ecological functions and socioeconomic services valued in Nevada. Factors to consider in the assessment of the threat of future loss include land status, management status of the site, and regulatory status of the land or water use activities that do or may soon impose a reduction in wetland quantity or quality.

Wetland and Related Resource Plans in Nevada

Nevada's Wetlands – An Element of Recreation in Nevada, 1987. Statewide Comprehensive Outdoor Recreation Plan. Nevada Division of State Lands, 1988. The 1987 priority conservation plan was the first and only previously prepared by Nevada to satisfy the federal L&WCF provisions of the Emergency Wetlands Resources Act of 1986. The 1987 plan antedated the National Wetlands Priority Conservation Plan, the National Wetland Inventory program, the national "no net loss" policy, and other substantive federal policies and programs operational today. The 1988 state wetland priority plan was prepared by the NDSP in consultation with the NDOW and the USFWS. State collaborators were the NNHP, NDEP, NDSL, and the federal support came from the BLM, BOR, and USFS.

The NDOW biologists took the lead in the identification and evaluation of eighty wetlands that needed protection. Twenty sites/areas were government owned, twenty-three were private, and thirty-seven were mixed ownership status. Wildlife habitat, fisheries, recreational opportunities, and economic activities were criteria used to value benefits, as were waterfowl population use, change in historic wetland acreage, habitat diversity, environmental quality, land use threats, and endangered species occurrences.

Threats used in the evaluation of the vulnerability of Major Wetlands are listed below. The value in parenthesis indicates the number of times a particular threat was identified among the eighty sites.

Overgrazing by livestock (60)
Water diversion/lack of water rights (59)
Agricultural encroachment (44)
Dredging (36)
Development, operations and maintenance (32)
Toxic spills (26)
Trace element contamination/nonpoint pollution (22)
Lack inventory data (17)
Intermittent water source (15)
Urban activity/pests/conflicts (15)
Lack data analysis (13)
Waterfowl nest predation (12)
Wildlife diseases (12)
Flood control projects (11)
Municipal encroachment (11)
Utility corridors (11)
Conflicts with public uses (11)
Highway encroachment (9)
Landfills (7)
Geothermal development (5)
Airspace competition (3)

The state wetland plan also reported findings from an evaluation of the effects of federal programs on public wetlands. Management activities contributing to negative riparian and wet meadow impacts cited include grazing practices, small and major diversions, vegetation management, miscellaneous (e.g., recreation, mining, road construction), and hydroelectric development (USFWS, 1986).

Five of the priority wetland areas identified as qualifying for federal LWCF grants, identified in the Fish and Wildlife Service Pacific Region Regional Wetland Concepts Plan (USFWS, 1990).

Stillwater Wildlife Management Area
Carson Lake
Humboldt Wildlife Management Area
Ruby Valley
Alkali Lake Wildlife Management Area

The priority types identified in the 1988 state wetland plan were riparian and wet meadows. The FWS added palustrine emergent and lacustrine to the priorities in the Regional Wetland Concept Plan.

Recommended strategies in the 1988 plan were categorized as "preliminary" and "intended to stimulate future planning and protection". The leading recommendation, to improve the administration and enforcement of Section 404 permits with the establishment of an ACOE state office, was partially implemented with the placement of a permitting and enforcement office in Reno. The regulatory field office in Reno is responsible for ACOE wetland actions in all Nevada counties but two. A single specialist in St. George, Utah handles the ACOE regulatory activities in Lincoln and Clark counties.

Other recommendations that have been substantively implemented include:

- Obtain federal funding for NDOW studies. The NDOW obtained an EPA grant fund to map and classify wetlands and develop management policies within state wildlife management areas.
- Agencies offer technical, educational, and management assistance. The NDF, NDEP, and NDCD administer federally funded grant programs for private wetland conservation assistance.
- Provide prime farmland managers with assistance to check erosion and floods. The NRCS administers grant and technical assistance programs intended to improve resource conservation on farms and ranches (e.g., Environmental Quality Incentives, Conservation Reserve, and Wetland Reserve, and Forest Incentives Program). However, these programs are underutilized in Nevada.
- Wetland acquisition decisions consider manageability, complementary resource objectives, less-than-fee acquisition potential, prime farmland impact, and willingness to sell. The principles generally apply in state agency decisions concerning properties or easements for various conservation purposes.
- A federal mitigation policy is in place (i.e., mitigation sequencing – first find ways to avoid, then minimize, and finally mitigate losses). The ACOE now applies a project review approach that follows the sequence of avoiding, minimizing, or mitigating wetland loss.

Recommendations receiving little or less attention include:

- Investigate the need for a Nevada statute to give regulatory authority and financial support to the NDEP and NDOW.
- Provide financial and staff support to the NDSL and NDEP for a program to disseminate technical and educational information about wetlands to private landowners and prospective 404 permittees.
- Assist local governments to minimize negative impacts from growth with a state program that shares responsibility, costs, and technical expertise.
- Improve coordination among natural resource and agricultural agencies to collect and distribute information about wetland functions and management for water quality, habitat, and recreation use.

Wetland Conservation Plan Applicable to Nine State of Nevada Wildlife Management Areas, Nevada Division of Wildlife, 1998. Preparation of the NDOW wetland plan for nine state wildlife management areas (WMAs) was intended to develop a written policy document that describes mechanisms to achieve the two part goal of no net loss of wetlands by area and function in the short term and enhance and increase wetland quantity and quality in the long term to guide comprehensive planning for wetlands in the WMA system. A wetland consultant assisted with an assessment of wildlife functions and values, especially hunting, fishing, and "nonconsumptive" natural resource values; water management issues; potential management constraints; and protective mechanisms and conservation strategies for wetlands in the state WMAs.

Wetlands site priorities consist of those within the state WMA system. Since the plan report was released, two more WMAs were established (Bruneau and Steptoe Valley), raising the total WMAs containing wetland habitats to eleven, and total acreage to roughly 62,000 acres, nine percent of the state vegetated wetland total. All WMAs are primarily managed for hunting and/or fishing services and wildlife viewing. Habitat management favors the needs of game birds, fishes, and mammals.

Wildlife Management Area	Associated Water Resources	Wetland Acres	"Non-Consumptive" Wetland Resource Functions and Values
Overton	Muddy and Virgin rivers. Agricultural irrigation and drainage, Lake Mead	6,686	Sensitive, threatened or endangered species plant, fish, amphibian, insect, and bird species. Migrant shore and water birds. Wintering Loons, Grebes and ducks.
W.E. Kirch	Upper White River Valley. Flag Springs, perennial and intermittent creeks, reservoirs	3,868	Sensitive threatened, or endangered species plant, bird, fish, and bird species. Nesting colony of White-faced Ibis, migratory Bald Eagles, Northern Harrier, Red-tailed Hawk. Hot spring system.
Key Pittman	Lower White River Valley. Hiko Springs, agricultural irrigation, wells, reservoirs	527	Sensitive, threatened or endangered species fish, insect, small mammal, and bird species. Migratory bald eagles, northern harrier, great blue heron, shorebirds. Spring systems.
Mason Valley	Walker River near confluence of east and west forks. Urban, industrial, and hatchery effluent	5,859	Sensitive, threatened or endangered plants and bird species. During drought used by White-Faced Ibis, White Pelicans, Bald Eagles, Great Blue, Black-Crowned Night Herons. Other birds include: Grebes, Egrets, Snowy Plover, Terns, American Bittern. Continuous desert riparian cottonwood gallery, last stretch on Walker River in Nevada. Variety of wetland types.
Humboldt	Humboldt River. Agricultural irrigation and drainage, intermittent playa inundation	27,946	Sensitive, threatened or endangered plant and bird species. Migratory shorebirds, wading birds, including Egrets, Herons, Grebe, White-Faced Ibis. White Pelican foraging, colonial bird nesting on constructed islands.
Fernley	Fernley Sink. Agricultural return flow, ponds, intermittent springs and playa inundation	5,295	Snow Plover, Black-Necked Stilt, American Avocet nesting. Migratory shorebirds.
Scripps	Washoe Lake. Carson Range creeks, spring	2,130	Sensitive, threatened or endangered bird and snail species. Western Willet and other shorebird nesting. White-Faced Ibis, Black-Crowned Night Heron, and Egret, and other colonial birds. Playa lake.
Alkali Lake	Artesia Lake, intermittent creeks, springs, agricultural drainage, impoundment	2,760	Colonial bird nesting (tern, grebe, gull, ibis); shorebird breeding and migration. Playa lake.
Franklin Lake	Ruby Valley. Franklin River, Ruby Mountains creeks, springs	3,120	Sandhill Crane, White-Faced Ibis, Trumpeter Swan, Peregrine Falcon, Wintering Bald Eagle, Swainsons Hawk. Relict dace. Major migratory bird stopover for waterfowl and shorebirds, such as Grebe, Tern, Black-Necked Stilt, Snowy Egret, and Redhead. Wilderness, aesthetics
Steptoe Valley	Comins Lake (reservoir), springs, perennial and intermittent creeks.	1,973	Sensitive, threatened or endangered springsnail, fish, plant, and insect species. Nesting, wintering migratory waterfowl
Bruneau	Bruneau River and tributaries		Redband trout, Greater Sage Grouse. Riparian zones.
Source: Wetland Conservation Plan Applicable to Nine State of Nevada Wildlife Management Areas, NDOW, 1998. Note: Steptoe Valley and Bruneau WMAs were not evaluated in the WMA wetland plan. Information from various sources.			

The NDOW wetland plan does not identify particular wetland sites that the agency would pursue in fulfillment of its wildlife management and sport mission. The NDOW was a key participant in the evaluation process that proposed the priority sites listed in the 1987 state wetland plan (above). The most recent NDOW acquisitions are Steptoe Valley and the Bruneau WMAs. These areas contain riparian forest and shrub habitat, wet meadow, marsh, and ponds.

Wetland functions and values that the NDOW identified as desirable for the WMA system include:

Fishing	Hunting
Watchable wildlife	Wilderness experience
Educational values	Aesthetic values
Commercial values – crops, grazing, fisheries, wildlife	Threatened and endangered species

Water quality values – irrigation/livestock, aquatic life/wildlife, recreation (contact and non-contact)

Each of the nine WMAs evaluated for the NDOW plan contain a mix of wetlands that were reported to perform these additional functions: flood peak attenuation; base flow augmentation, groundwater recharge, sediment retention, surface water storage, nutrient and contaminant retention, maintenance of wetland plant communities with desirable characteristics. In addition, the ecological qualities of the

wetland types were variously characterized as: progressing toward target plant species composition; interspersion of plant communities and water; complex vertical stratification (a mix of trees, shrubs, grasses and forbs); or intact standing and surface detrital (decomposing organic material) pools.

Overall threats to wetlands listed by NDOW in the WMA plan are the same as those listed above in the 1987 Nevada's Wetlands plan. Activities said to pose threats to riparian and palustrine wetlands were:

- Grazing practices
- Small diversions
- Vegetation management
- Miscellaneous (e.g., recreation, mining, road construction)
- Major diversions
- Major hydroelectric development
- Small hydroelectric development

Major issues pertinent to wetlands within WMAs described by NDOW include:

- Water quantity available to the WMAs varies depending upon the adequacy and seniority of water rights owned by NDOW. Some WMAs rely on surplus water. Most experience severe water reductions during droughts. Review the efficient management of water at each area. Augment existing supplies by purchasing additional water rights.
- Undesirable nonnative plant species such as tamarisk and tall whitetop have invaded some WMAs. Introduced plant species displace natives, are difficult to control, reduce hunting and fishing access and quality of experience, lower groundwater, and degrade wetland function and value overall.
- Future plans will need to integrate management considerations for nongame and sensitive species with game species. Sensitive species may have different habitat requirements from those of sportfish and wildlife game species.

The recommended management strategies identified in the NDOW plan addressed wetlands within WMAs, but the agency implements administrative policies supporting the acquisition of other wetlands. The NDOW plan also reiterates recommendations contained in the state's 1987 priority wetland plan.

Nevada 305(b) Report and 303(d) Assessment, Nevada Division of Environmental Protection, 2002. The purpose of the Section 305(b) report is to present information to Congress, the EPA and the public summarizing the quality conditions of waters of the state, including wetlands. The Water Quality Planning Bureau (WQPB) of the NDEP prepares the state 305(b) Water Quality Assessment Report and the 303(d) List of Impaired Waters. The 303(d) List reports specifically on the locations of water bodies, or portions in which water quality was monitored or evaluated and found to exceed standards. Surface water quality data are obtained by NDEP through implementation of the state's routine monitoring program that samples rivers and tributaries in major river basins (Truckee, Carson, Walker, Humboldt, Snake, and Colorado), as well as occasional intensive studies. The 305(b), 303(d), and other assessment activities, such as nonpoint source pollution, rely on monitoring program results to characterize water quality status and trends. Additional data are obtained from ongoing studies conducted primarily by the USGS. Monitoring of groundwater quality is conducted by various agencies (e.g., Nevada Department of Agriculture monitors wells in some agricultural areas for pesticide levels), but a cohesive state monitoring program has not been developed.

Table 4.1 Water Quality Status of the Five Wetlands Monitored by NDEP		
Monitored Wetland	2000-2001	2002-2003
Carson Lake	Fully supporting	Fully supporting
Stillwater Marsh	Fully supporting	Fully supporting
Ruby Marsh	Fully supporting	Fully supporting
Mason Valley Wildlife Management Area	Not supporting	Not supporting
Indian Lakes	Not assessed/no data	Fully supporting

Source: 2002 and 2004 biennial publications of the 305B Water Quality Assessment Report, Bureau of Water Quality Planning, NDEP.
Note: At Mason Valley WMA wetlands, impairing pollutants are arsenic, boron, pH, and salinity/TDS/chlorides. The source of these pollutants was reported as unknown.

State water pollution control statutes do not provide for the adoption of wetland water quality standards. In compliance with federal Clean Water Act regulations, the NDEP routinely monitors or evaluates the water quality status of five major resource wetlands (Table 4.1). These results presented in the 2002 and 2004 305(b) reports (which summarize conditions in the previous biennium) indicate that wetland water quality is not deteriorating. The NDEP monitors water quality data at the Mason Valley wetlands, but the four other wetland areas are evaluated using other information sources (known land use, location of pollution sources, wildlife agency report, and best professional judgment). The WQPB is the primary source of monitoring data used in the state 305(b) reports, but the agency may use credible data from other agencies. For example, the USGS has monitored and studied levels of pollution in agricultural drainage delivered to Stillwater National Wildlife Refuge and Carson Lake wetlands from the Newlands Project. The monitoring results showed drains carried elevated concentrations of dissolved solids, boron, and arsenic that exceeded water quality standards set to protect the health of fish and wildlife (Lico and Pennington, 1997). Whether USGS or other water quality data were consulted in the 305(b) evaluations cannot be determined. Though the 305(b) report does not identify mercury as a pollutant of concern at Stillwater Marsh, the 303(d) list does. Arsenic and boron are also identified as pollutants of concern at Stillwater. The NDEP may integrate the 305(b) and 303(d) reports in the future.

"Fully supporting" means monitored pollutants were not found at levels of concern (i.e., the beneficial use criteria, or water quality standard for a particular pollutant and use were not exceeded). "Non Supporting" means the measurements for one or more monitored pollutants occur at a level of concern. (The non supporting designation is congruent with the usage of "impaired" in the 303(d) list.) A beneficial use criterion is the concentration or level beyond which the pollutant is likely to negatively impact the use. Beneficial uses in Nevada are specified as aquatic life, wildlife propagation, recreation involving water contact, recreation not involving water contact, municipal drinking supply, stock watering, irrigation, and industrial supply. At Mason Valley Wildlife Management Area (managed by the NDOW), the water quality use criteria were exceeded for irrigation, aquatic life support, wildlife propagation, recreation involving water contact, and municipal drinking supply (NDEP, 2004).

Table 4.2 Summary of Water Quality Impairment of Nevada Waterbodies, 2000 and 2001			
Pollutant and Parameter	**Impaired River Miles**	**Impaired Lakes and Reservoirs Acres**	**Impaired Wetland Acres**
Total	1,474	76,928	19,511
Nutrients	1,070	2,830	185
Metals	1,066	0	19,326
Sediment	672	0	0
Temperature	535	0	0
Total dissolved solids	251	35,500	185
pH	41	4,616	185
Other	19	36,812	0

Source: 303(d) Impaired Waters List, Water Quality Planning Bureau, 2002, NDEP.
Note: statewide total monitored river [and stream] length = 4362 miles; total monitored lake and reservoir area = 148,660 acres; total monitored wetland area = 51,826 acres.

Table 4.3 Rivers and Streams on the Nevada 303(d) List of Impaired Waters		
River Basin	**Water Quality Impaired Rivers and Streams**	**Water Quality Impaired Miles**
Humboldt	Humboldt River, origin to sink Mary's River South Fork Humboldt Maggie Creek Little Humboldt Pine Creek Willow Creek	768
Snake	Salmon Falls Creek Shoshone Creek Jarbidge River and East Fork East and South Forks, Owyhee River Mill Creek	195
Walker	West Walker, stateline to confluence East Walker, stateline to confluence Walker River, confluence to Walker River Paiute Indian Reservation Sweetwater Creek, stateline to East Walker Desert Creek, stateline to West Walker Mason Valley Wildlife Management Area	180
Carson	Bryant Creek East Fork Carson River, stateline to confluence West Fork Carson River, stateline to confluence Carson River, confluence to sink Stillwater Marsh Carson Lake	174
Truckee	Tahoe Lake tributaries Second Creek Third Creek Incline Creek and East Fork Glenbrook Creek Edgewood Creek Truckee River, stateline to Pyramid Lake Steamboat Creek Franktown Creek	84
Colorado	Las Vegas Wash Virgin River, stateline to Lake Mead Muddy River, source (Moapa Valley) to Lake Mead	74

Source: Nevada 303(d) List of Impaired Waters, 2002, NDEP. Total linear wetland miles from NWI database.
Note: The association between water quality impaired waters and wetland status is a matter of scientific principle. We assume, for the purpose of identifying priority wetlands with water quality value, that watercourses identified as impaired by nonpoint source pollutants (nutrients, total suspended solids, turbidity, metals, trace elements, fecal coliform, and temperature) would benefit by maintaining or improving adjacent wetlands to reduce pollutant loads reaching impaired waters.

The reduction of flows in streams and rivers contributes to beneficial use impairment throughout the state. Natural sources are implicated as a reason for standards exceeded in some rivers and tributaries, but during the development of the 303(d) list, no waterbodies were found to qualify as impaired by natural causes (Table 4.2). Agricultural and rangeland activities generate large sediment and nutrient loads. The 305(b) report also observes that impaired water quality can be primarily attributed to nonpoint source pollution, such as nutrients, sediment, temperature, and metals. Vegetated wetlands are effective at removing most nonpoint source chemical pollutants and moderating other related quality problems, such as thermal pollution, turbidity, and suspended solids. The state report identifies the following activities as having the greatest impacts on water quality.

- Crop irrigation;
- Grazing; and
- Flow regulation practices.

Another significant and widespread source of pollution identified in the 305(b) assessment is mined land; both active operating mines and abandoned mines. The report cites the reduction in river flow for much of the water quality impacts.

Water quality impairment on the Truckee, Carson, Walker, and Colorado River basins and the monitored minor rivers extends uninterrupted downstream from major population and agricultural center to the terminus or point of exit from the state (Table 4.3). Presumably, substandard water quality conditions are partly attributable to the widespread loss and alteration of wetlands and riparian areas. Identifying wetland protection or restoration priority areas as a function of water quality maintenance of improvement may be possible by comparing known nonpoint pollution source areas with the Nevada NWI wetland coverage. The listed impaired rivers and streams are included in the NvWP priority wetland evaluation.

To identify, control, and abate the impacts of nonpoint source pollution, the NDEP administers the state Nonpoint Source Program. The current approach is to seek voluntary compliance through non-regulatory programs that offer technical and financial assistance, training, technology transfer, demonstration projects and public outreach. The NDEP implements the federally funded CWA Section 319 Program, which provides grant money for a wide variety of projects intended to reduce nonpoint source pollution. A modest portion of the funds allocated to local government, Conservation Districts, and Indian Tribes have been used to stabilize eroding stream channels, reduce grazing in riparian zones by fencing and

providing alternative stock watering, reestablish riparian vegetation, and construct wetlands. Including these water quality impaired bodies in the priority wetland evaluation process, could assist their qualifying for conservation funding.

Nevada State Water Plan, Nevada Division of Water Planning, 1999. The purpose of the 1999 Nevada State Water Plan was to guide the development, management, and use of the state's water resources. Development of the state water plan was mandated in NRS Chapter 540. Parties involved included the 15-member Advisory Board for Water Resources Planning and Development, the Department of Conservation and Natural Resources, federal, state and local agencies, and interested citizens. The plan included an assessment of the quantity and quality of water resources, identification of constraints and opportunities that affect decision-making, and coordination so future actions would obtain greatest benefits from the use of water resources. An unmet key goal was the establishment of a comprehensive process for addressing evolving water needs and the challenges generated by growth in this, the driest state in the nation. The Nevada Division of Water Planning (NDWP) was dissolved after production of the state water plan. Now, the NDWR performs water planning activities.

Wetlands were not addressed directly in the state water plan; however, Part 3 – Water Planning and Management Issues discusses wetland resources in the context of water supply for outdoor recreation as well as wildlife and environmental purposes (NDWP, 1999). Information from two issue papers, Maintenance of Recreational Values and Water for Wildlife and Environmental Purposes, which may be pertinent to the NvWP, is summarized below.

Fourteen of 24 state parks and ten of twelve state wildlife management areas encompass water resources and associated wetlands that allow for water and wetland centered recreation. The NDSP visitor count data show that seventy percent of the users in 1997 recreated at state parks that offer water-based recreation opportunities. On federal public land, the FWS, BOR, NPS, BLM, and USFS also manage various watercourses and waterbodies for outdoor recreation. Popular locations include areas accessible to the public at Stillwater and Ruby marshes, lakes Tahoe and Mead, Lahontan and Rye Patch reservoirs, and boating reaches of the Truckee, Carson, and Colorado rivers. Hunting, fishing, wildlife watching, boating, swimming, camping, and hiking are the most popular activities. Fishing and wildlife (primarily birds) watching generated annual expenditures of $211 and $263 million in Nevada, according to FWS survey data. Boating popularity has grown noticeably, especially in personal watercraft use (e.g., jet skis) as well as kayaking, canoeing and tubing on major rivers.

Wetland functions and values integral to water based outdoor recreation, wildlife and environmental purposes include:

- Water quality clear and safe as appropriate to recreation uses
- Depth, pool, or flow of water appropriate to recreation uses
- Support biological diversity
- Support threatened, endangered, rare, and sensitive plants and animals
- Condition of game fish and wildlife habitat
- Abundance of game fish, birds, or other wildlife
- Aesthetics
- Wilderness and solitude
- Scientific research
- Moderation of climatic and hydrologic extremes in aquatic habitats occupied by native fishes
- Resiliency and predictability to channel behavior in times of flood
- Waterfowl migration

Nevada agencies actively protect certain water and wetland resources. The NDEP sets water quality beneficial use objectives, or standards, for waterbodies used for contact and non-contact outdoor recreation activities. State statutes recognize recreation and wildlife as legitimate "in situ" (e.g., instream) beneficial uses for which water rights may be held to establish and maintain wetlands, fish populations, water quality standards, and watering sources at springs and seeps for wildlife use. State parks and wildlife management areas also serve to protect wetland resources associated with water based outdoor recreation sites through acquisition and management.

Important wetland sites are:

- Wetlands associated with lakes and reservoirs on public lands that provide outdoor recreation opportunities, especially fishing, hunting, and wildlife watching
- Wetlands that support large populations and a large diversity of wildlife, especially birds and fishes
- Agricultural wetlands nearby water bodies and native wetland habitats
- Wetlands within Nevada parks and wildlife management areas
- Wetlands used or likely to be used by threatened, endangered, rare, and sensitive species
- Pyramid and Walker lakes
- Riparian forest

Threats to wetland and aquatic habitats include:

- Periodically dry river channel segments and streams (outside natural variation)
- Few water permits issued for riparian forest, multi-functional wetlands, Pyramid and Walker lakes, especially in fully allocated river basins and watersheds
- Impaired water quality associated with artificially low water supply
- Nonpoint source pollution, including agricultural discharges
- Dams alter sediment movement, impairing quality of aquatic habitat for fish and wildlife
- Wells that drawdown water level in near surface aquifers that discharge into streams and springs
- Land use activities and developments that degrade watershed and channel conditions and do not mitigate effects on hydrologic processes that capture and slowly release runoff and recharge aquifers.
- Areas of widespread exotic plant invasion in riparian wetlands or throughout a watershed
- Inadequate knowledge, assessment, and research of minimum water supply needs of valued natural services, such as rare aquatic and riparian ecosystems, native biota, channel maintenance, and recreation.
- Constraints on ability of Nevada agencies to compete for and afford acquisition of water rights for *in situ* uses (e.g., aquatic wildlife communities, wetlands, water quality, recreation)

The following recommendations, summarized, were presented in the two issue papers:

- The Department of Wildlife should continue to seek opportunities to acquire water rights from willing sellers for recreation including fish and wildlife habitat
- Seek legislative support to enhance water supplies for recreation, wildlife and environmental purposes: 1) develop a plan to prioritize and coordinate interagency assessments of critical water needs for wildlife and environmental purposes; 2) adopt a policy encouraging acquisition of water rights for transfer to in situ uses; 3) establish a water rights trust fund; and, 4) develop incentive programs.
- Establish a statewide working group to examine the legal, institutional and economic aspects of alternative mechanisms for obtaining water supplies for resource conservation. Also, develop

guidelines and criteria used in planning and evaluating water resource projects, including dam construction, significant water transfers, and modifications to reservoir storage and operations.

Coordinated Implementation Plan for Bird Conservation in Nevada. Nevada Steering Committee of the Intermountain West Joint Venture (IWJV), 2002. The Coordinated Bird/IWJV Plan integrates several bird conservation plans. Most significantly from the state's perspective is the Nevada Partners in Flight (PIF) product. The Nevada PIF was developed over three years through collaboration among the NDOW, FWS, BLM, BOR, USFS, NPS, Lahontan and Red Rock chapters of the Audubon Society, Great Basin Bird Observatory, TNC, and Resource Concepts, Inc. The Nevada PIF was a baseline information resource for collaborative bird and habitat conservation planning and project selection. Incorporated are the birds/habitats targeted in North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, the North American Waterbird Conservation Plan, and Endangered Species Act.

Table 4.4. IWJV Prioritization of Major Bird Habitats in Nevada – Wetland and Riparian Habitats

Priority Rank & Criteria	Wetland Habitat Type	Threats	Strategic Goal/Objective
<u>Priority A</u> High overall rating High to medium value to bird species statewide High to medium threats Declining quantity and quality High to medium opportunities	Wetlands	Inadequate water Land and water development	Protect/maintain good condition Restore/improve degraded Permanently protect/restore 25,000 acres high-quality
	Lowland riparian (River floodplains below 5,000 feet north and 4,000 south)	Land and water development Irrigation diversion Livestock grazing Pollution	Protect, restore, enhance Permanently protect/restore 300 linear miles
	Mesquite/Catclaw Mojave Desert Ecoregion (Washes and riparian areas below 3,000 feet)	Lowered water tables Gravel mining Wood cutting Wildfire Land development Exotic weeds	Minimize loss Permanently protect/restore 8,000 acres in Clark County and other areas impacted by growth and development
	Aspen (Riparian stringers, seeps at stream bottoms, ridgelines, talus slopes)	Livestock grazing Fire suppression Recreational use	Reverse loss Restore and stabilize degraded Permanently protect/restore in a 40,000 acre management unit
	Montane parkland Great Basin Ecoregion (Meadows, 5,000 to 10,000 feet, with streams, springs, glacial lakes)	Livestock grazing Recreational use Pinyon-juniper encroachment	Reverse decline Restrictions and/or incentives for sound land use management, e.g. grazing Permanently protect/restore 350 acres
<u>Priority B</u> Medium overall rating One criterion may be high Generally, medium importance to bird species statewide	Montane riparian (Perennial, seasonal streams above alluvial fans, woodland and tall shrub cover)	Livestock grazing Hydraulic mining Road building Off road vehicle use Fire suppression	Protect, restore, enhance Permanently protect/restore 150 linear miles
	Montane parkland Sierra Nevada Ecoregion (Meadows, 5,000 to 10,000 feet, with streams, springs, glacial lakes)	Livestock grazing Recreational use Lodgepole pine encroachment	Reverse decline Restrictions and/or incentives for sound land use management, e.g. grazing Permanently protect/restore 50 acres
	Agricultural land (Valley bottoms and river systems, 600 to 7,500 feet)	Commercial and residential land development	Assist landowners to improve wildlife habitat values Protect, restore, enhance 13,000 acres of privately owned land

Source: Coordinated Implementation Plan for Bird Conservation in Nevada, 2002. Nevada Steering Committee, Intermountain West Joint Venture

The Nevada Steering Committee, the state's IWJV affiliate, provides detailed knowledge about the status of bird habitat and populations to national and continental conservation planning teams. The national and continental teams aggregated information from other areas and return range-wide (multi-state or multi-national) objectives for habitat and bird population conservation and restoration. The Nevada affiliate

then "steps down" the range-wide objectives and strategies to fit the real potential for conservation opportunities implied by environmental, jurisdictional, and political circumstances. The Coordinated Bird/IWJV Plan identifies the following wetland and riparian habitats with respect to the conservation of all birds: wetland, lowland riparian, and montane riparian, aspen, mesquite/catclaw, montane parkland, and agricultural land (IWJV, 2002). Table 4.4 presents IWJV habitant priority rankings. Three conditions were described for the criteria: 1) statewide importance to birds; 2) opportunities for funding, partnerships, and feasibility for habitat protection, restoration, or enhancement; and, 3) degree of threat.

Of the 103 bird species identified as conservation priorities in the Nevada IWJV Plan, ninety use one or more aquatic-wetland or -riparian habitat types for breeding, migration, wintering, or feeding. The Nevada Steering Committee also evaluated conservation targets described in ecoregional plans encompassing the Great Basin, Mojave Desert, and Colombia Plateau ecoregions prepared by TNC. Nineteen priority habitat conservation areas were selected using these criteria: importance of the area for priority bird species; the presence of threats; and, available conservation opportunities.

Argenta Marsh
Carson River
Muddy River Complex/Meadow Valley Wash
Piute/Eldorado
Duck Creek Range/Steptoe Valley
Walker Lake/Walker River
Humboldt River
Humboldt Sink
North-central Elko County (Aspen)
Sage Grouse Habitat
Amargosa River/Beatty/Ash Meadows
Lahontan Valley/Carson Sink
Pahranagat Valley/White River
Pyramid Lake/Lower Truckee River
Virgin River
Ruby Mountains/Ruby Marshes
Washoe Valley/Washoe Lake
Upper Truckee River
Sheldon/Quinn River

Important Bird Areas, Lahontan Audubon Society. A parallel bird conservation planning initiative is the Important Bird Area (IBA) program, implemented under the auspices of the National Audubon Society. The IBA continues to study and evaluate sites for their importance to bird species identified for heightened conservation attention. "Recognized sites" that entail wetland and riparian habitats are:

Boyd Humboldt Valley Wetlands
Gridley Lake
Lahontan Valley Wetlands
Oasis Valley
Walker Lake
Franklin Lake
Ash Meadows
Carson Valley
Meadow Valley Wash
Great Basin National Park
Swan Lake
Virgin River
Carson River Delta
Pahranagat Valley Complex
David E. Moore Bird and Wildlife Sanctuary
Pyramid Lake
Sheldon NWR
Wellington Hills -Pine Grove Hills
Ruby Lake
Moapa Valley
Mary's River
Washoe Valley

The IBA sites shown in italics are desert aquatic and wetland ecosystems the Lahontan Audubon Society considers to be especially vulnerable due to plans for increasing groundwater withdrawals throughout southern Nevada for importation to the Las Vegas Valley metropolitan area.

Regional Wetlands Concept Plan, FWS Pacific Region Office, August 1990. The Regional Wetlands Concept Plan presents priority acquisition sites identified in each state's wetland priority conservation plans (California, Idaho, Oregon, Washington, and Nevada along with Hawaii and the Pacific Islands). Wetlands placed on the priority acquisition list and eligible for Land and Water Conservation Funds must

meet the Wetlands Assessment Threshold Criteria that consider historic and recent loss trends, threats of future losses and degradation; and functions and values. The 1988 Nevada priority wetland sites were:

Stillwater Wildlife Area	Carson Lake
Humboldt Wildlife Management Area	Ruby Valley
Alkali Lake Wildlife Management Area	

The Nevada priority list does not identify all the important wetlands. Omitted are those already owned by federal, state, or local agencies, in addition to those deemed unsuitable for direct acquisition that may be protected through easements, trusts, agreements, zoning, or other means. The priority wetland types in the Intermountain West subregion (Nevada, Idaho, eastern Oregon and Washington, northeastern edge of California) are riparian wetlands in stream systems (palustrine forested and scrub-shrub), freshwater marshes, wet meadows, seeps, and small lakes (palustrine and lacustrine emergent). The types of wetlands identified as particularly important in Nevada were: riparian wetlands and wet meadows; palustrine emergent wetlands; and, lacustrine.

Highly valued functions and services throughout the planning subregion include: freshwater fisheries production; consumptive and non-consumptive recreational uses; groundwater recharge; flood control; and water quality improvement. Function/value characteristics of priority wetland types were reported as:

- Riparian zones. Less than one percent of the land base that supports the greatest diversity and abundance of songbirds, raptors and other wildlife in arid portions of the region. Many species have small home ranges and cannot relocate when a specific water source is lost or degraded. Maintenance of riparian wetlands correlates with maintenance of fisheries, providing cover for juveniles, moderate water temperature regime, reduce siltation, stabilize streambanks, and create holding areas for cover.
- Palustrine emergent wetlands. Feeding, nesting, and cover habitat for small mammals, songbirds, raptors, and other species. Seasonal nesting and wintering sites for waterfowl, described as high priority habitat in the North American Waterfowl Management Plan. Crucial habitat for redhead duck breeding and federally listed species.

Threats and losses noted for the subregion:

- Marshland – Water Diversion. A study on the Newlands Project in Lahontan Valley found that over 85 percent of area wetlands had been lost or severely degraded because of water diversion projects in the past century. Throughout the region, loss of freshwater marsh habitat has been significant with a corresponding reduction in waterfowl and other wetland dependent populations.
- Riparian Land – Grazing. Throughout the region, most riparian areas have been highly modified – cleared for crops or pasture use. Heavy grazing has destroyed understory vegetation and prevented regeneration of riparian vegetation in many areas. Little data is available to quantify the extent of loss, but studies indicate the loss has been significant.

The Regional FWS Plan acknowledges these factors in the past and ongoing loss of Nevada wetlands:

Grazing practices – livestock, feral horses, burros	Contamination due to mining operations
Diversion of water for agriculture	Lack of prime water rights
Poor water quality of irrigation return flow	Channelization
Drainage systems	Extraction of groundwater
Sedimentation from dam construction and erosion	Water degradation due to agricultural chemical use
Surface mining disturbance and vegetation removal	Inundation and dredging along the Colorado River
Dam construction removal of vegetation	Indirect impacts due to changes in flow patterns

The Regional Concept Plan describes issues associated with acquisition as a strategy to protect wetlands and buffer areas from onsite and offsite development pressures. The issues were:

- Direct acquisition may be infeasible due to high land costs, lack of available funding, lack of funding and personnel for management.
- Political opposition due to large public land base in federal ownership.
- Acquisition of water rights for wetlands on public land, such as state wildlife management areas. Wetlands are threatened by a lack of water resulting from diversions for agricultural purposes.
- Prime water rights may not, but must, accompany wetlands acquired. The LWCF grants can be used to acquire water (rights).

In addition to fee title acquisition of priority wetlands, other strategies are identified:

- Conservation easement or lease – similar benefits as direct acquisition, private status remains;
- Donation or trust – reduce high cost of acquisition;
- Zoning/master plan – local regulations direct intensity or character of land use to reduce impacts;
- Tax incentive to open space dedication – landowners willing to preserve and restore wetlands more likely to dedicate wetlands to unused open space if public funds pay property taxes;
- State wetland conservation protection policy development and additional legislation; and,
- Strict implementation of regulations – Clean Water Act Section 402 (regulate pollutant discharges), Clean Water Action Section 404, Swampbuster (Food Security Act), Endangered Species Act, and Water Resources Development Act.

Threatened or Endangered Species Conservation Plans and Agreements, FWS. Thirty-seven species and subspecies known to occur in Nevada are listed as threatened, endangered, or are a candidate for listing, under the federal Endangered Species Act (ESA). Thirty-six of those species and subspecies are wetland dependent; that is, they dwell in or are sustained by interactions with wetland. A list of the species and their conservation status is presented in Table 4.5. The desert tortoise is the only ESA-listed species in Nevada that does not directly or indirectly subsist on wetland or riparian resources or occupy such habitats to reproduce or complete other life stages.

On public lands, policies and regulations require federal agency management plans and permitting actions to give preferential attention and treatment to sustaining threatened and endangered species populations and their habitats. Where the species occur on private land, special plans or agreements must be prepared and approved between the landowner and FWS. Many of the taxa listed utilize or live in wetland and riparian habitats adjacent to streams, spring systems, or seasonal pools that may not be protected under Clean Water Act Section 404 regulations. Therefore, the Endangered Species Act works to protect the wetland and riparian ecosystems essential to survival of the species. With the exception of the Lahontan Cutthroat Trout, the number and size of areas inhabited by listed species is comparatively small. Fourteen of the fishes are endemic to a singular spring system or to an isolated complex of springs, widely scattered in southern and northeastern Nevada. Listed frog populations also occupy specific aquatic-wetland and -riparian sites, which are located in the Toiyabe Range, the Ruby Mountains, and the Independence-Jarbidge complex of ranges.

The Pacific Region Office of the FWS's National Wetland Inventory, in commenting on U.S. Supreme Court induced Clean Water Act rule changes that removes isolated waters from the sphere of regulatory influence, noted in particular that a large number of ESA listed birds, fishes and/or aquatic invertebrates that live in wetland and aquatic habitats of desert springs and playas could be negatively effected. The weakening of wetland regulations puts a greater onus on the FWS to protect at risk wetland dependent species through ESA regulations, including the action of placing species on the endangered list.

Table 4.5. Federal Endangered, Threatened, Proposed and Candidate Species of Nevada

U. S. FISH AND WILDLIFE SERVICE
NEVADA FISH AND WILDLIFE OFFICE

ENDANGERED, THREATENED, PROPOSED AND CANDIDATE SPECIES OF NEVADA

(Updated May 11, 2004)

Species	Federal Status	Critical Habitat in NV	Recovery Plan
Birds			
Yellow-billed cuckoo, *Coccyzus americanus*	C	N/A	N/A
Southwestern willow flycatcher, *Empidonax traillii extimus*	E	N	N
Bald eagle, *Haliaeetus leucocephalus* ★	T	N	Y
Yuma clapper rail, *Rallus longirostris yumanensis*	E	N	Y
Reptile			
Desert tortoise, *Gopherus agassizii* (Mojave population)	T	Y	Y
Amphibians			
Columbia spotted frog, *Rana luteiventris* (Great Basin population)	C	N/A	N/A
Mountain yellow-legged frog, *Rana muscosa* (Sierra Nevada Distinct Population Segment)	C	N/A	N/A
Relict leopard frog, *Rana onca*	C	N/A	N/A
Fishes			
Warner sucker, *Catostomus warnerensis*	T	N	Y
Cui-ui, *Chasmistes cujus*	E	N	Y
White River springfish, *Crenichthys baileyi baileyi*	E	Y	Y
Hiko White River springfish, *Crenichthys baileyi grandis*	E	Y	Y
Railroad Valley springfish, *Crenichthys nevadae*	T	Y	Y
Devils Hole pupfish, *Cyprinodon diabolis*	E	N	Y
Ash Meadows Amargosa pupfish, *C. nevadensis mionectes*	E	Y	Y
Warm Springs pupfish, *Cyprinodon nevadensis pectoralis*	E	N	Y
Pahrump poolfish, *Empetrichthys latos*	E	N	Y
Desert dace, *Eremichthys acros*	T	Y	Y
Humpback chub, *Gila cypha* *	E	N	Y
Bonytail chub, *Gila elegans*	E	Y	Y
Pahranagat roundtail chub, *Gila robusta jordani*	E	N	Y
Virgin River chub, *Gila seminuda* [a]	E	Y	Y
White River spinedace, *Lepidomeda albivallis*	E	Y	Y
Big Spring spinedace, *Lepidomeda mollispinis pratensis*	T	Y	Y
Moapa dace, *Moapa coriacea*	E	N	Y
Lahontan cutthroat trout, *Oncorhynchus clarki henshawi*	T	N	Y
Woundfin, *Plagopterus argentissimus*	E	Y	Y
Colorado pikeminnow, *Ptychocheilus lucius* *	E	N	Y
Independence Valley speckled dace, *Rhinichthys osculus lethoporus*	E	N	Y
Ash Meadows speckled dace, *R. osculus nevadensis*	E	Y	Y
Clover Valley speckled dace, *R. osculus oligoporus*	E	N	Y
Bull trout, *Salvelinus confluentus* (Jarbidge River Distinct Population Segment)	T	N	N
Razorback sucker, *Xyrauchen texanus*	E	Y	Y
Invertebrates			
Ash Meadows naucorid, *Ambrysus amargosus*	T	Y	Y
Elongate mud meadows Pyrg, *Pyrgulopsis notidicola*	C	N/A	N/A
Carson wandering skipper, *Pseudocopaeodes eunus obscurus*	E	N	N
Plants			
Ash Meadows milk-vetch, *Astragalus phoenix*	T	Y	Y
Spring-loving centaury, *Centaurium namophilum*	T	Y	Y
Ash Meadows sunray, *Enceliopsis nudicaulis* var. *corrugata*	T	Y	Y
Churchill Narrows buckwheat, *Eriogonum diatomaceum*	C	N/A	N/A
Steamboat buckwheat, *Eriogonum ovalifolium* var. *williamsiae*	E	N	Y
Ash Meadows gumplant, *Grindelia fraxinopratensis*	T	Y	Y
Ash Meadows ivesia (mousetail), *Ivesia eremica* (= *I. kingii* var. *eremica*)	T	Y	Y
Webber ivesia, *Ivesia webberi*	C	N/A	N/A
Ash Meadows blazing star, *Mentzelia leucophylla*	T	Y	Y
Amargosa niterwort, *Nitrophila mohavensis*	E	N	Y
Soldier Meadows cinquefoil, *Potentilla basaltica*	C	N/A	N/A
Tahoe yellowcress, *Rorippa subumbellata*	C	N/A	N/A
Ute lady's tresses, *Spiranthes diluvialis*	T	N	D

E = Endangered; T = Threatened; C=Candidate; ★ = Proposed for delisting
Y = Yes; N = No; D = Draft; N/A = Not Applicable
* = Believed extirpated from Nevada; [a] Endangered only in the Virgin River; population in Muddy River is species of concern.

Source: Nevada Fish and Wildlife Service Office, http://nevada.fws.gov/, March 2005

To assist in verifying actions to protect and recover listed species on private land will be implemented, the FWS has developed a number of habitat conservation plans (HCPs) and Candidate Conservation Agreements (CCA). One Safe Harbor Agreement (SHA) has been approved by the FWS. The approved HCP, CCAs, and SHA covering listed wetland species in Nevada are identified in Table 4.6.

Section 10 of the ESA authorizes the FWS to issue permits for the incidental take of listed species on non-federal land where a HCP has been approved for land use activities that may jeopardize the species existence. The HCP identifies mitigation measures that will reduce adverse effects of proposed activities on the listed species, such as preservation (acquisition or conservation easement) of habitat; enhancement or restoration of degraded or converted habitat; creation of habitat; establishment of buffer areas around existing habitats; modifications of land use practices; and, restrictions on access. Modifying the land status of wetland sites within a HCP planning area may be necessary to raise the level of protection of the listed and non-listed species and their habitats.

Table 4.6 Approved Habitat Conservation Plans and Candidate Conservation Agreements in Nevada for Wetland Dependent Species

Agreement Title	Listed Species	Location
Clark County Multiple Species HCP	Southwestern willow flycatcher, desert tortoise, and 76 non-listed species (plants, fishes, molluscs, amphibians, small mammals)	County-wide
Amargosa toad CCA	Amargosa toad (former candidate, 1996)	Spring systems Oasis Valley
Bonneville cutthroat trout (Range-wide) CCA	Bonneville cutthroat trout	Specified mountain creeks Spring Valley
Columbia Spotted Frog Great Basin DPS CCA Northeastern Subpopulations	Columbia spotted frog	Specified creeks and ponds Jarbidge, Independence, Tuscarora, Ruby Mountains
Columbia Spotted Frog Great Basin DPS CCA Toiyabe Subpopulation	Colombia spotted frog	Specified creeks and ponds Toiyabe Range, Nye County
Spring Mountains National Recreation Area CCA	Ecosystem-level agreement covering 36 endemic species	Springs, creeks, ponds Spring Mountains
Tahoe Yellow Cress CCA	Tahoe Yellowcress	Lake Tahoe shorezone
Virgin River Spinedace CCA	Virgin River Spinedace.	Virgin River mainstem
White River Spinedace SHA	White River Spinedace	Indian Spring System

A Candidate Conservation Agreement (CCA) is similar to an HCP, but applies to candidate species. The FWS identifies candidate species as plants and animals for which enough is known about the biological status and threats to propose a threatened or endangered designation, but the agency is unable to take action because other listing studies are higher priorities. The purpose of the CCA is to provide guidance to public land managers and an incentive to nonfederal property owners who conserve species and habitat. In return, the FWS agrees not to place additional restrictions or require additional actions beyond those specified in the agreement. Similarly, the Safe Harbor Agreement removes regulatory uncertainty and encourages the landowner to follow land management guidance and allow measures that will protect vulnerable species. The White River spinedace SHA involves the FWS and NDOW working with the landowner to introduce, maintain, and monitor a population of the endangered fish in the Indian Spring system. The landowner was willing to use water rights and create aquatic-riparian habitat conditions for spinedace survival. In addition, the landowner agrees to avoid land use activities that place the population of spinedace at risk for five years, such as grazing or removing the riparian vegetation near the spring and brook, depleting the water supply, and introducing exotic fishes or amphibians. After five years, the landowner can resume land use activities even if a portion of the habitat is altered or some of the fishes are incidentally "taken." The agreement with the FWS assures that no additional future restrictions will be imposed.

The frequently cited land use activities found to be impacting the populations and habitats of wetland dependent threatened and endangered species include water diversions, improper livestock grazing, spring development, groundwater withdrawal, and mining, along with encroaching urban development, roads and culverts, introduced aquatic species, and invasive plant species.

The goal of the ESA is the recovery of listed species to a point where protection under the ESA becomes unnecessary. Recovery involves stopping or reversing the decline of an endangered or threatened species and removing or lowering threats so survival of the species in the wild can be ensured. Usually a recovery plan is the first major step in preventing extirpation or extinction. Recovery plans spells out measures and responsibilities in order to coordinate protection, restoration, management, and monitoring of individuals and populations and habitats occupied or potentially occupied by the vulnerable species. Recovery plan development and implementation involves government agencies, private landowners, and various industry and conservation interest groups. Active recovery planning efforts for ESA listed species that occur in Nevada are shown in Table 4.7.

Table 4.7 Endangered and Threatened Wetland Dependent Species Covered Under FWS-Approved Recovery Plans

Common Name ***Scientific Name***	**Recovery Plan Name**	**Plan Stage**	**Listed As**	**Aquatic-Wetland Type** ***Hydrographic Region***
Southwestern willow flycatcher *Empidonax traillii extimus*	Southwestern Willow Flycatcher [Clark, Lincoln, Nye Co.s]	F	E	Lower riparian *Death Valley, Central (south), Colorado*
Ash Meadows Amargosa pupfish *Cyprinodon nevadensis mionectes*	Ash Meadows (12 spp.)	F	E	Spring system *Death Valley*
Ash Meadows speckled dace *Rhinichthys osculus nevadensis*	Ash Meadows (12 spp.)	F	E	Spring system *Death Valley*
Big Spring spinedace *Lepidomeda mollispinis pratensis*	Big Spring Spinedace [Condor Canyon]	F	T	Spring system *Colorado*
Bonytail chub *Gila elegans*	Bonytail Chub [Colorado River]	RF(2)	E	Lower riparian, open water *Colorado*
Bull Trout -- Jarbidge DPS *Salvelinus confluentus*	Bull Trout Jarbidge River DPS	D	T	Montane riparian *Snake River*
Clover Valley speckled dace *Rhinichthys osculus oligoporus*	Independence Valley Dace (2 spp.)	F	E	Spring system *Humboldt (upper)*
Cui-ui *Chasmistes cujus*	Cui-ui [Pyramid Lake, Truckee River]	RF(2)	E	Lacustrine open water, lower riparian *Truckee River*
Desert dace *Eremichthys acros*	Desert Dace [Soldier Meadows]	F	T	Warm spring system *Black Rock Desert*
Devils Hole pupfish *Cyprinodon diabolis*	Ash Meadows (12 spp.)	F	E	Warm spring system *Death Valley*
Hiko White River springfish *Crenichthys baileyi grandis*	Pahranagat Valley Fishes (3 spp.)	F	E	Spring system, lower riparian *Colorado*
Independence Valley speckled dace *Rhinichthys osculus lethoporus*	Independence Valley Dace (2 spp.)	F	E	Spring system, riparian *Humboldt (upper)*
Lahontan cutthroat trout *Oncorhynchus clarki henshawi*	Lahontan Cutthroat Trout [Carson City, Churchill, Douglas, Elko, Eureka, Humboldt, Lander, Lyon, Mineral, Storey, Washoe counties]	F	T	Lacustrine open water, upper-lower riparian *Truckee, Carson, Walker, Humboldt, Black Rock, Central, Snake River*
Moapa dace *Moapa coriacea*	Muddy River Aquatic Species (8 spp.)	RF(1)	E	Spring system, lower riparian *Colorado*
Pahranagat roundtail chub *Gila robusta jordani*	Pahranagat Valley Fishes (3 spp.)	F	E	Lower riparian, open water *Colorado*
Pahrump poolfish *Empetrichthys latos*	Pahrump Killifish (=Poolfish)	F	E	Spring system, riparian *Death Valley, Central*
Railroad Valley springfish *Crenichthys nevadae*	Railroad Valley Springfish	F	T	Spring system, lower riparian *Central*
Razorback sucker *Xyrauchen texanus*	Razorback Sucker [Colorado River]	RF(1)	E	Lacustrine open water, lower riparian *Colorado*
Virgin River Chub *Gila seminuda (=robusta)*	Virgin River Fishes (2 spp.)	RF(2)	E	Lower riparian open water *Colorado*

Table 4.7 Endangered and Threatened Wetland Dependent Species Covered Under FWS-Approved Recovery Plans				
Common Name ***Scientific Name***	**Recovery Plan Name**	**Plan Stage**	**Listed As**	**Aquatic-Wetland Type** ***Hydrographic Region***
Warm Springs pupfish *Cyprinodon nevadensis pectoralis*	Ash Meadows (12 spp.)	F	E	Thermal spring system *Death Valley*
Warner sucker *Catostomus warnerensis*	Warner Basin Fish (3 spp..)	F	T	Lacustrine open water, riparian *Northwest*
White River spinedace *Lepidomeda albivallis*	White River Spinedace	F	E	Spring system *Colorado*
White River springfish *Crenichthys baileyi baileyi*	Pahranagat Valley Fishes (3 spp.)	F	E	Spring system, riparian *Colorado*
Woundfin *Plagopterus argentissimus*	Virgin River Fishes (2 spp.)	RF(2)	E	Lower riparian *Colorado*
Ash Meadows naucorid *Ambrysus amargosus*	Ash Meadows (12 spp.)	F	T	Hot spring system *Death Valley*
Amargosa niterwort *Nitrophila mohavensis*	Ash Meadows (12 spp.)	F	E	Playa *Death Valley*
Ash Meadows gumplant *Grindelia fraxino-pratensis*	Ash Meadows (12 spp.)	F	T	Riparian meadow *Death Valley*
Ash Meadows ivesia *Ivesia kingii var. eremica*	Ash Meadows (12 spp.)	F	T	Desert wetland, spring system *Death Valley*
Spring-loving centaury *Centaurium namophilum*	Ash Meadows (12 spp.)	F	T	Wetland, lower riparian, seep *Death Valley*
Steamboat buckwheat *Eriogonum ovalifolium var. williamsiae*	Steamboat Buckwheat [Steamboat Hot Springs]	F	E	Wetland/upland complex, hot springs *Truckee River*
Source: FWS Website – Recovery and delisting of endangered species, http://endangered.fws.gov/recovery/#plans . Updated 8/10/04. Notes: Plan Stage code: F=final; D=draft; RF#=revision approved (revision #). Listed As code: T=threatened; E=endangered				

Lahontan Cutthroat Trout (LCT) Recovery Implementation Team Plans, FWS. Recovery of LCT populations is a project that has region-wide significance, involving substantial efforts to improve aquatic and wetland habitat conditions of rivers, tributaries, and lakes in the Truckee, Walker, Humboldt, and Quinn River systems, as well as several streams outside these river basins. A severe decline in range and numbers occurred due to competition and hybridization with introduced trout and a number of other factors leading to the destruction of stream and lake habitats. The riparian and channel conditions of streams were extensively and severely degraded by pollution and waste from logging, mining, and urban development; diversion dams; channel modification and erosion; de-watering for irrigation, municipal, and industrial uses; and watershed and riparian degradation by grazing of livestock. The fish occupies one tenth of its former stream habitats, and less than one percent of former lake habitats.

The LCT Recovery Plan was completed by the FWS in 1995. Implementation depends upon substantial cooperation among federal, state, and local agencies and private landowners to manage resources consistent with the habitat needs of the fish. The FWS has formed multi-party recovery implementation teams (RIT) that are developing action plans to, among other things, enhance and restore riparian habitats adjacent to water ways where LCT populations are intended to be sustained. Favorable ecological conditions needed to recover reproducing LCT populations in streams are characterized as relatively cool water, pools close to vegetative cover and velocity breaks, well vegetated and stable stream banks, and relatively silt free rocky substrate in riffle-run areas.

Federal law requires the BLM and USFS to restore and maintain riparian habitats consistent with recovery plans, and to ensure agency land use plans and activities are consistent with conservation and management of habitats occupied by LCT. A substantial portion of the riparian areas of streams targeted for LCT recovery are privately owned and used for a variety of agricultural, urban, and industrial purposes. Some private landowners who recognize the economic and ecological benefits of improving riparian habitats already have taken steps to modify harmful land use activities. To stimulate additional efforts, federal agencies encourage participation in various conservation incentive programs that compensate landowners for changing land use, installing protective measures and riparian habitat improvements. The NDOW supports LCT recovery as well, but complications arise in some rivers and streams where native fishes and introduced game species compete for habitat. On public lands, federal laws and agency policies direct resource managers to implement measures with grazing and mining permittees that reduce impacts and improve riparian conditions.

Recovering Native Trout and Riparian Habitat at Mahogany Creek

Restoration of aquatic and riparian habitat and recovery of threatened LCT continues within the Lahontan Cutthroat Trout Natural Area, managed by the BLM, and Summit Lake on the Summit Lake Paiute Indian Reservation. Since building livestock exclosures along sections of Mahogany Creek, riparian conditions improved and fish numbers rebounded. A number of streams on public land have recovered after resting and fencing degraded riparian areas. On some recovered streams, resource managers and ranchers have recommenced grazing under rotational schedules customized for site ecological conditions. The NRCS, FWS, NDOW, and NDEP are some of the federal and state agencies that operate incentive programs to obtain the cooperation of private ranch operators with recovery on their land. Mahogany Creek feeds Summit Lake, the only Nevada refuge for naturally reproducing LCT within its native range. Jim Morefield photo.

The geographic areas where RITs are concentrating LCT habitat recovery activities lie within the Truckee, Walker, Quinn and Humboldt River systems. In the Humboldt River basin, the FWS proposes to maintain and recover LCT populations in the Marys River, North Fork Humboldt River, East Humboldt River area, South Fork Humboldt River, Maggie Creek, Rock Creek, Reese River, Little Humboldt River, and the Lower Humboldt River subbasins. At this time, the planning areas in Nevada are the mainstem of the Truckee River, Hunter Creek, Pyramid Lake; and, the East Walker, West Walker, the mainstem of the Walker River below the confluence and Walker Lake.

In addition to the RITs working on LCT recovery, several others have been established threatened and endangered fishes in spring and stream systems of eastern and southern Nevada. Almost all the fishes are globally rare and dwell in the pools or brooks of isolated spring systems, some of which are confluent to minor rivers. These springs also contain endemic springsnails. The active membership of the RITs varies, typically consist of biologists with federal and state agencies, but the Southern Nevada Water Authority and land conservancy organizations also participate. Their teamwork focuses on reestablishing, maintaining, and monitoring fish populations and habitats; providing technical assistance to landowners interested in conservation; seeking potential cooperators in conservation agreements or acquisitions for protection; and managing resources to remove or reduce factors threatening at risk populations or the aquatic-riparian habitats. The geographic scope and fish species targeted for special management,

Table 4.8 Recovery Implementation Team Plan Areas and Covered Federal and State Protected Fish Species

RIT Focus Area	Recovery Plan Focus Species
White River Valley	White River spinedace Moorman White River springfish Preston White River springfish White River speckled dace White River desert sucker
Pahranagat Valley	White River springfish Hike White River springfish Pahranagat roundtail chub Pahranagat Valley speckled dace
Railroad Valley	Railroad Valley springfish Railroad Valley tui chub
Muddy River - Moapa Valley	Moapa dace Virgin River roundtail chub Moapa White River springfish Moapa speckled dace
Virgin (River) Valley	Woundfin Virgin River roundtail chub Flannelmouth sucker Virgin River desert sucker Virgin River spinedace
Condor Canyon and Meadow Valley Wash	Big Spring spinedace

Note: LCT RITs not included. See LCT section, above.

conservation, and recovery actions are listed in Table 4.8. All the fishes listed are part of a recovery plan effort, but critical habitat has not been secured for some of the species.

Mojave and Great Basin Ecoregional Conservation Plans, The Nature Conservancy, 2002. The TNC vision for Nevada is to "ensure the long-term survival of all viable native species, natural communities, and ecological systems through the design and conservation of functional conservation areas." In 2001, TNC published conservation area assessments for the Great Basin and the Mojave Desert ecoregions. The purpose was to "plan for site-based actions to conserve biodiversity within ecologically-defined areas." The assessments evaluate hundreds of conservation targets in seven ecosystem types including aquatic and riparian. Aquatic ecosystems were assessed separately from riparian and wetland ecosystems, but the report notes their interdependence and identifies coinciding aquatic and riparian conservation areas. The primary focus is on conserving rare, endemic plant and animal species and native communities. Data sources included published literature, Nevada Natural Heritage Program databases, regional conservation management plans, and expert interviews (Nachlinger, et.al, 2001; The Nature Conservancy, 2001)

Of 334 areas that TNC characterized as "fully representative of the ecological systems, natural communities, and specific characteristics of these ecoregions," 129 were aquatic and riparian. The ecoregion plans identify aquatic-riparian conservation areas considered "highlighted significant sites." The highlighted areas are:

- Carson River – functional network connecting the Sierra Nevada and Great Basin ecoregions. Excellent examples of spring-fed freshwater marsh systems. Singular habitats for two butterflies at Carson Valley sites; also, desert riparian shrublands for breeding and migratory birds.
- Carson Sink – Lahontan Valley with globally significant concentrations of millions of migratory birds, part of the Western Hemispheric Shorebird Reserve Network. Excellent example of large ephemeral terminal playa lake and dunes.
- Mason Valley – very good examples of freshwater marsh systems and desert riparian shrublands and woodlands important for breeding and migratory birds
- Walker Lake-Walker River – functional network connecting the Sierra Nevada and Great Basin ecoregions. Very good condition freshwater and brackish marshes; important desert riparian shrublands for breeding and migratory birds; Lahontan cutthroat trout river system.
- Pyramid Lake-Lower Truckee River – excellent examples of remnant Fremont cottonwood forests. Important riparian habitats for breeding and migratory birds; spawning habitats for endangered cui-ui and threatened Lahontan cutthroat trout; high diversity of small mammals and bats.
- Ruby Marshes – largest example of a spring-fed terminal lake. Important to migratory waterfowl and shorebirds. Hot springs host endemic aquatic invertebrate and plant.
- Soldier Meadows – hot springs complex with endemic fishes, springsnails, and important plant populations.

- Rainbow Canyon – ribbons of desert riparian shrublands and freshwater marshes among transitional desert uplands. Important for several migratory waterbirds, Meadow Valley Wash desert sucker, and Meadow Valley speckled dace.
- Meadow Valley – ribbons of wet meadows and desert riparian shrubland habitats in transitional desert uplands. Important for migratory waterbirds; singular site for endemic spinedace and pincushion.
- Amargosa River System – includes Ash Meadows, high concentration of biodiversity, described as "the most impressive suites of endemic, isolated, and imperiled species in the western hemisphere;" Important for mesquite bosque riparian woodland, mixed cottonwood-willow riparian woodland, interior riparian marsh and seep, plants, amphibians, birds, aquatic invertebrates
- Meadow Valley Wash – one of the longest contiguous riparian zones in the ecoregion; important as a wildlife corridor; important for mixed cottonwood-willow riparian woodland; Lower Wash important for Mesquite bosque-riparian woodland.
- Muddy River, Upper and Lower – large, functionally intact linear riparian corridor, including interior riparian forest and woodland; mixed cottonwood-willow woodland, marsh and seep, and riparian shrubland; critical nesting area and foraging site for breeding birds
- Virgin River, Upper, Middle, and Lower – large, functionally intact linear riparian corridor, including mixed cottonwood-willow woodland, marsh and seep, and riparian shrubland; critical nesting area and foraging site for birds and other wildlife; important for migratory shorebird and waterfowl, amphibians
- White River System – numerous isolated springs and brooks, wet meadows, alkaline substrates, and desert riparian shrublands; important for fishes, amphibians, aquatic invertebrates, butterflies, and plants.
- Pahranagat River Valley – perennial stream and springs; riparian corridor of significant length and regional importance for amphibians, fishes, aquatic invertebrates, mammal, migratory birds and waterfowl. Important for interior riparian marsh and seep, interior shrubland, and mixed cottonwood-willow riparian woodland. Singular site for three endemic fishes.

The wetland types highlighted as biologically significant are:

Isolated perennial stream	Mixed Cottonwood-Willow riparian woodland
Interior riparian marsh and seep	Mesquite bosque riparian woodland
Interior riparian forest and woodland	Interior riparian shrubland;
Terminal lake, ephemeral playa lake, terminal marsh	Freshwater marsh
Spring pool, brook, and marsh	Cottonwood riparian woodland

In general, the functions and values highlighted by TNC for the wetlands and riparian areas focus on the biodiversity of aquatic-wetland/riparian ecosystems.

- A disproportionately large share of the rare and endemic species in Nevada occurs in the small amount of space occupied.
- The ecology of some aquatic-wetland sites is so unusual or isolated that many species occur in a few sites or only one.
- Abundance of water, cover, and food supply all forms of wildlife, but especially migratory birds, and endemic fishes, amphibians, aquatic invertebrates (e.g., insects, springsnails, crustaceans). TNC cites research that found about 80 percent of the birds and 70 percent of butterflies are associated with riparian areas.
- Maintaining hydrologic regimes.

With regard to threats, the TNC observes that survival of aquatic and wetland organisms and communities is inherently tenuous in desert and semi-arid settings, especially the Mojave Ecoregion. Wetland and riparian ecosystems have a high sensitivity to resource use and management that alter hydrology and

watershed and floodplain hydrogeomorphic processes. Plant communities, and rare and common wildlife, have adapted to arid hydrologic regimes. Changes in the frequency, intensity, and duration of, for example, bank full flow and floodplain inundation, has been found to restrict regeneration or rejuvenation of some native riparian plant communities, thereby leaving gaps in corridors used for migration, routine movement, and dispersal. The Mojave Regional Plan presents a matrix of threats to habitats and native occupants with the addition of comments on stresses, wet ecosystem types affected, severity/reversibility, strategies, and partners. The combined list of threats TNC identified are:

- Water withdrawals that alter the surface and underground flow in riverine, spring, and playa systems;
- Hydro-modification of riverine and spring systems. Diversion dams, irrigation canals and drains, channelized watercourses;
- Excessive grazing by livestock and feral horses and burros. Negative affects on plant community composition and structure, vegetative cover, soil infiltration, biotic soil crust, channel stability, food and cover for wildlife, spread of exotic plants;
- Intensive agriculture. Consumes large quantities of water, changes hydrologic regime, water quality impairment and siltation;
- Mining. Destroys habitat, alters groundwater hydrology, discharges toxics, alters soil and ecological succession;
- Residential, commercial (urban) development. Replaces natural habitat and degrades habitat on adjacent wildland, withdraws more water;
- Groundwater withdrawal. Interrupts water movement and results in loss of habitat and alters species composition;
- Roads and highways. Fragments habitats, gives access to motorized recreation use in unmanaged area, disconnects surface flow hydrology;
- Utility corridors. Fragments habitats, gives access to motorized recreation in unmanaged area, enables exotic plant invasion;
- Vehicular recreation. Disturbs behavior of wildlife, new roads and trails created in unmanaged area;
- Military ground and air training activities. Destroys biotic soil crust and native vegetation, enables exotic plant invasion, disturbs wildlife behavior;
- Invasive exotic species. Alters native plant communities, displaces native biota, alters fire cycle, predation on native species by exotics;
- Outdoor recreation activities. Types that destroy native flora and habitat, allow camping near springs and streams, disrupt wildlife behavior, inhibit wildlife use;
- Solar and wind energy development. Destroys and fragments habitat; and,
- Global warming/climate change. Loss and conversion of habitat; alters flow regime.

The TNC identifies conservation strategies in the ecoregional plans. To achieve conservation objectives, TNC commonly acquires or accepts donated land, water rights, or conservation easements. Title to property or water rights may be retained, resold or conveyed to a government agency, or otherwise secured. Resource management and restoration plans typically are prepared for tracts and water resources retained by TNC. Federal conservation easement programs have been used by TNC in partnerships with private landowners, such as the Wetland Reserve Program administered by NRCS.

Southern Nevada Public Lands Management Act (Environmentally Sensitive Land Acquisition Program), Federal Land Managers, Clark County, and Nevada Department of Conservation and Natural Resources. The most well funded acquisition program operating in Nevada is the Southern Nevada Public Land Management Act, or SNPLMA. Among other authorized activities, the SNPLMA directs the Secretary of the Interior to sell public land within a designated urban growth area surrounding Las Vegas and to apply the revenue toward purchases of non-federal land (fee title or conservation easement) that are deemed environmentally sensitive. Water rights appurtenant to the land also may be

purchased. The Act identifies Clark County as the priority location for acquiring nonfederal land or easements, but provides for acquisitions of environmentally sensitive land throughout the state. The approval authority resides in the office of the Secretary of Interior. To obtain approval, the tracts of land proposed for purchase must meet minimum environmental significance and public benefit criteria. Land or water proposed for purchase and transfer to the public domain must be identified for protection or acquisition in a federal land management plan, a process requiring local government direction. Thus, the nomination and recommendation of wetland and riparian resources for SNPLMA purchase reflects priority sites of both public land management agencies and local agencies.

The general criteria of "environmentally sensitive" means "natural, scientific, aesthetic, historical, cultural, watershed, wildlife and other values contributing to the public enjoyment and biological diversity; enhance recreational opportunities and public access; provide the opportunity to achieve better management of public land through consolidation of Federal ownership; or otherwise serve the public interests." The BLM facilitates the nomination and selection process, which directly involves state resource agencies and local government. The owner and a government sponsor, or any local government, a federal or state resource management agency, or nonprofit conservation organization may nominate a tract of land for purchase with SNPLMA funds. Local government must support the sale of the property, and the owner must be a willing seller. The land for sale must demonstrably provide public benefits. The executive decision-making group consists of officials with the BLM, NPS, and the FWS. To qualify, a tract of land must satisfy one or more strategic objectives, some of which tend to favor selection of wetland and aquatic resources:

- Acquire in-holdings with significant natural resource values within the boundaries of National Conservation Areas, National Wildlife Refuges, National Recreation Areas, and other public lands;
- Support the recovery of threatened or endangered species and prevent the listing of at risk species by acquiring and protecting critical habitat;
- Protect the riparian areas associated with at-risk species, improve the quality and quantity of water resources, and provide recreational opportunities; and,
- Enhance recreation opportunities and protect significant wildlife habitat (including threatened or endangered species habitat).

The BLM maintains a web page that summarizes SNPLMA acquisition activities and a description of the properties approved for acquisition (http://www.nv.blm.gov/snplma/default.asp). During the first four rounds ninety-eight project proposals were approved. Sixty-four projects (about two-thirds) entail riparian and/or wetland features. The types of habitats frequently identified are higher and lower elevation riparian zones associated with rivers and streams, as well as with spring systems, ponds, and reservoirs; wet meadows; freshwater and alkali marsh; and, seasonal pools. Of the sixty-four projects:

- Forty-four were identified as critical or important habitat for threatened, endangered, or sensitive species, or species of concern that inhabit wetlands, including migratory birds, endemic fishes, and endemic plants. A like number were characterized as possessing recreation values or providing access to public recreation sites.
- Among the five major rivers in Nevada, only projects for the Truckee and Carson rivers were approved. Several projects were approved for the Muddy and Virgin rivers, tributaries to the Colorado River. Other prominent project sites include Railroad Valley, Washoe Valley, springs and streams in the Spring Mountains, and Ash Meadows (Amargosa River Valley).
- Some land acquisition projects included appurtenant water rights.
- Eleven counties had projects approved: Clark (17), Washoe (16), Douglas (8), Nye (6), Carson City (5), Elko (5), Lyon (3), Esmeralda (2), Humboldt (2), Mineral (1), and Storey (1).

Approximately 88,000 acres of conservation lands were approved for acquisition by the end of the fourth round. The total includes the proposals offering conservation easement deals, which involve agricultural lands in floodplains of the Virgin and Carson rivers. The most often cited threat to the aquatic-wetland resource was urban development. Several of the property acquisition proposals specify that the wetlands will require restoration. Most sites planned for restoration were heavily grazed ranchlands.

Wetlands Reconnaissance/Inventory Mid-Pacific Region. Bureau of Reclamation, Lahontan Basin Area Office, 1993. The Mid Pacific Region of the BOR inventoried wetland areas on agency-owned and managed land in western Nevada during 1992 (USBOR. 1993). For the most part, these are artificial wetlands associated with irrigation and water development structures. The intention was to locate BOR lands having potential for: 1) restoration and protection of functions and values; 2) the enhancement and expansion of existing wetlands; and, 3) development of new wetland areas through changes in project operation, water level manipulation, revegetation, and other structural and non-structural measures. The Nevada portion of the study encompassed Pershing, Churchill, and Lyon counties. The priority objective was replacement of lost wetland acreage historically used by waterfowl and migratory birds as spring and fall migration staging and wintering habitat within the Pacific Flyway. Section 9 of the North American Wetlands Conservation Act of 1989 directs federal land and water management agencies to cooperate with the FWS to restore, protect, and enhance wetland ecosystems and other habitats for migratory birds, fishes, and wildlife consistent with agency mission. In 1992, the agency was working under a revised management policy that raised the priority on protection and restoration of environmental resources. Study project cooperators include the NDOW, FWS, and Lahontan Basin Area Office of the BOR.

Six priority sites were selected for detailed study with regard to restoration, enhancement, expansion, or development potential. Observed wetland hydrology, soils, and vegetation characteristics of the sites were created, enhanced, or expanded by subsurface or surface drainage from extant irrigation works or irrigated farmland. Proposed wetland improvements at each site would require hydro-modifications (e.g., dikes, ditches, drains, etc.) and dedicated surface water allocation. The priority sites and recommended action were:

- Harmon Reservoir – enhancement of 290 acres
- Fernley Wildlife Management Area – enhancement of 184 acres
- Old River Reservoir – restoration and enhancement of 165 acres
- Mahala Sloughs – enhancement/expansion of 13 acres
- Lahontan Reservoir – enhancement of 632 acres
- Scheckler Reservoir – restoration/development of 166 acre

Wetland functions and values noted in the report are:

- Migratory waterfowl and shorebird habitat for staging and breeding;
- Education and recreation (interpretive) opportunities;
- Sediment retention; and,
- Water quality improvement.

Threats and vulnerabilities observed at the sites included:

- Heavy grazing;
- Invasive or noxious weeds;
- Poor water quality (natural and agricultural sources); and,
- Insufficient water supply.

In addition to the proposed wetland acreage enhancements, the BOR recommended:

- Establishing wildlife management areas at Lahontan (Carson River inlet arm) and Harmon Reservoirs;

- Building fences to exclude or control grazing;
- Acquiring dedicated water supply allocations and managing water suitable for waterfowl and shorebird habitat needs;
- Monitoring changes in wetland vegetation with implementation of water management practices.

The BOR may manage wetland and riparian resources along the Lower Colorado River, but whether the Lower Colorado Regional Office has a comprehensive riparian wetland resource management plan is not clear. Information sought about priorities apparently was not available.

Scorecard 2000: Highest Priority Conservation Sites, NNHP, 2000. The NNHP maintains an inventory and current databases on the locations, biology, and conservation status of all rare endemic, threatened, endangered, and sensitive species and biological communities in the state. The "scorecard" refers to the method used by state Natural Heritage Programs nationwide to "score" the conservation status of rare and vulnerable species and the sites containing the greatest number and diversity of relatively vulnerable species. The NNHP updates the Scorecard every two to four years, resulting in a set of sites highlighted for the presence of the state's most imperiled fish, amphibians, reptiles, birds, invertebrates, plants, and nonvascular plants. The species are ranked on a scale from one to five based on their vulnerability to loss or destruction, with one the most vulnerable and five the most secure. As occurrence records of species are added to the databases vulnerability ranks are reviewed and each occurrence is tentatively assigned to a "conservation site." A Scorecard conservation site is a landscape unit defined by mapped occurrences of sensitive species that may be managed as a unit based on common biological, land-ownership, and conservation-planning criteria. Figure 4.1 is a map showing the locations and names of highest biodiversity priority conservation sites identified in Scorecard 2000.

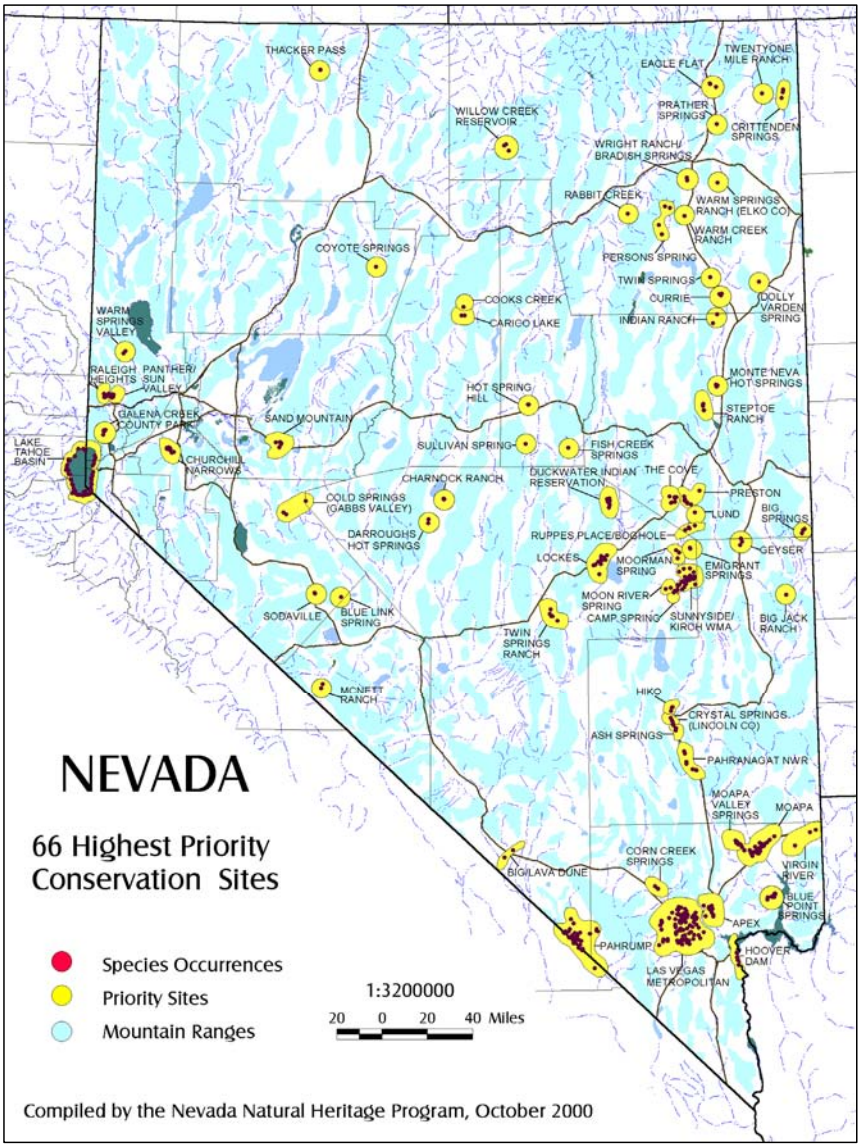
Rare Flora at Sodaville Springs, a Scorecard Site

In addition to rare endemic fishes, amphibians, mollusks, and insects, spring wetland habitats host rare native plant species. One endemic is the Sodaville milkvetch (*Astragalus lentiginosus* var. *sesquimetralis*). The ground hugging plants live in moist, alkaline hummocks and drainages near cool springs. The perennial herb produces purple flowers. Two populations exist, which are protected under Nevada law administered by the Nevada Division of Forestry. A permit and approval of a protection plan must be obtained for land use activities that might impact the populations of state protected plants. Threats to Sodaville milkvetch include commercial development, water diversion, animal grazing and trampling, off-road vehicle use, and competition from invasive nonnative plants. A seldom considered concern applicable here is the threat these land use activities pose to pollinating insect populations. Jim Morefield photo.

To prepare the 2000 Scorecard, the conservation status of six hundred sixty rare and sensitive native animals and plants was examined. The site selection, delineation, and assessment process begins with a review of all sensitive species occurrence records (currently numbering over seven thousand) to identify sites containing the greatest number and diversity of vulnerable species occurrences. The result is assignment of a Biodiversity Significance Rank (one to five, one being most significant) for each site. The sites are reviewed further to ensure that all contained occurrences are assigned to the most

appropriate site. Once the NNHP staff determines stable site definitions and Biodiversity Significance Ranks, they meet with a network of expert biologists, botanists, and ecologists to review the sites. Each site is ranked according to its Protection Urgency and Management Urgency, again on scales from one to five (one signifying most urgent). Sites that rank highest (the lowest sum) for the combination of Biodiversity Significance, Protection Urgency, and Management Urgency, form the working list of "highest-priority" conservation sites. Biologists, land management, and conservation professionals, and other knowledgeable people throughout the state review the draft list and provide additional data and recommendations that are incorporated into the assessment process. The NNHP Scorecard points to sites with flora and fauna requiring immediate remedies to reduce the risk of extirpation or extinction.

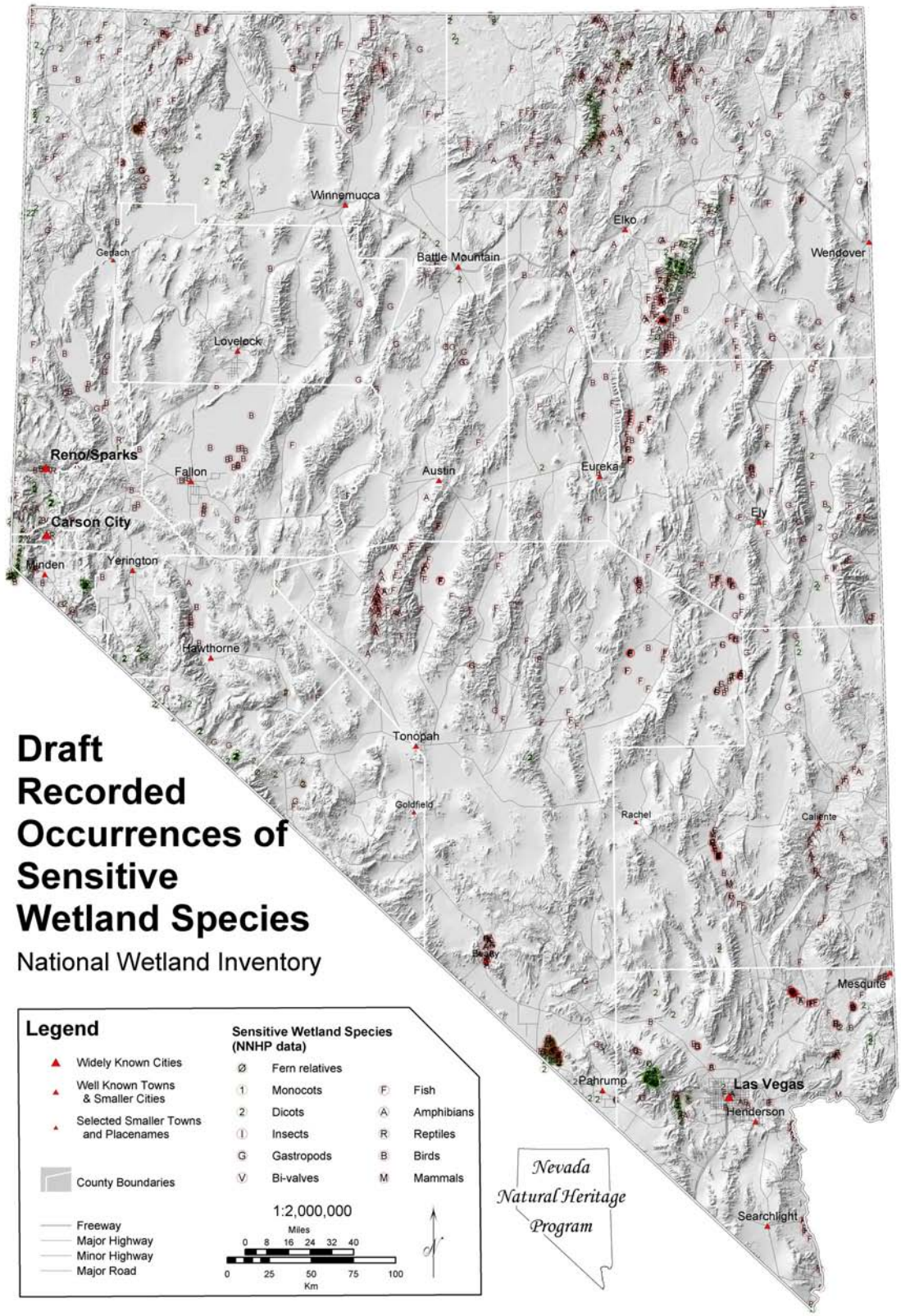
Figure 4.1 Map of NNHP Highest Priority Conservation Sites – Scorecard 2000



Though wetlands cover a tiny fraction of the land base, a third of the at-risk species tracked by the NNHP are aquatic-wetland dependent. This means the species is found: 1) only in aquatic or wetland habitats; 2) in such habitats for a portion of their life cycle; or, 3) in habitats in close proximity to, or are otherwise influenced by, aquatic or wetland habitats (e.g., dry meadow margins, the shade of riparian vegetation, soils derived from parent material created by spring outflows, or the shore zones of lakes or ponds). Figure 4.2 shows the known occurrences of wetland dependent species considered to be of high biodiversity significance, vulnerable to human activities or degraded conditions resulting from land uses and development, and urgently requiring appropriate management action.

Using the NNHP Scorecard method in 2000 to evaluate the current conservation status of at-risk species and their known occurrences resulted in identification of sixty-six highest priority biodiversity conservation sites were identified. Fifty-eight of the priority conservation sites host one or more aquatic-wetland dependent sensitive species. Table 4.8 lists the Scorecard 2000 sites and pertinent where at-risk and sensitive wetland species occur.

Figure 4.2 Occurrences of At-Risk and Sensitive Wetland Dependent Plant and Animal Species Mapped by the NNHP



Map compiled by the Nevada Natural Heritage Program, January 2005. Map is intended to depict general distribution of rare and sensitive wetland affiliated plant and animal species tracked by the NNHP.

Table 4.9 NNHP Highest Priority Conservation Sites Associated with Wetland Dependent Species

Macrosite Name / Scorecard Site Name	Wite Ranks	Owners Known	Owners Possible	Elevation (Feet)
Antelope Valley (Elko/White Pine Co)				
Site: Dolly Varden Spring	B1 P1 M1	p		5680-5680
Antelope Valley (Eureka Co) Macrosite				
Site: Sullivan Spring	B1 P1 M1	p	f	6800-6800
Big Smoky Valley North Macrosite				
Site: Charnock Ranch	B1 P1 M1	pb		5470-5495
Site: Darroughs Hot Springs	B1 P1 M1	p	f	5600-5600
Carico Lake Valley Macrosite				
Site: Carico Lake	B1 P1 M1	bp		5100-5320
Site: Cooks Creek	B1 P1 M1	b	p	5360-5360
Clover Valley Macrosite				
Site: Bradish Spring	B1 P1 M1	p		5800-5800
Site: Warm Creek Ranch	B1 P1 M1	pb		5800-5800
Site: Wright Ranch	B1 P1 M1	p		5780-5780
Delano Mountains Macrosite				
Site: Crittenden Springs	B1 P1 M1	p	n	5240-5280
Fish Creek Valley Macrosite				
Site: Fish Creek Springs	B1 P1 M1	p		6020-6020
Fish Lake Valley Macrosite				
Site: Mcnett Ranch	B1 P1 M1	p		4795-4795
Gabbs Valley Macrosite				
Site: Cold Springs (Gabbs V.)	B1 P1 M1	bp	n	4150-4300
Hamlin Valley Macrosite				
Site: Big Springs	B1 P1 M1	p		5560-5560
Hot Creek Valley/Palisade Macrosite				
Site: Twin Springs Ranch	B1 P1 M1	bp		5050-5200
Independence Valley Macrosite				
Site: Warm Springs Ranch (Elko Co)	B1 P1 M1	pb		5615-5615
Kobeh Valley Macrosite				
Site: Hot Spring Hill	B1 P1 M1	b		6110-6130
Lake Mead Macrosite				
Site: Blue Point Springs	B1 P1 M1	k	n	1440-2630
Site: Hoover Dam	B1 P1 M1	k		675-1510
Lake Tahoe Basin Macrosite				
Site: Lake Tahoe (Aquatics)	B1 P1 M1	n	t	6000-6000
Site: Lake Tahoe (Beach)	B1 P1 M1	ptn		6200-6280
Lake Valley Macrosite				
Site: Geyser	B1 P1 M1	p		5080-5960
Lamoille/Pleasant Valley Macrosite				
Site: Rabbit Creek	B1 P1 M1	p	n	5600-5600

Macrosite Name Scorecard Site Name	Site Ranks	Owners Known	 Possible	Elevation (Feet)
Las Vegas Macrosite				
Site: Corn Creek Springs	B1 P1 M1	wp	db	2918-2920
Site: Las Vegas Metropolitan	B1 P1 M1	pbnd		1695-4350
Moapa Valley Macrosite				
Site: Logandale/Overton	B1 P2 M1	bknp		1000-2000
Site: Moapa	B1 P1 M1	bnpi		1330-2400
Site: Moapa Valley Springs	B1 P1 M1	pwn	b	1172-1830
Montana Mtns/Double H Mtns Macrosite				
Site: Thacker Pass	B1 P1 M1	p	n	4440-4560
Pahranagat Valley Macrosite				
Site: Ash Springs/ Pahranagat R.	B1 P1 M1	pb		3480-3680
Site: Crystal Springs (Lincoln Co)	B1 P1 M1	p	n	3600-4000
Site: Hiko	B1 P1 M1	pn	b	3860-4000
Site: Pahranagat NWR	B1 P1 M1	w		3160-3400
Pilot Mountains Macrosite				
Site: Blue Link spring	B1 P1 M1	b		6440-6440
Pleasant Valley Macrosite				
Site: Coyote Springs	B1 P1 M1	p		4720-4720
Railroad Valley Macrosite				
Site: Duckwater Indian Reservation	B1 P1 M1	ipb		3380-5610
Site: Lockes	B1 P1 M1	bpn		4725-5350
Ruby Valley Macrosite				
Site: Persons Spring	B1 P1 M1	pb	fln	6250-6440
Sheep Creek Range Macrosite				
Site: Willow Creek Reservoir	B1 P1 M1	pb		5398-5600
Soda Spring Valley Macrosite				
Site: Sodaville	B1 P1 M1	bp		4635-4705
Steptoe Valley Macrosite				
Site: Currie	B1 P1 M1	bp	n	5870-5873
Site: Indian Ranch	B1 P1 M1	bp		6000-6626
Site: Monte Neva Hot Springs	B1 P1 M1	pb		5938-6000
Site: Steptoe Ranch	B1 P1 M1	p	b	6040-6140
Site: Twin Springs	B1 P1 M1	p		6200-6200
Thousand Springs Valley/Creek Macrosite				
Site: Twentyone Mile Ranch	B1 P1 M1	p		5160-5160
Virgin Valley Macrosite				
Site: Virgin River	B1 P1 M1	n	p	1220-1575

Macrosite Name Scorecard Site Name	Site Ranks	Owners Known Possible	Elevation (Feet)
White River Valley Macrosite			
Site: Camp Spring	**B1 P1 M1**	**p**	**5180-5180**
Site: Emigrant Springs	**B1 P1 M1**	**p**	**5460-5480**
Site: Lund	**B1 P1 M1**	**p**	**5598-5600**
Site: Moon River Spring	**B1 P1 M1**	**pb**	**5188-5290**
Site: Moorman Spring	**B1 P1 M1**	**pb**	**5265-5305**
Site: Preston	**B1 P1 M1**	**pnb**	**5600-6360**
Site: Ruppes Place/Boghole	**B1 P1 M1**	**pb**	**5350-5630**
Site: Sunnyside/Kirch WMA	**B1 P1 M1**	**nbp**	**5150-5650**
Site: The Cove	**B1 P1 M1**	**pb**	**5940-6170**
White Rock/Wilson Creek Range Macrosite			
Site: Big Jack Ranch	**B1 P1 M1**	**p**	**7000-7000**
Windermere Hills Macrosite			
Site: Prather Springs	**B1 P1 M1**	**p**	**5920-5920**

Scorecard 2000 – Column Explanation and Code Key

Site Name: Site Names in bold are *Highest* Priority Conservation Sites (i.e., B1, P1, M1 rank)

Site Rank:
Biodiversity Significance Of Site:
1 – Outstanding significance (only known or highest quality population of a G1 or T1 taxon; concentration of higher quality G1/T1, G2/T2, or declining taxa).
2 – Very high significance (lower quality G1/T1; higher quality G2/T2 or G3/T3; concentration of moderate quality G2/T2, G3/T3, or declining taxa).
3 – High significance (lower quality G2/T2; higher quality G3/T3; concentration of high quality S1 taxa).
4 – Moderate significance (lower quality G3/T3; higher quality or only S1 population; highest quality S2; concentration of higher quality S2 or S3s).
5 – Of general biodiversity interest or open space.
Protection Urgency Of Site:
1 – Good chance of being immediately threatened (within 1 year of rank date) by severely destructive forces.
2 – Threat expected within 5 years.
3 – Definable threat, but not in next 5 years.
4 – No threat known for foreseeable future.
5 – Land protection complete or adequate reasons exist not to protect the site.
Management Urgency Of Site:
1 – Loss or irretrievable degradation of populations could occur within 1 year without immediate new, or ongoing annual, management.
2 – Loss of populations could occur within 5 years without new or ongoing management action.
3 – Quality of populations could degrade within 5 years without new or ongoing management action.
4 – Although not currently threatened, management may be needed in the future to maintain current quality of populations.
5 – No serious management needs known or anticipated at site.

Land Ownership Symbols: These symbolize the major land-management categories in which the site is known to occur in Nevada, roughly in descending order of dominance for the site. These cannot be guaranteed to be either complete or entirely accurate, and are intended only for general information purposes. Owners known are those for which we have documentation, and possible are uncertain and/or nearby.

b – Bureau of Land Management (US Department of the Interior), Nevada districts
c – County land or right-of-way
d – US Department of Defense (Fallon, Hawthorne, Nellis, or Wendover)
e – US Department of Energy (primarily Nevada Test Site)
f – Forest Service (US Department of Agriculture), Humboldt-Toiyabe National Forest (Region 4)
i – Indian reservations and colonies
k – National Park Service (US Department of the Interior; Death Valley, Great Basin, Lake Mead)
l – Wilderness areas (all agencies)
m – Municipal land or right-of-way
n – State of Nevada (parks, transportation corridors, university, waters, wildlife management areas)
p – Private
r – Bureau of Reclamation (US Department of the Interior)
s – Bureau of Land Management (US Department of the Interior), California resource areas.
r - Forest Service (US Department of Agriculture), Lake Tahoe Basin Management Unit (Region 5)
w – Fish and Wildlife Service (US Department of the Interior; wildlife ranges and refuges)
y – Forest Service (US Department of Agriculture), Inyo National Forest (Region 5)

Elevation: range in feet for all occurrences belonging to the site.
Maximum Distance: the greatest distance between any two occurrences belonging to the site (to indicate the approximate size of the site).

Nevada Comprehensive Wildlife Conservation Strategy, NDOW, 2005. Congress created the federally funded State Wildlife Grants Program to encourage and assist states in efforts to prevent wildlife from becoming endangered. The grant program provides funding to NDOW for statewide wildlife management studies, plans, and habitat improvement activities. Eligibility for the federal funding requires completion of a Comprehensive Wildlife Conservation Strategy (CWCS). The Department of Wildlife completed the Nevada CWCS in August 2005. Traditionally, state wildlife agencies have focused conservation efforts on game species of wildlife. The purpose of the Nevada CWCS is to provide an action plan "for state wildlife conservation and funding by targeting the species of greatest conservation need and the key habitats on which they depend." The process was conducted in consultation with agency, research institution, and conservation organization biologists and ecologists, as well as knowledgeable people in special interest groups.

The Nevada CWCS process generated conservation strategies, objectives, and actions that address the biological and ecological needs of the species of conservation priority. The strategies are organized in a "key habitat" framework, each key habitat associated with an assemblage of birds, mammals, amphibians, fishes, reptiles, or invertebrates. Each key habitat comprises a group of ecological systems as classified and mapped by the Southwest Regional Gap Analysis Project (Southwest ReGAP, 2005). The species of conservation priority cover identified in the CWCS entail birds, fishes, mammals, reptiles, amphibians, and aquatic invertebrates, in particular, bivalves, gastropods, and insects. Criteria used to select priority taxa include federal or state regulatory protection status; rarity and sensitivity assessment rank by the NNHP; severity of threats to life history elements or habitat needs; percentage of native range in Nevada; limited knowledge of species; and, opportunity to learn more about or improve the conservation status. Appendix 4.3 lists the wetland and riparian key habitats and associated primary focal areas identified in the Nevada CWCS.

Nevada Wetland Priorities

To be placed on the Nevada list of priority areas and sites (and thereby qualify for acquisition with a grant from the Land and Water Conservation Fund), a wetland must meet these criteria:

- Is a type of wetland identified as rare or as having undergone significant decline;
- Is subject to imminent loss and/or degradation by one or more ongoing or impending land use activities; and,
- Possesses important values, relative to the ecological and socioeconomic setting.

Rare or Significantly Declining Wetland Types. The following wetland types are considered to be rare or having undergone significant decline, based on information contained in the wetland and associated resource conservation plans that are summarized in Part 4. Inclusion of hydrographic regions refines the area of concern.

1. Riparian zone and marsh types adjacent to desert spring pools and brooks in Colorado River Basin, Death Valley Basin, and eastern and southern arms of the Central Region.
2. Riparian zone and marsh in floodplain of major and minor river valleys of the Carson, Colorado, Humboldt, Truckee, and the Walker River basins.

Riparian Woodland and Marsh

Patricia Stoddard photo
Courtesy of Nevada Biodiversity Initiative

3. Riparian zone of isolated streams and aspen woodland communities in the mountain ranges of the Northwest Region, Black Rock Desert Region, north-center and east arm of the Central Region, Colorado River Basin, Humboldt River Basin, and Snake River Basin.
4. Large marsh and marsh/upland complexes in lower elevation valleys and terminal basins in the Carson River Basin, Truckee River Basin, Walker River Basin, Death Valley Desert Basin, and Central Region
5. Wet meadows in mountain ranges of the Humboldt River Basin, Central Region, Northwest Region, and Black Rock Desert Region.
6. Ephemeral playa and pool in the Northwest Region, Western Region, Truckee River Basin, Carson River Basin, and Walker River Basin.

Major Threats. The land use activities frequently associated with the ongoing loss and deterioration of rare and declining wetland types include:

- Surface water diversion
- Groundwater withdrawal
- Hydrologic modifications
- Urban or rural development
- Domestic livestock grazing
- Farm encroachment
- Mine development
- Transportation and linear public utilities development
- Invasion of nonnative plant species

In the wetland priority evaluation process, a "threat" rank will be assigned to each proposed site that represents the relative degree of influence that these land use activities are having, or can reasonably be expected have on the site in the next five years.

Important Functions and Services. The ecological functions and socioeconomic services recognized as important to the natural and human communities in the state include:

- Hydrology and water resource maintenance
- Erosion and sediment control
- Flood control
- Water quality maintenance and improvement
- Wildlife habitat, food web support, and biodiversity
- Wetland compatible economic uses
- Outdoor recreation, research, and education

In the wetland priority evaluation process, a relative "value" rank will be assigned to each proposed site that represents known functions and services, and in addition, the opportunity for functions and services to occur based on wetland type characteristics and location.

Process for Evaluating and Ranking Wetland Priorities. The following is the NvWP list of areas and sites proposed for wetland conservation priority. It was compiled from the indexes presented in Appendices 4.1, 4.2, and 4.3. Technical advice from managers and scientists knowledgeable about wetland resources will be sought to refine the list and to evaluate and rank the proposed areas and sites.

Railroad Valley Spring System Complex, a Proposed Wetland Priority Conservation Area

The Railroad Valley springfish is the only fish species native to the Railroad Valley thermal spring system complex in Nye County. The "threatened" conservation status of the species and poor habitat conditions prompted state and federal agency action. To assist in recovery of the springfish (*Crenichthys nevadae*), 460 acres was acquired adjacent to Railroad Valley Wildlife Management Area. The purchase was funded with grants from the FWS Recovery Lands Acquisition Program and Nevada Question 1 Bond Program grant, and facilitated by the Trust for Public Lands. Shorebirds, waterfowl, and numerous at-risk plant and invertebrate species will also benefit from plans for restoring the spring systems of the valley to historic flow patterns and rejoining the springfish populations surviving in nearby springs. A factor in the evaluation of conservation priority for at risk species is management need. As habitat restoration and management actions are deemed sufficient to protect the viability of fish populations, the species may be given a lower priority rank. A similar approach may be used to assess wetland priority conservation status. Glenn Clemmer photos

Wetland Areas and Sites Proposed for Priority Evaluation. To proceed with the NvWP priority process, technical input from knowledgeable people involved in the management or conservation of the wetlands and associated resources is needed. An extensive list of areas and sites has been drawn from the preceding resource conservation plan summaries (Table __). The wetland areas and sites vary in size, entailing a valley, river basin, major river tributary, mountain range, or more specific location, depending on the level of analysis used by the planning team. Because the purpose of and approach to identifying and circumscribing the areas and sites varies by plan, there is a lack of congruity between areas and sites in the Table 4.9 list that remains to be rectified. At this point, we prefer to generate a raw list for review and figure out how to consolidate areas and sites after input from reviewers has been received. Appendix 4.1 is a compilation of relative large geographic areas of importance/priority from all the referenced plans. The set of plans that identify the area, or a portion of the area, are identified in the right column in Appendix 4.1. Appendices 4.2 and 4.3 list the sites identified as possessing significant biological resources in the NNHP Scorecard 2000 and the Nevada CWCS, respectively. The references for selecting areas and sites of wetland conservation priority are:

- IWJV Coordinated Implementation Plan for Bird Conservation in Nevada (Nevada IWJV)
- FWS approved Candidate Conservation Agreements ("species name" CCA)
- The Nature Conservancy plans for the Mojave and Great Basin Ecoregions (TNC Ecoregional Plan)
- The NNHP Scorecard 2000, Highest Priority Conservation Sites (NNHP Scorecard)
- Recovery Implementation Teams actively developing or implementing conservation tasks for at risk, threatened, or endangered fishes ("species name" RIT)
- Audubon Important Bird Area Program (Audubon IBA)
- The NDEP Clean Water Act Section 303(d) List of Impaired Waters (NDEP 303(d) Impaired Waters)
- FWS approved Recovery Plans for threatened and endangered species (FWS T&E Recovery Plan)
- Southern Nevada Public Land Management Act (SNPLMA)

Table 4.10 Provisional List of Proposed Areas and Sites of Wetland Conservation Priority Compiled from Various Nevada Wetland and Related Resource Plans

Areas and sites obtained from the management and conservation plans reviewed in Part 4 are listed below. They are grouped by hydrographic region. Some mountain ranges repeat, since watersheds drain into the basins of adjacent regions.

Northwest Region

- Calcutta Lake complex
- Continental Lake
- Duck Flat
- Ferguson Springs
- Gridley Lake
- Massacre Lakes
- Sheldon NWR
- Wall Canyon/Reservoir

Black Rock Desert Region

- Black Rock Desert
- Jackson Mountains
- Montana/Double H Mountains (Kings River)
  - Thacker Pass (spring)
- Quinn River
- Santa Rosa Range
- Soldier Meadow
- Smoke Creek Desert
- Summit Lake/Mahogany Creek

Snake River Basin

- Bruneau River/tributaries
- Fox Creek Range
- Goose Creek
- Independence Mountains
- Jarbidge Mountains
- Jarbidge River and tributaries
- O'Neil Basin
- Owyhee River and tributaries
- Salmon Falls Creek and tributaries
- Tuscarora Range
- Wild Horse Reservoir
- Wilson Reservoir

Humboldt River Basin

- Argenta Marsh
- Carico Lake Valley
- East Humboldt Range
- Fox Creek Range
- Humboldt Sink
- Independence Mountains
- Jarbidge Mountains
- Mary's River Range
- Mary's River
- Pleasant Valley
  - Coyote Springs
- Reese River
- Rye Patch Reservoir
- Santa Rosa Range
- Snowstorm Mountains
- South Fork Reservoir
- Tuscarora Range
- Willow Creek Valley (spring)

Truckee River Basin

- Lake Tahoe Basin
- Truckee River
- Truckee River, Lower
- Pyramid Lake
- Sierra Nevada East/Carson Range
- Washoe Valley/Lake
- Winnemucca Lake

Carson River Basin

- Carson River Delta/Lake
- Carson Sink
- Carson Valley
- Harmon Reservoir
- Lahontan Valley
- Lower Carson River
- Sierra Nevada East/Carson Range
- Soda Lakes
- Stillwater NWR

Walker River Basin

- Mason Valley
- Mason Valley WMA
- Sierra Nevada East/Carson Range
- Walker River
- Walker Lake
- Cottonwood Canyon

Central Region

- Antelope Valley (Elko/White Pine) – Dolly Varden Spring
- Antelope Valley (Eureka) – Sullivan Spring
- Big Smoky Valley
  - Charnock Ranch
  - Cooks Creek
  - Darroughs Hot Springs
- Diamond Valley
- East Humboldt Range
- Fish Creek Valley – Fish Creek Springs
- Fish Lake Valley
- Gabbs Valley – Cold Springs
- Hot Creek Valley – Twin Springs Ranch
- Independence/Clover Valleys
  - Ruby Valley
  - Bradish Spring
  - Snow Water Lake
  - Warm Creek Ranch
  - Warm Springs Ranch
  - Wright Ranch
- Kobeh Valley – Hot Spring Hill (springs)
- Lake Valley – Geyser (spring)
- Lamoille/Pleasant Valley – Rabbit Creek (spring)
- Monitor Range
- Monitor Valley
- Railroad Valley
  - Duckwater Indian Reservation
  - Lockes (spring system)
  - Duckwater/Bull Creek
- Ruby Mountains
- Ruby Valley
  - Persons Spring
  - Franklin Lake
- San Antonio Mountains
- Schell Creek Range
- Soda Spring Valley – Sodaville (spring)
- Snake Range
- Spring Valley (Snake Range)
- Spring Mountains/Pahrump Valley
- Steptoe Valley
  - Currie (spring)
  - Indian Ranch (spring system)
  - Monte Neva Hot Spring
  - Steptoe Ranch
  - Steptoe WMA
  - Twin Springs
- Toiyabe Range
- Toquima Range
- White Mountains

Great Salt Lake Basin

- Delano Mountains – Crittenden Springs
- Hamlin Valley – Big Springs
- Snake Range
- Thousands Springs Valley
  - Twentyone Mile Ranch
  - Windermere Hills – Prather Spring

Colorado River Basin

- Grapevine/Sacaton Canyons
- Lake Mead
  - Lake Mead NRA
  - Blue Point Springs
  - Black Canyon
  - Overton WMA
- Las Vegas Valley/Wash
  - Corn Creek Springs
- Lake Mojave
- Meadow Valley Wash
  - Clover Creek
  - Condor Canyon
  - Rainbow Canyon
- Moapa Valley
  - Moapa Valley Springs
  - Muddy River, Upper
  - Muddy River, Lower
- Pahranagat Valley
  - Ash Springs
  - Crystal Springs
  - Hiko (spring system)
  - Pahranagat NWR
- Red Rock Canyon
- Spring Mountains/Las Vegas Valley
- Virgin River
  - Virgin Valley
  - Beaver Dam Wash
- White River Valley
- White River Valley, Upper
  - Camp Spring
  - Emigrant Springs
  - Lund
  - Moon River Spring
  - Moorman Spring
  - Preston
  - Roopes Place/Boghole
  - Sunnyside/Kirch
  - The Cove
- White Rock/Wilson Creek Range – Big Jack Ranch (spring)

Death Valley Basin
- Amargosa River Valley
  - Ash Meadows
  - Oasis Valley

West Central Region
- Fernley Sink

Appendix 4.1. Index of Proposed Priority Wetland Areas Identified in Wetland and Related Conservation Plans

Index of Proposed Priority Wetland Areas Identified in All Wetland and Related Resource Plans			
Area Name	**Hydrographic Region**	**County**	**Nominating Source**
Amargosa River Valley/Ash Meadows	Death Valley Basin	Nye	Nevada IWJV Amargosa Toad CCA TNC Ecoregional Plan FWS T&E Recovery Plan Nevada CWCS SNPLMA
Carson River, Carson River Delta	Carson River Basin	Carson City, Douglas, Lyon	Nevada IWJV Audubon IBA TNC Ecoregional Plan NDEP 303(d) Impaired Waters Nevada CWCS SNPLMA
Clover and Independence Valleys	Central Region	Elko	NNHP Scorecard FWS T&E Recovery Plan Nevada CWCS
Elko County – north central	Snake River Basin Humboldt River Basin	Elko	Nevada IWJV Columbian Spotted Frog CCA Lahontan Cutthroat Trout RIT NDEP 303(d) Impaired Waters FWS T&E Recovery Plan Nevada CWCS
Humboldt River/Humboldt Sink	Humboldt River Basin	Elko, Eureka, Lander, Humboldt, Pershing	Nevada IWJV Lahontan Cutthroat Trout RIT NDEP 303(d) Impaired Waters FWS T&E Recovery Plan Nevada CWCS
Lahontan Valley/Carson Sink	Carson River Basin	Churchill	Nevada IWJV Audubon IBA TNC Ecoregional Plan FWS T&E Recovery Plan Nevada CWCS
Lake Mead NRA	Colorado River Basin	Clark	NNHP Scorecard NDEP 303(d) Impaired Waters Nevada CWCS
Lake Tahoe Basin	Truckee River Basin	Carson City, Douglas, Washoe	NNHP Scorecard Tahoe Yellow Cress CCA Lahontan Cutthroat Trout RIT NDEP 303(d) Impaired Waters Nevada CWCS SNPLMA
Las Vegas Valley/Wash	Colorado River Basin	Clark	NNHP Scorecard Clark County MSHCP NDEP 303(d) Impaired Waters Nevada CWCS
Mary's River Watershed	Humboldt River Basin	Elko	Audubon IBA Lahontan Cutthroat Trout RIT NDEP 303(d) Impaired Waters FWS T&E Recovery Plan Nevada CWCS
Moapa Valley (Muddy R.)	Colorado River Basin	Clark	Nevada IWJV Audubon IBA NNHP Scorecard At-risk, T&E fishes RIT TNC Ecoregional Plan NDEP 303(d) Impaired Waters FWS T&E Recovery Plan Nevada CWCS SNPLMA

Index of Proposed Priority Wetland Areas Identified in All Wetland and Related Resource Plans			
Area Name	**Hydrographic Region**	**County**	**Nominating Source**
Pahranagat Valley	Colorado River Basin	Lincoln	Nevada IWJV Audubon IBA NNHP Scorecard Lahontan Cutthroat Trout RIT At-risk, T&E fishes RIT TNC Ecoregional Plan FWS T&E Recovery Plan Nevada CWCS
Quinn River	Black Rock Desert Region	Humboldt	Nevada IWJV FWS T&E Recovery Plan Nevada CWCS
Railroad Valley	Central Region	Nye	NNHP Scorecard At-risk, T&E fishes RIT FWS T&E Recovery Plan Nevada CWCS SNPLMA
Ruby Valley (Lake/Marsh)	Central Region	Elko	Nevada IWJV Audubon IBA NNHP Scorecard TNC Ecoregional Plan Nevada CWCS
Spring Mountains NRA	Colorado River Basin Central Region	Clark, Nye	Ecosystem-wide, Multi-species CCA Nevada CWCS SNPLMA
Spring Valley	Central Region	White Pine	Bonneville Cutthroat Trout CCA Nevada CWCS
Steptoe Valley	Central Region	White Pine	Nevada IWJV NNHP Scorecard Nevada CWCS
Toiyabe Range	Central Region	Nye	Columbia Spotted Frog CCA Nevada CWCS
Truckee River (Lower) and Pyramid Lake	Truckee River Basin	Washoe	Nevada IWJV Audubon IBA Lahontan Cutthroat Trout RIT TNC Ecoregional Plan NDEP 303(d) Impaired Waters FWS T&E Recovery Plan Nevada CWCS
Virgin River Valley	Colorado River Basin	Clark	Nevada IWJV Audubon IBA NNHP Scorecard Virgin River Spinedace CCA At-risk, T&E fishes RIT TNC Ecoregional Plan NDEP 303(d) Impaired Waters FWS T&E Recovery Plan Nevada CWCS SNPLMA
Walker River/Walker Lake	Walker River Basin	Lyon, Mineral	Nevada IWJV Audubon IBA Lahontan Cutthroat Trout RIT TNC Ecoregional Plan NDEP 303(d) Impaired Waters Nevada CWCS
Washoe Valley/Washoe Lake	Truckee River System	Washoe	Nevada IWJV NDEP 303(d) Impaired Waters SNPLMA

Index of Proposed Priority Wetland Areas Identified in All Wetland and Related Resource Plans			
Area Name	**Hydrographic Region**	**County**	**Nominating Source**
White River Valley	Colorado River Basin	White Pine, Nye, Lincoln	Nevada IWJV NNHP Scorecard White River Spinedace SHA At-risk, T&E fishes RIT TNC Ecoregional Plan Nevada CWCS

Appendix 4.2. Index of Wetland Sites In the NNHP Scorecard 2000

Index of Wetland Sites Identified In NNHP Scorecard 2000		
Site Name	**Hydrographic Region**	**County**
Ash Springs (Pahranagat R.)	Colorado River Basin	Lincoln
Big Jack Ranch (White Rock/Wilson Creek Range)	Colorado River Basin	Lincoln
Big Springs (Hamlin V.)	Great Salt Lake Basin	White Pine
Blue Link Spring (Pilot Mt.)	Central Region	Mineral, Esmeralda
Blue Point Springs (Lake Mead NRA)	Colorado River Basin	Clark
Bradish Spring (Clover V.)	Humboldt River Basin	Elko
Camp Spring (White River V.)	Colorado River Basin	Nye
Carico Lake (Carico Lake V.)	Humboldt River Basin	Lander
Charnock Ranch (Big Smoky V.)	Central Region	Nye
Cold Springs (Gabbs V.)	Central Region	Mineral
Cooks Creek (Carico Lake V.)	Humboldt River Basin	Lander
Corn Creek Springs	Colorado River Basin	Clark
Coyote Springs (Pleasant V.)	Humboldt River Basin	Pershing
Crittenden Springs (Delano Mt.)	Great Salt Lake Basin	Elko
Crystal Springs (Pahranagat V.)	Colorado River Basin	Lincoln
Currie [spring] (Steptoe V.)	Central Region	White Pine
Darroughs Hot Springs (Big Smoky V.)	Central Region	Nye
Dolly Varden Spring (Antelope V.)	Central Region	Elko, White Pine
Duckwater Indian Reservation	Central Region	Nye
Emigrant Springs (White River V.)	Colorado River Basin	Nye, Lincoln
Fish Creek Springs (Fish Creek V.)	Central Region	Eureka
Geyser (Lake V.)	Central Region	White Pine, Lincoln
Hiko [spring system] (Pahranagat V.)	Colorado River	Lincoln
Hot Spring Hill (Kobeh V.)	Central Region	Eureka
Indian Ranch	Central Region	White Pine
Lockes [spring system] (Railroad V.)	Central Region	Nye
Lund	Colorado River Basin	White Pine
Moapa – Muddy River (Moapa V.)	Colorado River Basin	Clark
Moapa Valley Springs (Moapa V.)	Colorado River Basin	Clark
Moon River Spring (White River V.)	Colorado River Basin	Nye
Moorman Spring	Colorado River Basin	Nye
Monte Neva Hot Spring (Steptoe V.)	Central Region	White Pine
Pahranagat NWR	Colorado River Basin	Clark
Persons Spring (Ruby V.)	Central Region	Elko
Prather Springs (Windermere Hills)	Great Salt Lake Basin	Elko
Preston (White River V.)	Colorado River Basin	White Pine
Rabbit Creek (Lamoille/Pleasant V.)	Humboldt River Basin	Elko
Roopes Place/Boghole (White River V.)	Colorado River Basin	Nye, White Pine
Sodaville [spring] (Soda Spring V.)	Central Region	Mineral
Steptoe Ranch (Steptoe V.)	Central Region	White Pine
Sullivan Spring (Antelope V.)	Central Region	Eureka
Sunnyside/Kirch (White River V.)	Colorado River Basin	Nye, Lincoln
Thacker Pass [spring] (Montana Mountains)	Black Rock Desert Region	Humboldt
The Cove (White River V.)	Colorado River Basin	White Pine
Twentyone Mile Ranch (Thousand Springs V.)	Great Salt Lake Basin	Elko
Twin Springs (Steptoe V.)	Central Region	White Pine

Index of Wetland Sites Identified In NNHP Scorecard 2000		
Site Name	**Hydrographic Region**	**County**
Twin Springs Ranch (Hot Creek V.)	Central Region	Nye
Virgin River	Colorado River Basin	Clark
Warm Creek Ranch	Central Region	Elko
Warm Springs Ranch	Central Region	Elko
Willow Creek Reservoir (Sheep Creek Range)	Humboldt River Basin	Elko
Wright Ranch	Humboldt River Basin	Elko

Appendix 4.3. Nevada Comprehensive Wildlife Conservation Strategy Wetland Sites and Types

Index to NDOW Comprehensive Wildlife Conservation Strategy Wetland Sites (Preliminary Focal Areas) and Types (Key Habitats)		
Preliminary Focal Area	**Key Habitat**	**Hydrographic Region**
Amargosa River Valley / Oasis Valley	Springs and Springbrooks Mojave Rivers and Streams Marshes	Death Valley Basin
Argenta Marsh	Marshes	Humboldt River Basin
Ash Meadows	Springs and Springbrooks	Death Valley Basin
Beaver Dam Wash	Mojave Rivers and Streams	Colorado river Basin
Black Canyon	Mojave Rivers and Streams Springs and Springbrooks	Colorado River Basin
Black Rock Desert	Desert Playas and Ephemeral Pools	Black Rock Desert Region
Bonneville Drainage	Intermountain Rivers and Streams	Great Salt Lake Basin
Bruneau River and trib.s	Intermountain Rivers and Streams Wet Meadows	Snake River Basin
Calcutta Lake complex	Desert Playas and Ephemeral Pools	Northwest Region
Carico Lake Valley	Desert Playas and Ephemeral Pools	Humboldt River Basin
Carson Lake	Marshes	Carson River Basin
Carson River	Intermountain Rivers and Streams Wet Meadows Marshes	Carson River Basin
Clover Creek	Mojave Rivers and Streams	Colorado River Basin
Clover Valley	Springs and Springbrooks	Central Region
Colorado R. below Davis Dam	Mojave Rivers and Streams	Colorado River Basin
Condor Canyon	Intermountain Rivers and Streams Springs and Springbrooks	Colorado River Basin
Continental Lake	Desert Playas and Ephemeral Pools	Northwest Region
Cottonwood Canyon	Springs and Springbrooks	Walker River Basin
Diamond Valley	Springs and Springbrooks	Central Region
Duck Flat	Marshes	Northwest Region
Duckwater / Bull Creek	Springs and Springbrooks	Central Region
East Humboldt Range	Aspen Woodland Intermountain Rivers and Streams Wet Meadows	Humboldt River Basin Central Region
Ferguson Springs	Springs and Springbrooks	Great Salt Lake Basin
Fernley Sink	Marshes Desert Playas and Ephemeral Pools	West Central Region
Fish Lake Valley	Springs and Springbrooks	Central Region
Fox Creek Range	Aspen Woodland	Snake River Basin Humboldt River Basin
Franklin Lake	Marshes Lakes and Reservoirs Desert Playas and Ephemeral Pools	Central Region
Goose Creek	Intermountain Rivers and Streams Wet Meadows	Snake River Basin
Grapevine / Sacaton Canyon	Mojave Rivers and Streams	Colorado River Basin
Gridley Lake	Desert Playas and Ephemeral Pools	Northwest Region
Harmon Reservoir	Lakes and Reservoirs	Carson River Basin
Humboldt R. and trib.s	Intermountain Rivers and Streams Wet Meadows	Humboldt River Basin
Humboldt Sink	Marshes Desert Playas and Ephemeral Pools	Humboldt River Basin
Independence Mountains	Aspen Woodland Intermountain Rivers and Streams Wet Meadows	Snake River Basin Humboldt River Basin
Independence Valley	Springs and Springbrooks	Snake River Basin
Jackson Mountains	Wet Meadows	Black Rock Desert Region
Jarbidge Mountains	Aspen Woodland Wet Meadows	Snake River Basin Humboldt River Basin

Index to NDOW Comprehensive Wildlife Conservation Strategy Wetland Sites (Preliminary Focal Areas) and Types (Key Habitats)		
Preliminary Focal Area	**Key Habitat**	**Hydrographic Region**
Jarbidge River and trib.s	Intermountain Rivers and Streams	Snake River Basin
Kirch WMA	Marshes Lakes and Reservoirs	Central Region
Lahontan Valley and Stillwater NWR	Marshes Lakes and Reservoirs	Carson River Basin
Lake Mead	Lakes and Reservoirs	Colorado River Basin
Lake Mohave	Lakes and Reservoirs	Colorado River Basin
Lake Tahoe Basin	Lakes and Reservoirs Sierran Rivers and Streams	Truckee River Basin
Las Vegas Wash	Mojave Rivers and Streams Marshes	Colorado River Basin
Mary's River	Wet Meadows	Humboldt River Basin
Mary's River Range	Aspen Woodland	Humboldt River Basin
Mason Valley and WMA	Marshes Lakes and Reservoirs	Walker River Basin
Massacre Lakes	Desert Playas and Ephemeral Pools	Northwest Region
Meadow Valley Wash (Upper)	Intermountain Rivers and Streams Springs and Springbrooks	Colorado River Basin
Meadow Valley Wash, Lower	Mojave Rivers and Streams	Colorado River Basin
Monitor Range	Aspen Woodland Wet Meadows	Central Region
Monitor Valley	Springs and Springbrooks	Central Region
Montana Mountains	Intermountain Rivers and Streams Wet Meadows	Black Rock Desert Region
Muddy River	Mojave Rivers and Streams	Colorado River Basin
Northern Big Smoky Valley (S.)	Springs and Springbrooks	Central Region
O'Neil Basin	Wet Meadows	Snake River Basin
Overton WMA / Overton Arm	Mojave Rivers and Streams Springs and Springbrooks Marshes	Colorado River Basin
Owyhee River and trib.s	Intermountain Rivers and Streams Wet Meadows	Snake River Basin
Pahranagat Valley, including NWR	Mojave Rivers and Streams Springs and Springbrooks Marshes Lakes and Reservoirs	Colorado River Basin
Pyramid Lake	Intermountain Rivers and Streams Lakes and Reservoirs	Truckee River Basin
Quinn River	Intermountain Rivers and Streams Marshes	Black Rock Desert Region
Railroad Valley (and Duckwater)	Springs and Springbrooks Marshes Desert Playas and Ephemeral Pools Lakes and Reservoirs Intermountain Rivers and Streams	Central Region
Red Rock Canyon	Springs and Springbrooks	Colorado River Basin
Reese River	Wet Meadows	Humboldt River Basin
Ruby Valley / Marshes	Marshes Lakes and Reservoirs Wet Meadows	Central Region
Ruby Mountains	Aspen Woodland Intermountain Rivers and Streams Wet Meadows	Central Region Humboldt River Basin
Rye Patch Reservoir	Lakes and Reservoirs	Humboldt River Basin
Salmon Falls Creek and trib.s	Intermountain Rivers and Streams Wet Meadows	Snake River Basin
San Antonio	Wet Meadows	Central Region

Index to NDOW Comprehensive Wildlife Conservation Strategy Wetland Sites (Preliminary Focal Areas) and Types (Key Habitats)		
Preliminary Focal Area	**Key Habitat**	**Hydrographic Region**
Santa Rosa Range	Aspen Woodland Intermountain Rivers and Streams Wet Meadows	Black Rock Desert Region Humboldt River Basin
Schell Creek Range	Aspen Woodland	Central Region
Sheldon NWR	Wet Meadows Marshes Lakes and Reservoirs Desert Playas and Ephemeral Pools	Northwest Region
Sierra Nevada Range, East Side (and Carson Range)	Wet Meadows Sierran Rivers and Streams Aspen Woodlands	Truckee River Basin Carson River Basin Walker River Basin
Smoke Creek Desert	Desert Playas and Ephemeral Pools	Black Rock Desert Region
Snake Range	Aspen Woodland Wet Meadows	Great Salt Lake Basin Central Region
Snow Water Lake	Desert Playas and Ephemeral Pools	Central Region
Snowstorm Mountains	Aspen Woodland	Humboldt River Basin
Soda Lakes	Lakes and Reservoirs	Carson River Basin
Soldier Meadow	Springs and Springbrooks	Black Rock Desert Region
South Fork Reservoir	Lakes and Reservoirs	Humboldt River Basin
Spring Mountains	Mojave Rivers and Streams	Colorado River Basin Central Region
Spring Valley	Springs and Springbrooks Wet Meadows	Great Salt Lake Basin
Steptoe Valley (and WMA)	Marshes Wet Meadows	Central Region
Summit Lake / Mahogany Creek	Intermountain Rivers and Streams	Black Rock Desert Region
Toiyabe Range	Aspen Woodland Wet Meadows	Central Region Humboldt River Basin
Toquima Range	Aspen Woodland Wet Meadows	Central Region
Truckee River	Intermountain Rivers and Streams	Truckee River Basin
Tuscarora Range	Aspen Woodland	Snake River Basin Humboldt River Basin
Upper Muddy River	Springs and Springbrooks	Colorado River Basin
Upper White River (Kirch to Preston)	Springs and Springbrooks	Central Region
Virgin River (and floodplain)	Mojave Rivers and Streams Marshes	Colorado River Basin
Walker Lake	Lakes and Reservoirs	Walker River Basin
Walker River	Intermountain Rivers and Streams Wet Meadows Lakes and Reservoirs	Walker River Basin
Wall Canyon (and Reservoir)	Intermountain Rivers and Streams Lakes and Reservoirs	Northwest Region
White Mountains	Wet Meadows	Central Region
White River Valley	Intermountain Rivers and Streams	Central Region
Wild Horse Reservoir	Lakes and Reservoirs	Snake River Basin
Wilson Reservoir	Lakes and Reservoirs	Snake River Basin
Winnemucca Lake	Desert Playas and Ephemeral Pools	Truckee River Basin

PART 5. PROTECTION AND CONSERVATION STRATEGIES USED TO MANAGE THE WETLAND RESOURCES OF NEVADA

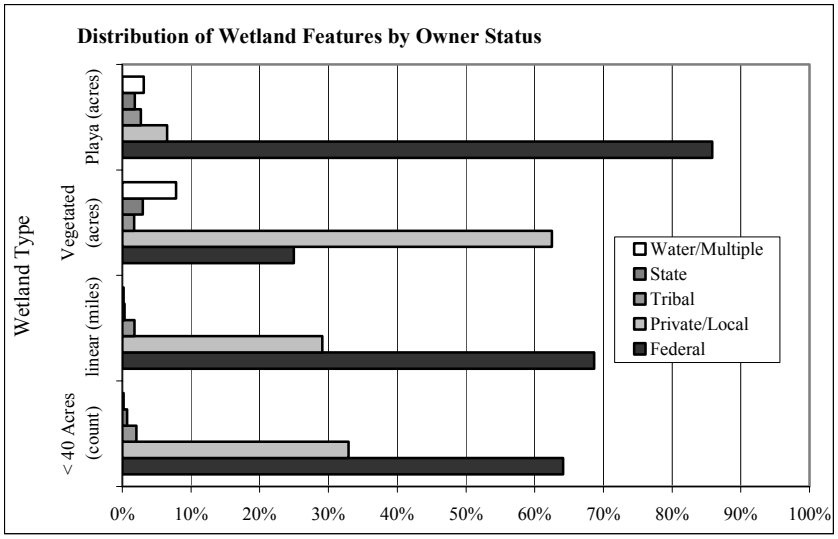
Overview

Nevada's expanding population, living space, and economy draws on a fixed amount of land and water to generate more goods and services. To sustain growth and simultaneously provide for public and ecological health, stewardship must advance at a pace at least equal to the mounting pressures on environmental and natural resources. Loss of wetlands indicates society's efforts are not keeping up. To reach the federal no net loss goal, Congress enacted a mix of regulatory and conservation programs. Some apply to public land managers and others rely on state and local agencies as well as private landowners to act. As a whole, the laws and programs do not form a well-knit wetland safety net appropriate for our arid state. Setting a clear, cohesive state wetland policy would perhaps be the most provident step, inasmuch as wetlands are part or parcel to a covey of statewide issues concerning water resources and watersheds, wildlife habitats and diversity, outdoor recreation, and environmental quality. Part 5 describes many of the laws, regulations, and the nonregulatory programs of governments and nonprofit organizations. We also attempt to address the achievements of agency efforts where performance measurement data are available or may be inferred from other program information.

Our state's relationship with wetlands formed during a period of colonization and industrialization. So much hard work and ingenuity was dedicated to carving a living out of a land with incomparably sparse supplies of water, timber, forage, and arable soil that the disappearance of wetlands drew little attention until serious problems arose. Over time, however, people came to see the mounting evidence that arid land vegetation, wildlife, and water resources were not rebounding from heavy use, and now we are learning to adjust our expectations for what natural resources might produce or withstand if better tended. Looking forward, we must accept the essential and fragile nature of wetland ecosystems. Society's values have changed. Now, are better equipped with the science, tools, and skills to work around wetlands and minimize cumulative impacts. The pragmatic (and hopefully majority) view holds that wetland ecosystem protection and restoration must be elevated to a higher level of efficiency and effectiveness in order to secure environmental conditions, renewable resources, and socioeconomic services needed by a growing and diversifying human population.

About twenty years ago wetland inventories indicated more than half of Nevada's (and the nation's) wetlands had been eliminated and much of the remnants were in disrepair. This awareness cultivated a willingness to accept regulations and public investment to secure valued wetland resources. The social contract, which continues to evolve, starts with the premise that wetland ecosystems are places of exceptional value to all life forms and do their best work in their natural state and position. Because the wetland resource base involves public and private

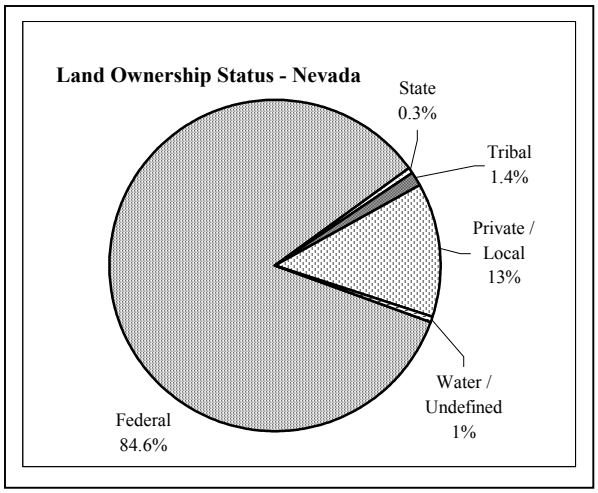
Figure 5.1. Relative Distribution by Land Owner Status of NWI Wetland Types



Source: Analysis by NNHP using datasets from the NWI (wetland) and BLM (land ownership).

ownership (Figure 5.1) and benefits, the responsibility for and the costs of stewardship must be shared. This principle underlies regulatory and nonregulatory mechanisms implemented by resource agencies, conservation organizations, and knowledgeable, engaged citizens.

Federal policies, regulations, and programs form the bulwark of wetland strategies. Major federal statutes and Executive Orders are highlighted in Table 5.1. State laws implemented by the Nevada Departments of Conservation and Natural Resources (DCNR) and Wildlife (NDOW) modestly enhance protection, and other state agency activities may indirectly do so (see Appendix 5.1, Nevada Revised Statutes Concerning Wetlands). Local government strategies include master plans, zoning ordinances, or open space plans. In Washoe and Carson City counties voters supported tax initiatives to fund public purchases of sensitive natural areas approved through open space planning processes. The pie-chart graph shows a large share of the state is public land. Federal agencies administer about eighty-five percent of the land base, but a disproportionately large share of wetlands lie on private land. Public land managers (BLM, USFS, FWS, NPS, and BOR) have the best chance of zeroing out losses, since a broad set of federal statutes, regulations, policies, and management directives come into play for projects or uses that impact wetlands.



The key nonregulatory strategy today is publicly funded projects to acquire, place under conservation easement, or restore high value wetland sites through interagency and/or agency-nonprofit conservation organizations (NCOs) partnerships. Funding mechanisms include voter-approved state bonds (e.g., Nevada Conservation and Resource Protection (Q1) Grant Program), auctions of public land identified for disposal (e.g., Southern Nevada Public Lands Management Act). High value wetlands typically are those that benefit wildlife (game or imperiled species) and outdoor recreation uses. The NCOs tap into a current of grassroots (citizen and corporate) support to fund wetland preservation and restoration. Some resistance exists where such efforts add to the public land base, or subtract from the local property tax revenue base. Other nonregulatory programs, such as Partners for Fish and Wildlife (FWS), the Forest Stewardship Program (NDF), and Food Security Act (NFRCS) farmland conservation options offer monetary and technical assistance to land owners willing to adjust land use and maintain wetlands. Since no one tracks nonregulatory program outcomes, we cannot estimate to what extent gains in wetland quantity and or quality are actualized.

Federal Regulatory and Nonregulatory Programs

The lead federal regulatory agencies are the ACOE and NRCS, with the EPA focusing on policy, planning, and enforcement. Authority derives mainly from Section 404 of the Clean Water Act. The goal of the CWA is to maintain, restore, and enhance the physical, chemical, and biological integrity of the nation's waters and wetlands. The federal permit program applies to wetlands associated with "waters of the U.S." The association must be determined according to protocol and criteria set forth in the 1987 Manual for Delineation of Wetlands (ACOE, 1987). "Waters of the U.S." meet any of these conditions:

Isolated spring systems like this in Oasis Valley usually do not meet the jurisdictional criteria that qualify wetlands for protection under provisions of the federal Clean Water Act. Glenn Clemmer photo

- All waters which are, were, or may be susceptible to use in interstate commerce (navigable);
- All interstate waters;
- All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce;
- Tributaries of waters identified above; and,
- Wetlands adjacent [hydrologically connected] to waters identified above.

Agencies Team Up to Protect Rare Fish Species and "Swamp Cedar" Woodlands in Spring Valley

Clean Water Act regulations do no apply to many wetlands here. Few satisfy the condition of adjacency to waters of the U.S. However, the management status of Shoshone Ponds and surrounding "Swamp Cedar" woodland demonstrates how agencies can team up to protect exceptional wetlands. The ponds lay within an uncommon "Swamp Cedar" plant community, an unusual ecotype known to occur at only four sites. The National Park Service had nominated the Shoshone Ponds site for National Natural Landmark status. Five ponds were constructed in 1970 by NDOW on two acres purchased from the BLM in an attempt to create refugia suitable for the preservation of four rare endemic fish taxa in the genus *Empetrichthys* (killifish or poolfish). These taxa were placed on the federal endangered species list as populations declined rapidly when natural springs dwindled in response to groundwater pumping. The NDOW and NDSP acquired water rights to reserve spring flow for the pools. Despite these efforts, three extinctions occurred. Only *Empetrichthys* latos (Pahrump poolfish) exists. The ponds and the surrounding Rocky Mountain juniper/wetland community are within a BLM Instant Study Area (ISA). An ISA is managed "in a manner so as not to impair the suitability of such areas for preservation as wilderness." NatureServe provisionally ranks the *Juniperus scopulorum* temporarily flooded woodland association) as G1 (globally rare, imperiled) and S1 (rare, imperiled statewide). Three of the four Swamp Cedar sites are managed as multiple use lands, a relatively vulnerable status. Brian Hobbs photo.

Determining jurisdictional status in Nevada can be a complex process and result in perplexing determinations. A confounding factor is year-to-year fluctuations in precipitation, streamflow, and shallow groundwater that cause saturated or flooded conditions to wax or wane abruptly. Also, most waterways drain to isolated, interior basins and so fail "navigable" test. In 2001, the Supreme Court ruled inhabitation of "isolated" waters by migratory waterfowl may not justify federal protection under the interstate commerce clause. Bona fide "navigable" status has been decreed only for the Truckee, Carson, Colorado, and Virgin rivers, Lake Tahoe, and Washoe and Walker lakes, leaving out prominent water resources. Water bodies that overlap tribal/non-tribal land may meet "interstate" criteria.

Table 5.1. Federal Laws and Executive Orders Concerning Wetland Protection, Conservation and Management		
Federal Law or Executive Order	**Federal Agencies**	**Highlights**
Fish and Wildlife Coordination Act	FWS, ACOE	Requires federal agencies to consult with the FWS and state fish and wildlife agencies on water resource development projects. Requires ACOE to include ecological effect in their regulations.
Land and Water Conservation Act	FWS, BLM, FS, NPS	Creates federal grant program for state and local government to acquire recreational land and natural areas, including wetlands funded by federal revenue from offshore oil and gas leases and production.
National Environmental Policy Act	CEQ	Requires the filing of environmental impact statements (EIS) for major federal activities. EIS must identify environmental impacts of proposed activities and alternatives to avoid, reduce, or mitigate environmental and socioeconomic impacts, including actions affecting wetlands.
Federal Water Pollution Control (Clean Water) Act	ACOE, EPA, NRCS	Section 404 authorizes the ACOE and EPA to regulate the discharge of dredged and fill material into waters (and wetlands) of the US. Exempts certain agricultural activities from wetland permitting. Authorizes EPA to veto ACOE actions and policies.
Endangered Species Act Sections 4, 7, & 10	FWS, All	Requires federal agencies to ensure actions will not jeopardize endangered/threatened species or injure or destroy their habitat, including wetlands. In Nevada, most ESA listed species are wetland affiliated.
Federal Aid to Wildlife Restoration Act (Pittman-Robertson Act)	FWS	Establishes state funding (taxes on hunting equipment and hunting fines) to manage, restore, study, and plan for wildlife; to acquire/improve habitat and public access; to implement the North American Wetland Conservation Act.
Water Resources Development Act	ACOE	Authorizes the ACOE to establish wetland areas from dredged material at water resources development projects; to undertake fish and wildlife mitigation/enhancement and to restore/enhance degraded environmental quality at water resources development projects; to carry out ecosystem restoration.
Executive Order 11990 Protection of Wetlands	All	Requires federal agencies to minimize the destruction, loss, or degradation of wetlands; to preserve and enhance natural and beneficial values when carrying out agency activities and programs affecting land use. Terminated federal assistance for wetland conversion, including channelization and drainage.
Executive Order 11988 Floodplain Management	All	Directs federal agencies to take actions that reduce the risk of flood damage and impact on human safety, health, and welfare; to restore and preserve natural and beneficial values of floodplains through: purchase, management or disposal of federal lands; participation in construction/improvement projects; or programs to promote land use planning and regulation.
Fish and Wildlife Conservation Act	FWS	Authorizes financial and technical assistance for states that develop and implement nongame fish and wildlife conservation plans/programs. Requires the FWS to identify lands and waters in the U.S. and other Western Hemisphere countries for migratory nongame bird protection, management, or acquisition. Requires federal agencies to consult with the FWS and NDOW if activities may affect, control, or modify a watercourse or body of water.
Food Security Act "Swampbuster"	NRCS	Removes eligibility of farmers that convert wetlands after December 23, 1985 to obtain commodity price supports, loans, crop insurance, disaster or other USDA payments. Requires the Farm Services Agency to consult with the FWS on wetland identification, wetland protection exemptions, regulations, mitigation, and restoration of wetland values and functions. Establishes Conservation Reserve Program – farmers paid annual rent for cropland returned to permanent vegetative cover and wildlife habitat.
Emergency Wetland Resources Act	FWS	Authorizes purchase of wetlands from Land and Water Conservation Fund (LWCF). Directs the FWS to: prepare a National Wetlands Priority Conservation Plan; report to Congress on wetland loss and analyze the role of Federal programs and policies in losses; continue the National Wetlands Inventory program; and update the "Status and Trends of Wetlands and Deepwater Habitat in the Coterminous United States" every ten years. Requires states to prepare a priority wetland plan for LWCF eligibility.
North American Wetlands Conservation Act	FWS	Increases wetland protection and restoration under the North American Waterfowl Management Plan. Reallocates Pittman-Robertson funds for waterfowl plan implementation and wetland conservation projects in Mexico, Canada, and the US.
"No Net Loss" Policy (Water Resources Development Act)	All	Requires federal agencies to develop action plans to achieve no net wetland loss. Directed the ACOE to use the 1987 Manual for Delineation of Wetlands.
Food, Agriculture, Conservation and Trade Act	NRCS	Tightens restrictions on wetland conversion for crop production and adds requirements for mapping and on-site visits to delineate and protect wetlands. Enhances the Conservation Reserve Program to achieve water quality and wildlife benefits. Creates the Wetland Reserve Program to provide incentives for wetland protection and restoration with easements (30 year, permanent, or per state law).
Executive Order 12962 Conservation of Aquatic Systems for Recreational Fisheries	All	Directs federal agencies to coordinate activities within existing authorities and when practicable to improve the quantity, function, sustainable productivity, and distribution of aquatic resources for increased recreational fishing opportunities.
Federal Agriculture Improvement and Reform Act	NRCS	Requires NRCS to certify accuracy of wetland determinations on agricultural land. Exempts wetland protection provisions if wetland conditions return. Repeals requirement for consultation with the FWS for wetland determinations, restoration, and mitigation. Authorizes the USDA to implement a pilot program for mitigation banking of diminished/destroyed wetlands.

US Army Corps of Engineers. The ACOE has primary authority to issue permits for fill, dredge, or drain activities that will impact wetlands adjacent to or hydrologically connected to waters of the US, and in some instances, isolated water. The EPA may overrule ACOE permit or policy decisions. The NDEP participates in permit decisions under CWA Section 401 Water Quality Certification provisions. Public agencies and private owners of land not in agricultural production must apply to the ACOE for a permit if a project will cause a wetland area to be filled or drained. The level of wetland impact affects the type of permit that the ACOE may issue. Table 5.2 highlights wetland protection laws and possible permit actions jointly administered by the ACOE and/or EPA with state agency coordination. The range of activities for which the ACOE in Nevada has issued individual permits includes:

Linear utility facilities (pipe and wire)
Road construction, culverts, bridge replacement
Railroad structures
Flood control structures (channel, levee, basin)
Water recreation facilities (ramp, pier, marina)
Dam, weir, fishway
Golf course
Residential subdivision
Commercial subdivision
Industrial park
Mining operation
Airfield runway
Irrigation ditch, levee, drain
Stream channel stabilization
Stream realignment
Riparian/wetland restoration

Table 5.2 Overview of Federal Wetland Protection Laws Administered by the ACOE and EPA with State Agency Coordination

Permits Required		Covered Activities in Wetlands	Agency
Section 10 Rivers and Harbors Act		Building a structure in the channel or along the banks of navigable waters of the U.S. that alters the course, conditions, location, or capacity	ACOE NDSL
Section 404 Clean Water Act	Letter of Permission	Minor or routine work with minimum impacts	
	Nationwide Permits (43 types, applicable to mining, farming, canals, drains, stormwater, recreation, and various other activities)	Repair, rehabilitation, or replacement of structures destroyed by storm, fire, or flood in past 2 years	
		Bank stabilization less than 500 feet in length for erosion protection	
		Filling up to 1 acre of a wetland or less than 500 linear feet of a stream isolated from other surface waters or upstream of a point in a drainage system where average annual flow is less than 5 cubic feet per second	ACOE
		Restoration of natural hydrology, vegetation, and function to altered/degraded wetland, and restoration of natural riparian area on private land, provided an agreement exists	
	Regional Permit	Small projects posing less than significant environmental impacts (e.g., fill placement for roadway culverts, wildlife management area, emergency stabilization of structures)	
	Individual Permit	Proposed filling or excavation that causes significant impacts, but for which no practical alternative exists. A NEPA assessment may be required.	
Section 401, CWA		Water quality certification that permitted action will not exceed standards	NDEP
Section 402, CWA National Pollution Discharge Elimination System (NPDES)		Point source discharges, such as discharge of pollutants in outflow from a building, industrial or water treatment facility to waters of the state	EPA NDEP

Source: Sacramento District, ACOE; web pagehttp://www.spk.usace.army.mil/organizations/cespk-co/regulatory/index.html. January 2005.
Note: Navigable waters of the US in Nevada are the Truckee, Carson, Colorado, and Virgin rivers, Lake Tahoe and Washoe and Walker Lakes.

The ACOE regulatory strategy consists of a tiered system of permits and of mitigation requirements. The system of individual, nationwide and regional permits generally follows a pattern of decreasing probability for significant wetland elimination or damages. Project impact review emphasizes wetland loss avoidance first, then minimization, and mitigation. Mitigation may be required for the loss of acreage plus the alteration of ecological functions and socioeconomic services. A permit issued for a project where wetland loss was found to be unavoidable may be conditioned to require more acres to be replaced than are lost. Higher ratios for mitigation acreage typically involve an evaluation of functions and services and the type of wetland to be created or improved for mitigation. Ensuring that mitigation projects are completed and provide the functions and services designed into the project is an ongoing issue that the ACOE is attempting to address.

Artificially irrigated wetlands create special regulatory cases that warrant careful consideration. A large amount of wetland losses result from stream diversions for irrigation, and irrigated wetlands may partially offset the losses in quantity and quality. Irrigated wetland may form along ditches, drains, or in flooded fields, as a result of leaky ditches or impoundments, or the combined influence of irrigation water and natural hydrology. The ACOE policy is that any area exhibiting wetland characteristics sustained solely by the application of irrigation water is not regulated under Section 404. However, where uncertainty exists about the contribution of natural hydrology and irrigation water to wetland characteristics, the ACOE may request the discontinuation of irrigation for two growing seasons. If the landowner or project proponent determines discontinuation is impractical, and it is not obvious that the area would be dry without irrigation, the wetland area may be subject to Section 404 regulations.

The ACOE District Headquarters in Sacramento opened a field office in Reno in 1994. The Reno office administers ACOE Section 404 regulations in all but two of the Nevada counties. In Lincoln and Clark counties, the ACOE staff from the St. George, Utah office administers wetland regulations. Table 5.3 presents a summary of data provided by the Sacramento District Office on permit activities during recent years. The data were requested to assist in learning more about the level of wetland development and associated regulatory activity that has been occurring in Nevada. A comparatively large number of Nationwide Permits and small number of Individual Permits were issued for the period 1998 to 2003.

The data may or may not suggest that implementation of Section 404 regulations prevents wetland losses. The total acres permitted for development or drainage is comparatively small, and the number of final permits issued (790) far exceeds the number of applications for which an administrative action was taken (2154). However, wetland losses are occurring, so there may be other factors affecting the low number of wetland acres permitted. An intensive wetland status survey conducted by the FWS in the Reno-Carson City area estimated the net loss of approximately 2,800 acres due to development from 1980 to 2000. Though the timing of the FWS survey and the ACOE permit data do not entirely coincide, the discrepancy between losses and permit activity raises questions. It is possible that wetland delineations by project proponents misidentify or inadvertently omit wetland acreage from project permit applications. As discussed earlier, the ACOE wetland delineation criteria may not be well suited for desert wetland mapping, and since the mid-1980s, northwestern Nevada has experienced two extended droughts.

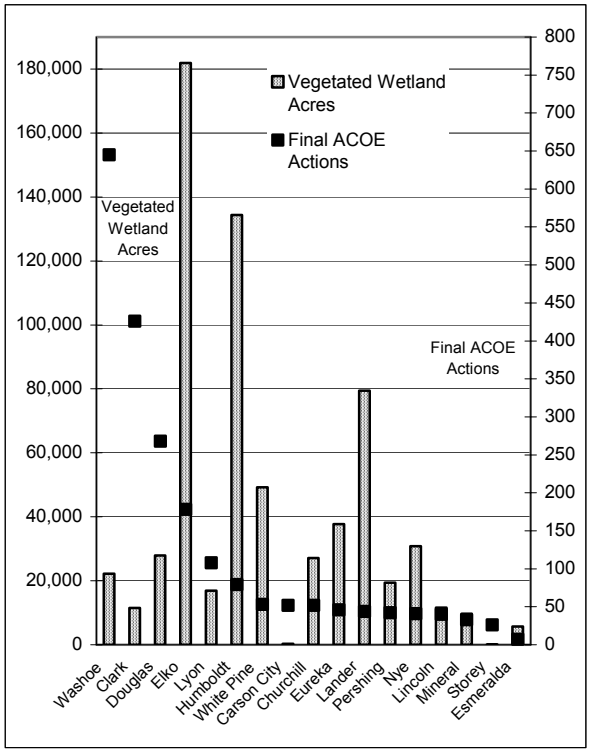
Table 5.3 ACOE Section 404 Permit Activity: Acres Permitted and Acres Mitigated, 1998 to 2003.

Year	Individual Permit Actions			Nationwide Permit Actions		
	# Final Permits	Total Acres Permitted	Total Acres Mitigated	# Final Permits	Total Acres Permitted	Total Acres Mitigated
2003	1	0.02	0.02	49	9.4	5.4
2002	4	3.4	9.1	61	44.4	16.8
2001	0	1.1	2.8	50	73.2	73.2
2000	1	43.1	64.2	52	2.6	0.7
1999	3	3.0	3.0	92	20.3	46.1
1998	4	124.4	387.5	73	3.2	8.6

Source: ACOE dataset, Sacramento District Office. December 2004.
Notes: The ACOE issued 790 final permits during the period, but processed and administratively acted on 2154 applications.

Mitigation is intended to "compensate for" or replace lost wetland acreage, functions, and services with self-sustaining wetlands that will not require ongoing intervention. The ACOE determines a mitigation acreage ratio based on recommendations from the project proponent and involved resource agencies. The ratio may be greater than 1 to 1. The functions and values of wetlands to be eliminated or degraded compared to the proposed mitigation area is considered. Table 5.3 indicates mitigation ratios often are in the 2:1 or 3:1 range. Mitigation projects are expected to be completed in advance or concurrent with the impact, as near to the site of impacts as practicable, and with protections from subsequent loss or degradation. In-lieu payments and/or purchase of a wetland property usually are not acceptable alternatives. Comparison of the permitted and mitigated data for 2002 and 2003 indicate mitigation remained to be completed. The enforcement of mitigation requirements has been an issue for the ACOE. Another issue is that mitigation projects may require tradeoffs of wetland values, for example the loss of riparian wetlands with water quality and wildlife values for lacustrine wetlands with recreation values.

Figure 5.2 Comparison of ACOE Final Permit Actions (1998 – 2003) to Vegetated Wetland Acreage by Nevada Counties



Source: ACOE dataset, Sacramento District Office. December 2004. Vegetated and linear wetland estimates by country from NWI, 2003.

The mitigation may also involve mitigation banking. Mitigation banking involves restoring, creating, enhancing, or possibly preserving permitted wetland losses prior to development, where compensation cannot be accomplished at the project site or would be less beneficial than an alternative site. Often small, fragmented wetland mitigation projects are consolidated into one larger site. Units of prior mitigated wetlands can be thought of as credits, which may be withdrawn later to offset debits incurred at the project site. The Nevada Department of Transportation created a mitigation bank in Washoe Valley to compensate for losses associated with highway construction in the Truckee Meadows and Eagle Valley. Nevada state law (NRS 244.388) authorizes counties to establish, operate, and regulate wetland mitigation banks.

The intensity of ACOE wetland regulatory activity differs among counties. The number of final permit actions taken by the ACOE during the period 1998 to 2003 is greatest in urban counties with much less wetland acreage compared to the counties with a large share of wetlands. Figure 5.2 is an attempt to illustrate graphically the apparent unevenness in wetland protection. The ACOE issued 1,071 final actions in Clark and Washoe counties, which combined contain a total of 33,700 vegetated wetland acres. In Elko and Humboldt counties, the ACOE executed only 257 final actions where vegetated wetlands total 316,250 acres. The vegetated wetland acreage in Elko and Humboldt is ten times greater than Clark and Washoe, but regulatory actions are four times less. The jurisdiction of the ACOE is limited in Elko and Humboldt counties where fewer wetlands lie adjacent to waters of the U.S. Clark and Washoe include rapidly developing urban and industrial areas, whereas farming and ranching are the prevalent land uses in Elko and Humboldt counties Information on the regulatory activities undertaken by NRCS on agricultural land are not available for wetlands in Humboldt and Elko counties.

Natural Resources Conservation Service. The NRCS is the lead agency for wetland delineations on agricultural land and compliance with CWA Section 404 and Swampbuster regulations. The Wetland Conservation or Swampbuster provisions (1985 and 1990 Farm Bills) require farmers to protect wetlands on their agricultural land to maintain eligibility for federal farm program benefits. Wetland conversion is allowed if only a minimal effect on the hydrological and biological value of the wetlands will occur. The NRCS determines whether the conversion will cause a minimal effect. Drainage of frequently cropped wetlands may be allowed if the producer mitigates by replacing converted wetlands with equivalent values. NRCS must approve the plans. When applying for federal farm program benefits through the federal Farm Services Agency, producers indicate whether activities will manipulate any wetlands. The NRCS must make a certified wetland determined/delineation, which producers can appeal. For wetlands farmed prior to December 25, 1985, producers can maintain but not enlarge or extend existing drainage improvements.

Irrigated Farmland, Fallon Area

"…a most apt illustration of the magic touch of the hand of man, and his genius in producing agencies which caused the desert wastes of that arid country to bloom as the rose, and created a veritable Paradise in the territory which had been parched and seared. This transformation resulted from the promotion of an irrigation district fostered by the U. S. government, in Lahontan Valley, and the dividing of the land into forty and eighty-acre tracts, for sale to interested agriculturists."

C.W. Torrence

Long before federal land and water management agencies arrived, settlers in 1863 had begun building irrigation ditches and hay ranches in Lahontan Valley. Before then, the Carson River entered Carson Lake on the northwest side and exited from the northeast corner, flowing into Carson Sink through Stillwater Slough. Carson River runoff in wetter years inundated parts of the valley, branching into shallow lakes and wetlands, braided channels, oxbows, perennial and ephemeral marshes, and playas. Before the Reclamation Act of 1902 was passed a large number of farms and ranches already were in operation in the Lahontan Valley. Glenn Clemmer photo.

Agricultural land uses in Nevada generally are described as cropland, hay land, and pastureland; rangelands are not included. Established, normal farming activities in wetlands are exempt from regulation, such as plowing, harvesting, seeding, minor drainage, cultivating, maintenance of drainage ditches, as well as construction and maintenance of irrigation ditches, farm or stock ponds, and farm roads. Generally, areas subject to regulation under Swampbuster and CWA Section 404 are the same, but some activities exempted under Swampbuster may require a CWA Section 404 permit.

Various exemptions to wetland permitting apply to "prior converted cropland" or "farmed wetland." Prior converted croplands are wetlands that were drained, dredged, filled, leveled, or otherwise altered before December 23, 1985 for agricultural production, and that: 1) do not meet wetland hydrology criteria; 2) were farmed prior to December 23, 1985; and, 3) have not been abandoned. Activities in prior converted cropland are not regulated under Swampbuster or CWA Section 404. If prior converted cropland is not farmed for more than five consecutive years and wetland conditions return, the cropland is considered abandoned and subject to Swampbuster and CWA Section 404 regulations. Farmed wetlands are similar (i.e., drained, dredged, filled, leveled, or altered before December 23, 1985 to produce a crop), but conditions exist that indicate valuable wetland habitat is present. Farmed wetlands include intermittent

or seasonal wetlands. Swampbuster and CWA Section 404 may apply to farmed wetlands.

The acreage of valley bottoms and benches amenable to irrigated farming and ranching is limited. The vast majority was converted to farms and ranches long before Swampbuster regulations took effect. Probably much of the agricultural land with wetlands would qualify as prior converted cropland or farmed wetlands. The Nevada state office of the NRCS does not release data on their wetland permit or inspection program, or riparian proper functioning condition assessments. Therefore, it is difficult to gauge the effect of NRCS regulatory programs on the protection or improvements of wetlands on private agricultural land. About sixty percent of the vegetated wetland resources occur on private land in Nevada, and thirty percent of the linear wetlands.

The NRCS operates numerous programs that offer incentives and technical assistance to eligible agricultural producers that meet a variety of criteria. The incentive programs applicable to wetland conservation are the Wetland Reserve (WRP), Environmental Quality Improvement (EQIP), and Wildlife Habitat Improvement (WHIP) programs. The programs are intended to help improve crop and livestock production while improving environmental quality and resources. The EQIP and WHIP work on a cost share basis with producers volunteering to install qualifying practices. Priority objectives in Nevada include reduction of nutrients discharged from animal feeding operations, conservation of water supplies, habitat for sage grouse or other at risk species, and improving riparian and aquatic areas.

Table 5.4 NRCS Agricultural Wetland Program Performance Results, 2002 to 2004

County	Wetland Acres Created, Restored, or Enhanced and Managed for Wetland Wildlife Habitat		
	2002	2003	2004
Churchill	60	NR	NR
Douglas	NR	NR	55
Elko	23	NR	NR
Nye	60	16	95
Washoe	1	2	74
Nevada Total	144	18	224

Source: National Performance and Results Measurement System, http://prmsreports.nrcs.usda.gov/index.html (January 2004 and 2005).
Note: NR = none reported. No entries are shown in the NPRMS report for the twelve Nevada counties not listed.

Nevada's first WRP conservation easement was implemented in 2002 on the Parker Ranch in Beatty. The Nature Conservancy (TNC) purchased the ranch, and is restoring desert riparian habitat for migratory birds and two rare, native species – the Amargosa toad and Oasis Valley speckled dace. The USDA pays for the easement and costs of restoring wetlands. The conservation easement is incorporated into the title of the land, which stays in private ownership and on the county property tax role. Compatible uses may be permitted within the easement, such as harvesting hay or wood products, grazing, and undeveloped recreational activities. The easement on the Parker Ranch is permanent. The assistance of TNC accelerated implementation of the WRP in Nevada, a potentially important advancement. Wetlands in lower valley floodplains converted to farm and ranch land present prime riparian restoration sites with high water quality, summer/fall streamflow augmentation, floodway channel protection, and wildlife values. The orientation toward rapid growth and development makes Nevada attractive to land and water speculation. Agricultural properties in Oasis Valley and other rural valleys nearby urbanizing regions appeal to developers for future subdivisions or as a bank of water rights that may be sold for transfer to another place of use. The NRCS conservation incentive programs could assist in keeping prime farm and ranch land in production, and accelerate riparian wetland improvements on agricultural land. However, participation in NRCS conservation incentive programs appears to be quite low.

The NRCS reports the annual results of conservation program activities in the National Performance and Results Measurement System (NPRMS), which is available on the Internet. Sharing data about the implementation of government wetland programs is a positive and necessary step in building public awareness of the status of conservation activities and issues. The data for NRCS activities in Nevada for wetlands creation, enhancement and restoration are presented in Table 5.4. The level of wetland activity appears low in the context of the 1997 to 2002 Natural Resources Inventory report that indicates a

182,600 acre gain nationwide within the agricultural land use category (Table 1.16). Also, the NPRMS provides wetland program results for all states, which shows Nevada lagging behind all other western states. A large share of the historic losses and the remaining vegetated wetlands are connected to agricultural land uses, suggesting many opportunities for restoration and enhancement would coincide with farms and ranches. Apparently, program participation has occurred in only five of the seventeen counties. The NRCS programs have been carefully designed to support the needs and address concerns of the agricultural community, and are an important strategy for wetland conservation. The state may be able to do more to support or augment the NRCS agricultural wetland conservation programs.

The NRCS also administers the federal Watershed Protection and Flood Prevention Act program to address erosion, floodwater, and sediment damage that causes loss of life or property damage. The NRCS and Farm Services Agency apportion technical and financial assistance to local, state and other public agencies for the planning and implementation of watershed-based projects on nonfederal land. Consultation with the FWS is required. The Division of Conservation Districts acts as a liaison for conservation districts with the NRCS as requested. Eligible organizations include Indian tribes, state or local governments, soil or water conservation districts, flood prevention or control districts, and similar organizations that can carry out and maintain improvements. Qualifying projects must help fix natural resource and related economic problems in a watershed no larger than 250,000 acres related to watershed protection, flood prevention, erosion and sediment control, water supply, water quality, fish and wildlife habitat enhancement, wetland creation and restoration, and public recreation. The watershed protection program also allows cost sharing (50/50) for the acquisition of perpetual easements on wetlands or floodplains for conservation or flood prevention.

The Environmental Protection Agency. The involvement of the EPA in wetland regulation, conservation, and restoration primarily is an extension of its wide-ranging Clean Water Act (CWA) duties. Included are programs for setting water quality standards, monitoring and assessing water quality, permitting point source pollution discharges, controlling nonpoint source pollution, and water quality certification of wetland projects. Through the EPA, state agencies receive federal funding that partially supports stateside implementation of CWA regulations. The EPA wetland programs encourage and enable states, tribes, and local governments to protect and restore wetlands and associated ecosystems, including shallow open waters and free-flowing streams. The program activities include establishing national policies and standards, as well as assisting others to meet them. The EPA supports creation of both regulatory and non-regulatory wetlands protection programs; promotes and distributes wetlands science for wetlands decision making; and, provides guidance or back up enforcement for state and tribal wetlands programs regarding Clean Water Act Section 404 permit decisions.

The EPA Region 9 office administers two key nonregulatory programs that provide financial and technical support for wetland conservation and restoration activities in the state. The Section 319 program, carried out by the Water Quality Planning Bureau (within NDEP), co-funds projects intended to reduce nonpoint source pollution, many of which target riparian wetland restoration and improvement. The State Wetland Program Development grant has co-funded the development of the Nevada Wetland Classification System, Nevada Wetland Information System and GIS, and this state wetland priority conservation plan, in addition to the preparation of a wetland policy and management plan for state wildlife management areas (NDOW, 1998).

SWANCC Supreme Court Ruling and the Joint ACOE/EPA Proposed Rule on Isolated Wetlands. The ACOE regulations include in the definition of waters of the U.S. “waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce…” In essence, these are “isolated” water and wetland resources over which the ACOE may invoke jurisdiction, provided other factors were present. A key criteria is whether

the aquatic and wetland habitat of the isolated waters "are or would be used as habitat by birds protected by Migratory Bird Treaties…are or would be used by other migratory birds which cross state lines…" The ACOE adopted the "Migratory Bird Rule," which justified permitting authority using interstate commerce as the rationale for designating certain isolated wetlands as waters of the US. Such wetlands, though not navigable, are visited by people from other states to view or hunt migratory birds, thereby generating significant economic benefits. The ACOE rationale cited the Commerce Clause of the U.S. Constitution as authorization to protect the wetland habitats of migratory birds.

In the case, Solid Waste Agency of Northern Cook County (SWANCC) vs. U.S. Army Corps of Engineers, the U.S. Supreme Court ruled that the Congress did not intend Section 404 to apply to isolated waters based on their use by migratory birds. Specifically, the high court decided the federal Clean Water Act does not prevent the ACOE from permitting construction of a landfill on wetlands used by migratory birds. The USACOE had denied the 500-acre landfill permit, finding that seventeen acres of gravel pits had become shallow ponds supporting wetland vegetation and over one hundred species of migratory birds. "Navigable waters" includes wetlands adjacent, near, or hydrologically connected to navigable waters. But, the Court countered that permitting the government to claim federal jurisdiction over ponds and mudflats would also result in a significant impingement of the states traditional and primary power over land and water use.

While striking down the Migratory Bird Rule, the high court did not clearly state whether Section 404 would henceforth be limited to wetlands adjacent to navigable and interstate waters and tributaries. In other high and lower court decisions, the ACOE successfully defended permit authority over wetlands adjacent to certain isolated waters with a "significant nexus" (e.g. hydrologically connected) to waters of the U.S. Following the courts ruling, the EPA and ACOE issued a joint memorandum that narrowly interpreted the SWANCC decision, but provided limited guidance on the meaning of key terms left ambiguous by the high court – "tributary," "adjacent," and "significant nexus." In other words, it is unclear how large is the gap in federal wetland regulations. The EPA and the USACOE directed field staff to cease relying on the use of waters or wetlands as habitat for migratory birds as a sole criterion to determine regulatory jurisdiction. The Corps identified 8.4 million isolated wetland features in 43 states that would default to protection by the states. If the ruling implicitly extends authority of state governments to regulate activities on isolated wetlands, then a large number of wetlands throughout Nevada are not protected.

An example of the confusion created by the SWANCC decision is the matter of the ACOE regional office for Oregon and Washington, which recently agreed to a court settlement that extends Section 404 protection to irrigation canals and drainage ditches connected to navigable or interstate waterways. The question of whether these ditches and canals should be protected by the Clean Water Act has been the subject of numerous cases since the Supreme Court ruled in 2001 that isolated, nonnavigable, intrastate waters and wetlands could not be regulated by the Clean Water Act merely because migratory birds visited them. Some developers and ACOE officials interpreted the ruling to mean that landowners could fill ditches and connecting wetlands and streams without permits or mitigation previously required by the law. Other states in the West are expected to protect canals and ditches and the waters and wetlands that flow from and into navigable streams. As mentioned in a previous section, the Sacramento District Office of the ACOE has issued policy on the regulation of such waterways, but there is no nationwide guidance.

In January 2003, the EPA and ACOE published jointly the Advance Notice for Proposed Rulemaking on CWA Definitions of Waters of the United States (ANPR). In response, 130,000 comments were sent to the ACOE and EPA, the bulk supporting a narrow interpretation of SWANCC. Forty-one states argued against a broad interpretation of the SWANCC ruling, asserting a large gap in CWA protection would result. States also expressed concern that a broad interpretation would undermine state Section 401 water quality certification. Section 401, which gives NDEP authority to veto or condition ACOE permits based

on water quality standard impairment concerns, is the primary state wetland protection mechanism. Arizona, Montana, and New Mexico commented that an estimated ninety-five, eighty, and seventy-one percent, respectively, of the streams in their state were not perennial and would be omitted from CWA protection. The state of Nevada apparently did not submit formal comments on the ANPR.

The Pacific Region office of the NWI submitted written comments to the Secretary of the Interior concerning the implications of the ANPR for Nevada wetlands. The NWI notes the majority of streams flow to interior basins and lakes. These watercourses are intrastate and non-navigable. Playas and desert spring wetland habitats would be at risk with SWANCC-driven rule changes. The Nevada waterbodies and wetlands at risk include most of the nearly 32,000 wetlands smaller than 40 acres (small ponds, seeps, and springs) and 100,800 acres of wetland/upland complexes; 74 percent of linear wetlands (the portion of ephemeral and perennial rivers and streams outside of the Truckee, Carson, and Colorado River basins); and, most of the 935,500 acres of playa. Though waterways and wetlands that overlap federal public land and tribal land would be considered interstate, this constitutes a tiny portion of the wetlands likely to go without protection. More specifically, the NWI Pacific Regional office noted:

- Playas. The ACOE would no longer regulate perhaps all of the 935,500 acres of playas. Over half of Nevada wetlands are playas. These provide important foraging and resting habitat for migrating waterfowl and shorebirds, including ten of the 29 bird species on the FWS Birds of Conservation Concern list, for which habitats are not protected under the ESA. Some playas are threatened by fill for urban development. Loss of all or part of a playa would eliminate or reduce the number of waterfowl and shorebirds supported during migration, burdening species in decline.

- Desert Springs and Associated Wetlands. Most springs would likely not be regulated under the proposed rule. Desert springs are critical sources of water to wildlife, being the only water for many miles. Studies suggest the stresses of migration may make insectivorous and frugivorous bird species at least seasonally dependent on springs. Spring ecosystems are distinctly different from stream and lake riparian habitats, characterized by relatively constant water temperature, subsurface flow through aquifers, and refugia for endemic native fishes and snails. Fourteen fish species inhabiting springs and spring brooks are endangered or threatened. Some springsnail species are endemic to one or a few springs. Most springsnail species are not protected under the ESA, and a number of genera and species remain undescribed. Springs are threatened by diversion and other water development techniques including aquifer dewatering by the mining industry. Loss of any spring results in the loss of occupying organisms and may extinguish an entire species if endemic to that spring along. Wildlife, forced to move, would compete with established organisms for food, nest sites, and cover.

- Wetland/upland Complexes. The NWI has identified 100,800 acres of wetland/upland complexes. The majority would likely fit the definition of isolated, intrastate, non-navigable waters. Many include desert springs.

Nevada State Regulatory and Nonregulatory Programs

Nevada state law does not proffer an overarching declarative policy or statutory framework for wetland protection and conservation. The Association of State Wetland Managers reports that seventeen states do. Among them is Oregon. Key elements of the Oregon approach are a tiered system of permits for fill and dredge activities in wetlands not protected by CWA Section 404; delegation of wetland programming to a local entity where a qualified wetland conservation plan has been adopted; and creation of a state wetland inventory. Washington has adopted a state no net wetland loss policy and closes the wetland protection gap with the State Environmental Policy Act (modeled after the National Environmental Policy Act, or NEPA) and the Growth Management Act (requires local government to protect critical natural areas including wetlands), in addition to water quality, fish and wildlife, forestry, and navigable channel laws similar to those in Nevada. California, which also uses a mix of environmental and natural resource laws, but also and the California Environmental Quality Act provides a protective mechanism also similar to NEPA, and a permit must be obtained from the Regional Water Quality Control Board before discharging pollutants, including fill into isolated waters. The California Resources Agency asserts that the no net wetland loss target has been achieved, but the claim applies to a select set of wetland resources.

Table 5.5 Nevada Revised Statutes with Provisions That May be Used to Protect or Conserve Wetland Resources

NRS Chapter	Responsible State Agency	Overview of NRS Provisions That May Protect or Conserve Wetland Resources
321 322	Division of State Lands	• Authorize use of state land, e.g., beds and banks of navigable water • Permit to use, dredge, fill, construct on land below high water mark of navigable river
407	Division of State Parks	• Acquire land of outstanding scenic, recreational, scientific, historical importance for public use • Prepare statewide comprehensive outdoor recreation plan
445A 519A	Division of Environmental Protection	• Regulate point and control nonpoint source discharges to, set effluent limits for, waters of the state • Establish water quality standards, monitor water quality, set beneficial use criteria • Requirement to reclaim mines/exploration projects, prevent undesirable surface water conditions
472 527 528	Division of Forestry	• Maintain forest, watershed to conserve water and soil, prevent floods; restore vegetative cover • Permit to take any flora on private land, state park land • Special permit to remove or destroy flora threatened with extinction • Permit to log, limitations on logging activities near water body
532 533 534 535	Division of Water Resources	• Evaluate flood control and water development projects for compliance with state water law/plan • Operate program to aid local government with channel clearance/maintenance of navigable rivers • Permits, limits, restrictions on water use, appropriation, rights to quantity needed for beneficial use • Requirement to allow water not appropriated to flow in natural stream past diversion • Requirement for hydrological/environmental study before determination on application • Authority to "designate" groundwater basin for special regulation of aquifer vulnerable to depletion • Permit to construct/alter dam, requirement to provide fish passage • Removal of beaver dam where flow obstructed to detriment of water users
548	Division of Conservation Districts	• Provide local conservation districts with administration, coordination, and technical assistance to develop programs/projects for conservation of renewable natural resources [e.g., riparian and wetland]
501 502 503 504	Department of Wildlife	• Preserve, protect, manage, and restore wildlife through regulation • Establish policies on acquisition of interest in land, water rights, easements for wildlife protection • Require dam or other water body obstruction to provide for passage of fish with fishways/ladders • Permit to use dredge in water body • Special permit to take fauna declared threatened with extinction; protect threatened fauna, habitat • Requirements to hunt birds protected by the Migratory Bird Treaty Act • Create and maintain state wildlife management areas to revive wildlife provide recreation
555 561	Department of Agriculture	• Requirement to control, destroy, eradicate noxious weeds, support weed control district formation • Establish and implement policy to preserve and allocate natural resources for agricultural industries • Regulate aquatic agriculture in coordination with the Department of Wildlife
704	Public Utility Commission	• Require public water supplier to plan for and offer incentives for water conservation • Requirement to study environmental impacts and suitability of alternatives and obtain utility facility construction permit

Water quality and fish and wildlife programs administered by the state Department of Wildlife and Department of Conservation and Natural Resources provide the most direct means for wetland protection and conservation in Nevada. The Divisions of Environmental Protection, Forestry, Water Resources, State Lands, and State Parks each implement programs that may provide for wetland protection, conservation, or restoration. Individual state agency wetland efforts are not conducted within an integrated/intrastate framework. State statutes that directly or may indirectly lead to wetland protection or conservation are listed in Table 5.5. An expanded statute summary is presented in Appendix 5.1.

Nevada Division of Environmental Protection. The NDEP administers programs to eliminate and control the discharge of pollutants to streams and aquifers, to set water quality standards for the maintenance of beneficial uses, and to monitor the physical, chemical, and biological qualities of waters of the state. "Waters of the state," is defined as all waters that are situated wholly or partly within or bordering upon this state, including but not limited to: 1) all streams, lakes, ponds, impounding reservoirs, marshes, water courses, waterways, wells, springs, irrigation systems and drainage systems; and, 2) all bodies or accumulations of water, surface and underground, natural or artificial (NRS 445A.415). This broad definition applies to the regulation by NDEP of point source pollution discharges and the nonregulatory control of nonpoint source pollution discharges. Implementation of the National Pollution Discharge Elimination System and other state discharge permit programs has substantially reduced surface and groundwater discharges from industries, mines, wastewater treatment plants, and other "end of pipe" sources. Wetlands in a few instances are created and used to treat discharges from wastewater treatment plants and urban runoff, such as the Las Vegas Wash and the wetlands cells in Carson Valley where treated effluent from Lake Tahoe Basin communities is disposed.

Nevada Water Pollution Control Policy (NRS 445A)

445A.305. The Legislature finds that pollution of water adversely affects public health and welfare; is harmful to wildlife, fish and other aquatic life; and impairs domestic, agricultural, industrial, recreational and other beneficial uses of water. The Legislature declares that it is the policy of this state to maintain the quality of the "waters of the State" consistent with the public health and enjoyment, the propagation and protection of terrestrial and aquatic life, the operation of existing industries, the pursuit of agriculture, and the economic development of the State; and to encourage and promote the use of methods of waste collection and pollution control for all significant sources of water pollution, both point and diffuse.

445A.400. "Pollutant" means dredged soil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water. 445A.405 Pollution" means the man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of water.

445A.415. "Waters of the State" include all streams, lakes, ponds, impounding reservoirs, marshes, water courses, waterways, wells, springs, irrigation systems and drainage systems; and all bodies or accumulations of water, surface and underground, natural or artificial.

445A.465. Except as authorized by a permit issued by the Department [Division of Environmental Protection] and regulations adopted by the Commission, it is unlawful for any person to discharge from any point source any pollutant into any waters of the State.

445A.520. The Commission shall establish water quality standards at a level designed to protect and ensure a continuation of the designated beneficial use or uses. The water quality standards shall be based on water quality criteria, which numerically or descriptively define the conditions necessary to maintain the designated beneficial use(s) of the water, that is to support, protect and allow the propagation of fish, shellfish and other wildlife and to provide for recreation in and on the water if these objectives are reasonably attainable.

445A.570. The Commission may prescribe controls for diffuse sources existing on July 1, 1979, if the Director determines that the source is significantly causing or adding to water pollution in violation of a water quality standard; or created after July 1, 1979, if controls are necessary to prevent the degradation of any water of high quality in the waters of the State.

Reducing the amount of pollution discharged from point sources surely benefits wetland water quality conditions. In concept, given the broad definition of waters of the state and NDEP authority to require a permit for a point source discharge to both navigable and isolated water bodies, a state permit may be required for the discharge of fill to wetlands connected to isolated waters not subject to CWA Section 404 regulation by the ACOE. Water quality regulations do not identify wetland as a beneficial use, so water quality standards protective of wetlands have not been set.

The NDEP implements the state Nonpoint Source Program (CWA Section 319) to manage activities and implement projects intended to prevent and reduce nonpoint source pollution in surface and groundwater. The statutes address nonpoint pollution as "diffuse

sources" in NRS Chapter 445A. The goals of the state Nonpoint Source Program emphasize reduction of nonpoint source pollution loads entering water quality impaired waters (CWA Section 303 (d) listed waters); education about water quality riparian area health and nonpoint source issues; and, intergovernmental coordination on implementation of Best Management Practices to control pollution. The state-run Section 319 grant program co-funds projects that include bank restoration and other riparian improvements, many of which involve the Conservation Districts in the Carson, Walker River, and Truckee River basins. The Las Vegas Wash wetland rehabilitation projects have been funded through the grant program too.

The 1999 update of the State Nonpoint Source Management Plan, reported that forty-seven percent of the rivers and streams monitored and assessed were found to be partially or fully not supporting beneficial uses (i.e., water quality conditions do not meet standards for beneficial uses), and nonpoint sources were responsible for sixty-six percent of the total pollution impact. The standards for turbidity, suspended solids, and total phosphates were the most common pollution problem (over seventy percent), and temperature exceedances were also significant. The limited distribution of wetlands, which effectively filter sediment, phosphorous, and direct sunlight along rivers and streams, may be a factor in nonpoint source pollution impairment. A potentially serious nonpoint source concern is accumulation of potentially toxic trace elements, such as boron, arsenic, and selenium salts, in the terminal marshes and inundated playa arriving in drains from irrigated farmlands. The USGS has studied this issue in the Stillwater Marsh area for years and reports that wildlife, water, and vegetation have been negatively impacted from elevated levels of trace elements. It is not known if similar impacts are occurring in terminal marshes in other basins where irrigated agriculture is a dominant land use.

The NDEP coordinates with the ACOE in Section 404 regulation of dredging or filling waters of the US though state implementation of CWA Section 401. The purpose of Section 401 is to ensure that ACOE wetland permits comply with state water quality regulations. Section 401 is implemented through a certification process. An applicant for a federal permit that could result in the discharge of a pollutant to waters of the state is required to obtain a certification from the Nevada Division of Environmental Protection verifying that the activity will not violate state water quality standards. The division must evaluate whether the materials to be discharged will comply with applicable effluent limitations and water quality standards. If NDEP denies certification, the ACOE must deny the permit application, and any NDEP conditions become part of the federal permit. Wetlands can vary greatly from other kinds of waters, and the state has not set water quality standards applicable to the characteristics of wetlands separate from other waters. Apparently a significant limitation of the state Section 401 program is the relatively narrow scope of its applicability. As discussed in the Isolated Wetland/SWANCC Decision section above, a majority share of the wetland resource base does not coincide with streams, springs, or other water resources that meet the criteria for waters of the U.S., and thus fall outside the ACOE permit and NDEP certification programs.

Nevada Division of Water Resources. Most of the state's scarce water resources are fully appropriated. Population growth and frequent droughts are primary factors driving changes in water use. Given the limited supplies and interdependence of wetland and water resources, the state's oversight of water supply appropriation, change in use, and interbasin transfer has a significant influence on the quantity and quality of the wetland resource base. Water law is founded on the priority appropriative rights doctrines. The first person to take a quantity of water and put it to beneficial use has an earlier and superior (senior) priority right to use than a subsequent (junior) appropriator. Senior right holders must be fully satisfied before a junior appropriator may take their share, and some junior rights may not receive any when surface supplies are low.

To appropriate or change the use of water, an application must be filed with and approved by the State Engineer. In general, the use of an appropriative water right involves capturing and retaining streamflow

in a reservoir, removing water from a stream. On the other hand, the water rights requires the holder to allow unused water to continue to flow past the diversion and to return unconsumed water to its origin or the next user. A permit to use water must not be issued if it conflicts with existing rights, or there is no unappropriated water in the proposed source of supply (exceeds the perennial yield), or it threatens to prove detrimental to the public interest. The public interest criteria include statutory principles pertaining to wise use of a scarce resource. A certified water permit or water right identifies point of diversion, amount to be withdrawn, purpose of use, and place of use for the water. All water sources belong to the public; shall not be wasted; diversion shall cease when the need does, and unused water shall be allowed to flow past a diversion.

State water law focuses on efficient allocation of water for human uses and not for ecological needs. In the late 1800s, when the foundations for water law were being established, there was a great need to develop a fair and orderly system to divert water from streams to mill ore, irrigate valley terraces and plains, transport logs, and to build towns. It has continued in that vein with some adjustments. There are two statutory provisions that explicitly water to be protected or appropriated to maintain natural resources: 1) Before a person may obtain a right to use water from a spring or seepage to the surface, he must ensure that wildlife which customarily uses the water will have access to it (NRS 533.367); and, 2) The use of water from any stream system and from underground water for any recreational purpose is declared to be a beneficial use (NRS 533.030).

Historically, the vast majority of water was taken for irrigation and mining uses. The State Water Plan provides estimated statewide water use data for the period 1970 to 1995. Total annual withdrawals (surface and groundwater) fluctuated between 3.7 and 4.2 million acre feet/year with no apparent trend up or down. Withdrawals for irrigated agriculture, which accounted for seventy-five percent of the total during the twenty-five year period, changed little. The only apparent trend was the increase in the quantity of water withdrawn for domestic, commercial, power plants, and mining use categories. Withdrawals for non-agricultural uses increased substantially (factors of 3 to 10), without a reduction in agricultural withdrawals (NDWP, 1999). The USGS reports that the amount of water used for public supply has increased since 1985 from 8 percent of all withdrawals to 20 percent, and water use in mining has increased from less than 1 percent to 4 percent. If more of the growth in water supply demand is met by development of new sources of supply and less by changes in use (e.g., conversion from agriculture to municipal and industrial), presumably the quantity of water incidentally available to maintain wetlands will tend to decrease.

Blue Lakes, Pine Forest Range – Site of the First Instream Flow Water Rights in Nevada

Upper Blue Lake was the focal point of a Nevada Supreme Court ruling in 1989 upholding the State Engineer's decision to permit the "in situ" and "nonconsumptive" use of water, i.e., without diversion from the natural water body. In this case, the uses were recreation, fisheries, wildlife, and stock watering, which required maintaining a minimum pool in the lake. Previously, water appropriations were approved only for uses involving a diversion. Since then, a number of water use permits have been issued for instream or in-lake uses, including wetlands, water quality, and fisheries. The setting is a glacial cirque at 8,300 feet in the Pine Forest Range. The lakes are stocked by NDOW with rainbow and brown trout for sport fishing. Joseph FitzGerald photo.

Ensuring flow will be present in a stream at a rate necessary to maintain instream beneficial uses requires an agency or organization obtain a water use permit that identifies the quantity, timing, duration, location, and purpose of use (e.g., to keep water in its natural channel for environmental quality, fish and wildlife populations, recreation, or wetland maintenance. Finally, in 1989 Nevada water law was interpreted by the Nevada Supreme Court to allow the State Engineer authority to grant water rights for instream (or "*in situ*") uses that are "nonconsumptive".

In recent years, agencies and NCOs have obtained water rights for instream purposes related to wetlands, fish and waterfowl habitat, survival of imperiled species, and water quality. Water has been obtained by purchasing and transferring water rights to a designated water body, filing for new appropriative water rights, as well as entering into agreements for reuse of water from agricultural irrigation systems, wastewater treatment plants, and mine dewatering operations. The water generally is used to augment streamflow, reservoir and lake levels, spring pools, wetlands and riparian areas. Water rights have been acquired for the lower Truckee River, Meadow Valley Wash (Condor Canyon), Upper Blue Lake (Pine Forest Range), Bruneau River, Carson Lake and Pasture and perhaps a few other aquatic and wetland resources on federal wildlife refuges and state wildlife management areas. Many water acquisition projects have been cooperative interagency solutions to meeting requirements in federal legislation, including the Truckee-Carson-Pyramid Lake Water Rights Settlement Act, Endangered Species Act, Section 404 of the Clean Water Act, the Migratory Bird Treaty Act, and the National Environmental Policy Act.

Rare, Endemic Plant Species Protected by State Law

Monte Neva paintbrush (Castilleja salsuginosa) is a rare native plant that grows in an unusual wetland setting, specifically on travertine hot spring mounds. Intensive surveys have found the species to occur in small populations at only two sites in eastern Nevada. Thus, this species is very vulnerable to ongoing and potential land use activities, which include off-road vehicle travel, water diversion, grazing and trampling by animals, commercial tourism development, hydrothermal exploration and development, or water diversion. The species has been placed on the state fully protected plant list. Destruction or taking of any plants without a permit from NDF is prohibited. James Morefield photo.

However, a water right does not guarantee that water will be available for a permitted instream use. The uncertainty arises during drought, of course, but also where the volume and rate of flow appropriated in the river or stream exceeds the supply normally available; the diversion and storage operations of the river or stream system are subject to a court adjudicated decree with limited flexibility to satisfy the time, duration, and place of use conditions; or the instream water right has a junior priority. Generally, state water law and adjudicated decrees lack the flexibility that would be needed to realize a consistent benefit from instream water rights for the intended wildlife, fisheries, recreation, or wetland uses.

Nevada Division of Forestry. The NDF coordinates and manages forestry, endangered plant species, and watershed resource activities on nonfederal land that can provide for the protection, conservation, and management of wetland resources. Under the state Forest Practices Act (FPA – NRS Chapter 528), a permit from the NDF must be obtained for logging operations on nonfederal land. The purpose for requiring a permit is to ensure that a logging plan is

prepared that documents which practices will be used to preserve the water supply of the state, including measures to protect riparian zones. Activities are prohibited within 200 feet of the high water mark of streams and other water bodies, including tree falling, skidding, road or landing construction, and vehicle operation. A variance may be obtained if resource management objectives are not compromised, such as maintaining water quality, water flow, fish life, and stream habitat.

The Forest Practices Act was intended for logging timber on nonfederal land, of which there are approximately 750,000 acres remaining. The NDF typically permits two or three timber harvest plans annually, an indication of the diminished status of private forestland, primarily in the Carson and Sierra Nevada ranges that can be practicably harvested. In central and eastern Nevada, progressively larger and dense pinyon pine and juniper woodlands has become a land use issue, so removal and thinning activities has increased. The Forest Practices Act may not apply to woodland clear cutting or thinning operations, since the Act applies to timbered lands. Riparian areas in woodland cutting areas may be at risk if the stream buffers are violated.

The Threatened and Endangered Species program provides for the conservation, protection, restoration, and propagation of native plant species declared by the State Forester to be critically endangered and threatened with extinction (NRS 527.260). Of the twenty-three state protected species, eleven depend upon wetland habitat (Table 5.6). The objectives of the program are carried out by placing imperiled plant species on the state list of fully protected plant species and requiring a permit for land use activities that may negatively impact the species or its habitat. The NDF (State Forester) may issue a permit to authorize a project that will likely result in the taking of a plant listed as a fully protected native species or subspecies. Plants are placed on the list of fully protected species if experts determine it is threatened with extinction. The State Forester in consultation with the NNHP and other experts makes the listing determination when it is found that the survival of the species requires assistance due to over-exploitation, disease, or its habitat is threatened with destruction or substantial alteration. The permit program is intended to ensure that project activities will include measures to avoid the taking of a protected species, or minimize and mitigate the impacts on the population or habitat. Where NDF determines a permit is required, the project proponent must provide a plan and enter into an agreement that specified measures will be employed to manage the land and activities for species survival or recovery in the wild. The agency may also coordinate with the landowner to establish a special management area for preservation or transplantation.

Table 5.6 State Fully-Protected Wetland Dependent Plant Species

Astragalus lentiginosus Douglas var. *sesquimetralis*	Sodaville milkvetch
Catilleja salsuginosa	Monte Neva paintbrush
Centaurium namophilum	Spring-loving centaury
Eriogonum argophyllum	Sulphur Springs buckwheat
Eriogonum ovalifolium var. *williamsiae*	Steamboat buckwheat
Grindelia fraxino-pratensis	Ash Meadows gumplant
Ivesia kingii var. *eremica*	Ash Meadows ivesia
Nitrophila mohavensis	Amargosa niterwort
Polyctenium williamsiae	Williams combleaf
Rorippa subumbellata	Tahoe yellowcress
Spiranthes diluvialis	Ute lady's tresses

Source: Rare Taxa Dependent Upon Wetland/Aquatic Habitat from NNHP web page http://heritage.nv.gov/wetland.htm. Fully Protected Species of Native Flora from NAC 527.010.
Note: Listed species are wetland or aquatic obligates except Steamboat buckwheat, which also occupies the margins of wetlands.

The NDF operates other programs that advance wetland conservation. The Forest Land Enhancement Program, Forest Stewardship, and Urban and Community Forestry Programs provide technical, education and financial assistance to nonfederal landowners planning native vegetation and watershed improvements, including wetland and riparian sites. The Nursery/Seedbanks Program provides native plant materials for riparian and wetland revegetation tasks. The Conservation Camps Program, under the supervision of experienced resource managers, trains and employs prisoners in a variety of native vegetation protection and management projects, including stream channel rehabilitation using bioengineering techniques; removal of tamarisk, tall white top, and other invasive plants; and wildfire control.

Nevada Division of State Lands

The Division of State Lands (DSL) permits projects on state owned land, some of which may contain water bodies and wetland areas. Specific to wetland protection is state ownership and permitting authority for projects involving navigable bodies of water. In Nevada the navigable water bodies are the Carson, Colorado, Truckee, and Virgin rivers, Lake Tahoe, and Walker and Washoe lakes. The state owns the beds and banks of these bodies of water (up to the ordinary and permanent high water mark). Activities that may require a permit from the NDSL include construction, dredging and fill, and certain channel stabilization projects as well as crossing or operating construction or heavy equipment (NRS Chapters 321 and 322). The regulations also apply to pier and other shorezone construction (up to elevation 6223.0) that alter the shoreline of Lake Tahoe (NRS 445.080). Generally, state ownership of navigable waters does not extend to wetlands and tributaries above the high water mark. Any use or disturbance of these lands requires agency authorization. The State has acquired many parcels of sensitive land in the Tahoe basin. These parcels are protected and managed for watershed values.

The NDSL administers $65.5 million to provide grants for state agencies, local governments, or qualifying private nonprofit organizations proposing recreational trails, urban parks, habitat conservation, open spaces, and natural resource protection projects. Voters in the general election of 2002 passed into law the Conservation and Resource Protection Grant Program, or Question 1 (Q1) Program. The Q1 Program authorizes the State of Nevada to issue general obligation bonds up to $200 million to “preserve water quality; protect open space, lakes, rivers, wetlands, and wildlife habitat; and restore and improve parks, recreational areas, and historic and cultural resources.” The law specifies funding allocations for various state agencies and local government entities. The first round of funds was allocated in 2004. Of twenty-six funded projects, thirteen involve aquatic, wetland, and riparian resources for purposes of recreation access, natural area protection, and river channel and floodplain restoration.

Nevada Division of State Parks

The NDSP becomes involved with wetlands in the acquisition and/or development of parklands for outdoor recreation. The division is charged with the implementation of NRS Chapter 407, the intent of which is to “acquire, protect, develop and interpret a well-balanced system of areas of outstanding scenic, recreational, scientific and historical importance for the inspiration, use and enjoyment of the people of the State of Nevada and that such areas shall be held in trust as irreplaceable portions of Nevada’s natural and historical heritage.” Protection and management of wetland, riparian, and aquatic resources within the state parks system may be a challenging responsibility. (The Bureau of Reclamation is responsible for maintaining wetland resources associated with water resources at Rye Patch, Lahontan, and Wild Horse reservoirs.) Most of the state park units contain water and wetland resources or abut public waterways. Reservoirs, which typically fluctuate too much to support healthy, high functioning wetlands, are the most common water feature. But high quality stream, spring, meadows, and marshes are part of the valued state park resources. Except for Lake Tahoe Nevada State Park, state funding is typically not sufficient for the division to put substantial effort into maintaining and restoring wetlands. An informal survey by state park resource specialists of wetland and riparian resource concerns indicates that the most widespread problem is the spread of undesirable nonnative or noxious weeds. Streambank and shoreline erosion is common also. An inventory of state park wetland resources is tentatively planned as part of the wetland classification and inventory activities of the NNHP.

The federal Land and Water Conservation Fund (LWCF) provides money to acquire recreation lands with an emphasis on aquatic and wetland resources. The purpose of the LWCF program is "...to assist in preserving, developing and assuring accessibility to all citizens of the United States of America of present and future generations... such quality and quantity of outdoor recreation resources as may be available and

are necessary and desirable for individual active participation." This federal program provides matching grants (50/50) to states and through the states to local governments for projects that acquire or development of public outdoor recreation areas and facilities. The LWCF has funded 270 projects in Nevada since 1965, which include the purchase of wetland sites with recreation potential. Wetland sites and water rights may be acquired with LWCF grants that are on the state priority wetland list. The state Question 1 Clean Water, Parks and Wildlife (Q1) Bond allocates $27 million for the NDSP, which is being used to acquire twelve sites and undertake fifty-six major development or renovation projects throughout the state park system. The $27 million of bond funds also provides co-funding for matching LWCF dollars. Conservation of aquatic-wetland resources was not an explicit, but may have been an implicit criteria in the project selection process.

Eligibility for the LWCF grants requires that the state prepare or update every five years a Statewide Comprehensive Outdoor Recreation Plan (SCORP) supplemented with a priority wetland conservation plan element. The 2003 SCORP generally addresses the preference of outdoor recreationists for activities involving water and wetland resources. As part of the state recreation planning process, an issue survey was conducted. Survey participants were asked to respond to the statement: "Water resources must be protected to maintain the quantity, quality, and accessibility for public recreation. Recreation and wildlife depend on the limited water resources in Nevada." Participants identified various actions state resource agencies may take to protect water resources for outdoor recreation. The suggested actions, after revision to reflect NDWR comments concerning state water law, are:

- Provide education that water is a precious resource and must be protected for development, recreation, and wildlife through proper legislation and planning.
- Work with local government and water districts to identify and develop water reclamation activities.
- Continue to give wildlife, environmental, and recreation uses of water equal status with agriculture, industrial, and urban uses in determining potential beneficial use for appropriation of water.
- Identify and map water resources for recreational purposes and include the information in the public process when developing the statewide trails plan.
- Develop minimum instream flows and acquire water rights to maintain water levels that provide for quality water resources and recreation.
- Carefully balance the development of new water based recreation opportunities with other competing water uses. Give consumptive and environmental needs for water priority over recreational needs.

Nevada Department of Wildlife. The vast majority of the wildlife – fishes, amphibians, birds, mammals, and reptiles – absolutely require the use of wetlands. Some species spend their entire lives in aquatic and wetland habitats, others require wetlands to pass through a stage in their life cycle, and many more are occasional users, but would not survive but for the presence of wetlands in times of need. The NDOW is charged with the preservation, protection, management, and restoration of wildlife and its habitat. Thus, wetland and aquatic resources are high priorities in various NDOW programs. In 1998, the NDOW completed an EPA funded project to develop a Wetland Conservation Plan for state Wildlife Management Areas (WMA).

The State Board of Wildlife Commissioners provides policy and program implementation direction to NDOW. The Commission have adopted policies that particularly respond to the concern that rapid population growth in the driest state has increased demands for the limited water resources, elevating the importance of strategies to keep viable and functioning wetlands and other water-related habitats upon which game, nongame, and sensitive species of fish and wildlife depend. Policies 61, 62 and 66 address wetland habitat protection. Policy 61 states an intent to achieve adequate instream flows, minimum reservoir pools, and maximum possible wetland acreage necessary to support viable fish populations and aquatic ecosystems. The Department has direction, when practicable, to apply for and purchase such waters as necessary to maintain water for instream flow, minimum pool, and wetlands for fish and

wildlife. Policy 62 gives the Department direction to continue collecting and disseminating wildlife data so that wildlife values can be fully considered in the land use decision-making process of local, state, and federal government; and to provide recommendations for mitigation as appropriate for project proposals that may cause significant adverse impacts to wildlife resources. Mitigation strategies, in order of priority, means to: avoid the impact of conflicting land uses to existing natural habitat; minimize the impact; rectify the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and/or compensating for the impact be replacing or providing substitute resources or environments. Policy 66 promotes the acquisition and maintenance of wetlands on state wildlife management areas and the development of site operational plans to maintain, enhance, and restore wetlands for fish and wildlife.

The NDOW has used its authority to acquire or lease land and water for the establishment of WMAs throughout the state. The WMAs are managed to protect habitats for game fishes, waterfowl, and fur bearing mammals, as well as protected and at risk species. Ten of the twelve WMAs contain aquatic-wetland habitats totaling almost sixty thousand acres. Wetland types mainly entail valley bottom riparian and marsh habitats, some maintained with diversions and reservoirs. The wetland policy plan applicable to WMAs recommends development of wetland management plans for each. Nevada Conservation Bonds (Q5 in 1991 and Q1 in 2001) have provided substantial funding to acquire wetland areas and water rights for WMAs. Securing opportunities for the public to hunt, fish, and view wildlife is a top objective of the WMA program. With completion of the agency's Nevada Comprehensive Wildlife Conservation Strategy, NDOW will be bringing more management resources to bear on its wildlife diversity conservation activities. Monitoring aquatic-riparian habitat conditions is an ongoing activity, and the improved stream survey database will aid wetland priority species conservation.

The agency implements a policy to purchase water rights for premier wetland areas and to stabilize core wetland habitats at the WMAs. A limiting factor in maintaining some of the WMA wetland and aquatic ecosystems is the availability of water rights. The NDOW misses out on some opportunities to purchase water rights due to a lengthy state approval process. Furthermore, increasing demand for public and industrial water supply puts upward pressure on the cost and competition for water rights, which is another limiting factor in acquiring water to maintain aquatic and wetland habitats with high wildlife and recreation values. Water rights were recently acquired on the Carson River and Muddy River using state conservation bond funds to maintain wetlands at Carson Lake and the Overton WMA.

There are other ways that the NDOW enhances the protection and management of wetland resources. The agency operates the Habitat Proliferation Permit program (NRS 503.425). A permit must be obtained prior to dredging in any river, stream, or lake so biologists can review the proposed operation and ensure activities are not deleterious to fish or aquatic life. The NDOW may also invoke NRS 503.430, which makes the deposit of substances deleterious to fish a misdemeanor. The state Board of Wildlife Commissioners (NBWC) is responsible for using its authority to manage land to carry out a program for the conservation, protection, restoration, and propagation of selected species of native fish, wildlife, other vertebrates and their habitats that are threatened with extinction and destruction (NRS 503.587). The Fisheries Bureau manages sport, native, and federally listed fishes and aquatic wildlife species (amphibians, mollusks and crustaceans). Seventy-seven lakes, ponds, reservoirs and rivers also are managed in accordance with the Fisheries Management Plan. Also, stream survey teams visit dozens of streams each year to monitor fishery and habitat conditions and trends. Recovery efforts for sensitive or federally listed fishes, such as Lahontan cutthroat trout, Bonneville cutthroat trout, Yellowstone cutthroat trout, redband trout and bull trout include riparian habitat improvements and restoration.

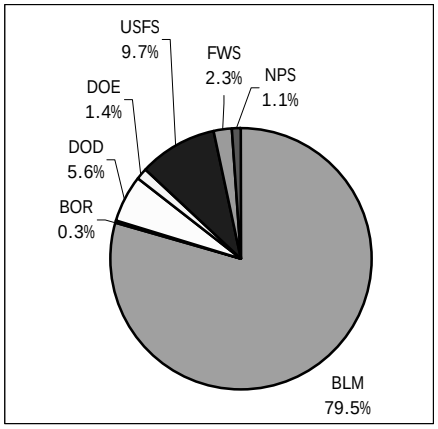
Coordination with public land wildlife and habitat managers and NCOs (e.g., Nevada Waterfowl Association, Ducks Unlimited) has yielded a variety of actions that induce wetland conservation. Notable are conservation plans and agreements for declining, sensitive and imperiled wetland species, such as the Columbia spotted frog, Amargosa toad, native trout, native spring and pool fishes, migratory birds (water, shore, and songbirds), and even Sage Grouse. By leading and participating in multi-agency conservation teams, endangered species recovery teams, and broader collaboratives, the NDOW creates opportunities to pass through or have access to federal and NCO funding sources for wetland projects. Among the sources for joint project funding are the North American Wetland Conservation Act; North American Waterfowl Management Plan and Intermountain West Joint Venture; Federal Aid to Wildlife Restoration Act (Pittman-Robertson Act); Aquatic Resources Trust Fund (Wallop-Breaux); Partners in Wildlife; and various NCO sponsored or supported projects with Ducks Unlimited, The Nature Conservancy, Rocky Mountain Elk Foundation, Nevada Waterfowl Association, and the Audubon Society, to name a few.

Management of Wetland Resources on Public Land

Overview. Nevada contains vast tracts of public (federal) lands, approaching sixty million acres (Figure 5.3). Congress legislates the manner of use of public lands, which the Supreme Court has ruled "are held in trust for the people of the whole country." Multiple use and sustainable yield are dominant management principles on public lands, though exceptions are notable (e.g., Wilderness Areas). Each public land agency brings its own administrative law into the regulatory, management, and planning scheme: BLM – Federal Land Policy and Management Act; USFS – National Forest Management Act; NPS – National Park Service Organic Act; and, the FWS – National Wildlife Refuge System Administration and Improvement Acts. Implicit or explicit in each is the responsibility to manage wetland, riparian, and aquatic resources for environmental and ecological values through resource plans and permits issued for commercial land uses. Federal administrative laws also direct the agencies to coordinate planning and management activities with local, tribal, and state government. On public land, state agencies retain authority to administer water resources, water quality, and wildlife. Wetland and riparian resource management is primarily a federal agency responsibility on public land, but to the extent feasible, state resource agencies maintain a presence in wetland planning, permitting, and regulatory actions taken by federal agencies partners.

Figure 5.3 Distribution of Public Land Acreage by Federal Agency

Public Land Status	Total Acres
BLM	47,571,399
USFS	5,812,697
DOD	3,375,852
FWS	1,377,457
DOE	862,973
NPS	654,805
BOR	168,547
Total Public Land	59,823,730

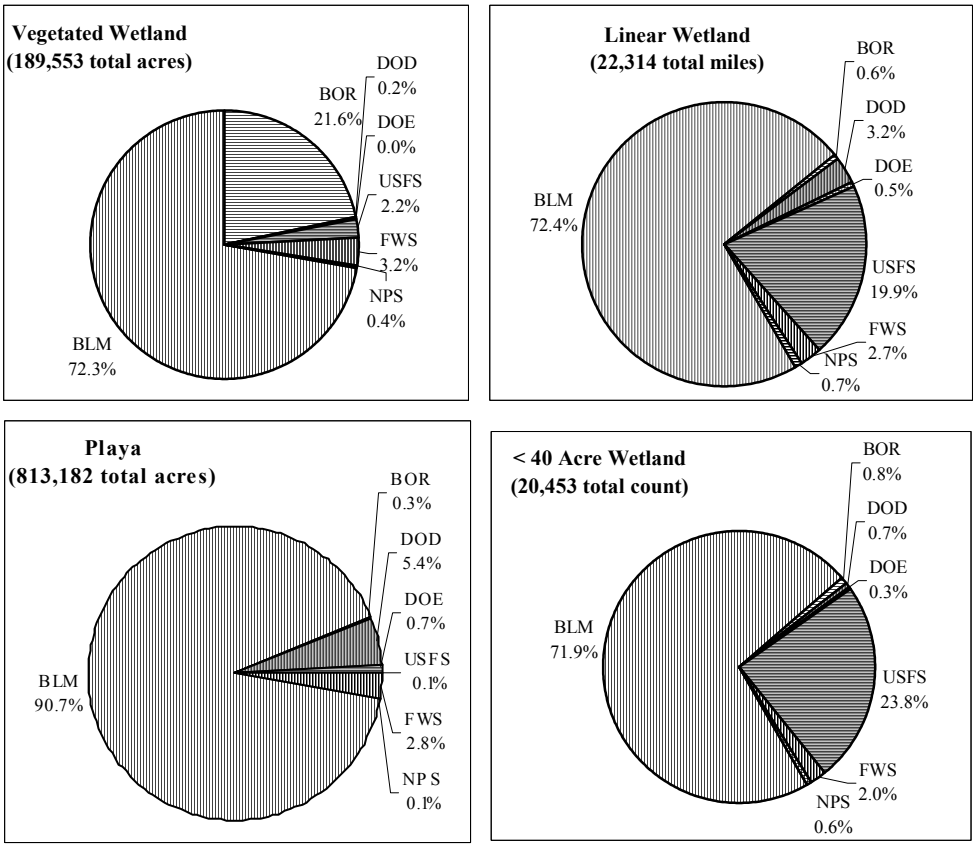


Wildlife, watershed, and pollution control are priority functions in the wetland and riparian managements schemes of the BLM, USFS, and FWS. Public land use includes extraction or harvest of commodity resources, primarily livestock, precious metals, and outdoor recreation; therefore, federal agencies regulate land uses according to policies that call for a balance between resource development and conservation. Clean Water Act Section 404 applies to wetlands associated with waters of the U.S. on public land. Certain federal statutes require agencies to coordinate when undertaking activities that might impact wetland resources. The North American Wetlands Conservation Act of 1989 requires federal agency cooperation with the FWS to restore, protect, and enhance the wetland ecosystems and other habitats for migratory birds, fish and wildlife. A federal agency or nonfederal entity under federal permit/license proposing a project to impound, divert, or control a water body on public land must consult with the FWS and NDOW under the Fish and Wildlife Coordination Act, and take actions to prevent

loss and damage of wildlife resources and habitat. The Water Resources Development Act of 1990 requires federal agencies to develop plans and programs to meet the short and long term elements of the no net wetland loss goal. The impacts of development or land use activities on public wetland and riparian resources are subject to environmental assessment and mitigation as provided in the National Environmental Policy Act. Also, federal agencies must manage activities affecting populations and habitats of threatened and endangered plant and animal species that depend on wetlands in conformance with the Endangered Species Act.

The distribution of wetlands on public land is roughly in proportion to the share of land area administered by each federal agency, as indicated by a comparison of Figure 5.3 and the pie charts in Figure 5.4. Noteworthy exceptions are: 1) USFS manages about ten percent of the public land base, but almost twenty percent of linear wetlands and twenty-four percent of the wetlands smaller than forty acres; 2) the BOR manages a larger share of the vegetated wetlands, which are associated with the state's large water development projects on the Truckee, Carson, and Colorado rivers; and, 3) the BLM lands contain most of the public playa acreage.

Figure 5.4 Relative Distribution of NWI Wetland Types on Public Land in Nevada, by Federal Agency



Source: NNHP analysis of Nevada NWI and BLM Land Status datasets.

Implementation of the "multiple use" policy on public land in Nevada applies to wetlands – an especially difficult management challenge. For example, the main BOR function is water supply development and operation, but lands not submerged are available for grazing, recreation, or ecological values. The BLM and USFS may allow grazing, mining, energy development, or utility corridors, timber or woodland harvest, and outdoor recreation in wetland and riparian ecosystems, but the agency must also protect wetlands. Almost all activities require some structural development, such as roads, impoundments, irrigation ditches, fences, corrals, campgrounds, linear utility structures, or excavation and waste rock disposal areas. Exploitation pressure on public wetlands is lower on special status public lands, but these make up a small portion of Nevada's public land base. Special status management units include wilderness and wilderness study area, national park, national conservation or recreation area, wildlife refuge, or others enacted by act of Congress or administrative designation. Generally, these tracts are created to protect or preserve the ecological, natural, and cultural resources. Limited outdoor recreation and commodity land uses may be

continued, but with restrictions to protect and preserve the special values, including aquatic, wetland, and riparian resources. A small portion of the state's wetlands lies within special status public lands (Table 5.7). Only 1.5 percent of the vegetated wetlands occur on lands where preservation is the overriding strategy.

Table 5.7 Distribution of NWI Wetland Types on Public Lands with Special Designations

Special Status Public Lands	Federal Agency	Vegetated Wetland (acres)	Linear Wetlands (miles)	Wetlands < 40 acres (count)	Playa (acres)
Wilderness Area	BLM	181	414	241	944
	USFS	247	775	815	0
Wilderness Study Area	BLM	1,224	872	998	43
	USFS	0	74	98	0
National Conservation Area	BLM	940	281	189	84,797
Area of Critical Environmental Concern	BLM	1,964	332	58	215
Research Natural Area	USFS	118	16	38	0
National Wildlife Refuge and Range	FWS	6,158	610	400	22,621
National Parks and Recreation Area	NPS	733	165	114	474
	USFS	0	215	21	0
Total in Special Status Statewide		11,565	3,754	2,951	109,094
Total Statewide		758,594	32,512	31,901	947,357
Percent Wetlands in Special Status Statewide		1.5%	11.5%	9.2%	11.5%

Source: NNHP analysis of NWI datasets and BLM Land Status as mapped November 2004.
Note: The assumption is that specially designated public land is managed primarily for protection and preservation of wetlands (and other renewable resources), in contrast to multiple use management emphasis.

Bureau of Land Management. The Nevada BLM manages almost fifty million acres (includes DOD lands) consisting broadly of lowland shrub-scrub and highland shrub-steppe communities interspersed with pinyon and juniper woodlands and non-native grassland. Wetland and riparian habitats managed by BLM occur in semi-arid to arid landscapes that are used for watershed, biodiversity, livestock grazing, mining, wild horse, and outdoor recreation purposes. About half of the states linear wetlands, eighty percent of the playas, and forty percent of smaller wetlands, including springs and seeps occur on BLM land. The Federal Land Policy and Management Act and Public Rangelands Improvement Acts of 1978 direct the BLM to manage public land in a manner that maintains or improve resources for multiple use, sustained yield, and healthy ecosystems. The Rangeland Reform rules of 1994 require the BLM to emphasize protection and recovery of riparian, wetland, and aquatic ecosystems. Rangeland Reform also directed the BLM to set-up multi-stakeholder Resource Advisory Councils to establish standards and guidelines for rangeland health concerning grazing and other management problem areas (most recently improper off-highway vehicle use). The standard in Nevada is: Riparian/wetland systems are [maintained] in properly functioning condition as indicated by: 1) sinuosity, width/depth ratio, and gradient are adequate to dissipate streamflow without excessive erosion or deposition; 2) Riparian vegetation is adequate to dissipate high flow energy and protect banks from excessive erosion; and, 3) plant species diversity is appropriate to riparian-wetland systems.

Wetland Statistics – BLM Land				
<40 Acres (count)	Linear (miles)	Vegetated (acres)	Playa (acres)	BLM Acres in Nevada
14,710	16,149	137,111	737,572	47,571,399

The BLM continues to work on implementation of the Riparian-Wetland Initiative, a federal multi-agency program started in the early 1990s. The goals of the initiative are to:

- Restore and maintain riparian-wetland areas so that seventy-five percent or more are in proper functioning condition (PFC) by 1997.
- Achieve an advanced ecological status, except where resource management objectives, including proper functioning condition, would require an earlier successional stage.

Objectives are to protect riparian-wetland areas and associated uplands through proper land management and avoid or mitigate negative impacts; acquire and expand key riparian areas to provide for their maximum benefit, protection, enhancement, and efficient management; ensure an aggressive riparian-wetland information outreach program with training and research; and, improve partnerships and cooperative restoration and management processes. Budget reductions have hampered implementation.

Figure 5.5 Riparian Recovery Project Demonstrates Benefits of Ecosystem Management, Bear Creek, Central Oregon, 1977-1996

In 1977, streamside vegetation showed little diversity, streambanks were actively eroding, and sediment levels were high when flows were high. During the summer, stream flow was intermittent.

Grazing was reduced from 1976 to 1980, and from 1981 to 1984 the area was not grazed at all. By 1983, banks had started to heal and embankment vegetation was trapping sediment. In 1985, the pasture was divided into three units. Livestock were grazed in late winter and early spring to preserve vegetation on banks for protection from summer thunderstorms and floods. The channel narrowed and the floodplain trapped almost 1.5 feet of sediment by August 1986.

In June 1987, the vegetation along the banks filtered sediment from a summer flood. The higher floodplain caused widening of the channel. One month after the flood, vegetation was growing through the newly deposited sediment and stabilizing it on the floodplain. By October 1988, the channel was fully recovered from the 1987 flood and the floodplain was over two feet higher than in 1976.

Forage had increased to nearly 5 times the amount previously grazed in the area by 1989. The livestock operator reportedly reduced his annual cost for hay by $10,000.

After years of drought, in August 1994, the stream channel was vegetated by sedges and rushes that seek out the lower water table and filled most of the channel. The natural change in wetland vegetation helped to slow the spring snowmelt flood and trap sediment. In the past, the stream would have dried up during a drought. Beaver returned to the creek by 1995. Previously, they had a hard time keeping dams due to the poor stream condition.

During February 1996, heavy snowpack and rapid melt generated an extreme flood peak. By April the stability of the channel became clear. Denser riparian vegetation had minimized flood damage. Improvement of the aquatic-riparian ecosystem continued. Rainbow trout returned.

Renewable resource statistics tell part of the story. Forage increased from 200 lbs./acre to 2000. The streambed rose 2.5 feet and the area stores 4 million gallons of water per mile compared to 500,000 gallons in the 1970s. The resilient and productive ecosystem, however, is the climax.

(Source: http://www.blm.gov/riparian/Profiles/bearcrk.htm.. accessed January 2005)

The Riparian Recovery Initiative is a component of the BLM approach to riparian management that emphasizes restoration by ecological succession. BLM range conservations work with cooperative ranchers to design and implement grazing practices within riparian and adjacent buffer zones that will allow the natural potential of the site to return – the landform, hydrology, vegetation, and soil conditions that are necessary for a functioning ecosystem to perpetuate. Prescribed grazing practices may include rest, seasonal use, and/or fencing to subdivide allotments into pastures for rotational grazing or as riparian exclosures.

The Nevada BLM 2005 status report on the Riparian Recovery Initiative identified project work occurring on reaches of the following streams and creeks, including the North and South Forks of the Little Humboldt, North Fork of the Humboldt, Marys River, and the Pearl, Dixie, Crowley, Beaver, Susie, Maggie, War Canyon and Burbank Canyon (http://www.blm.gov/riparian/data.htm#nevada, January 2005). The prospects for ecological and commodity values generally are reported to be favorable. An exemplary riparian recovery project at Bear Creek (south-central Oregon) raised forage production ten-fold and water supply four-fold (Figure5.5). The outcome of Bear Creek recovery also demonstrates the importance of evaluating and monitoring project results and reporting the same to the public so others can readily see encouraging models of success.

Rangeland Improvement Needs Intersect with Riparian Recovery

Deteriorated geomorphic conditions such as those in Condor Canyon drove passage of the Public Rangelands Improvement Act of 1978. The law intended to correct practices on public land contributing to "soil loss, desertification, increased siltation and salinity, reduction of water quantity and quality, loss of fish and wildlife habitat, increased surface runoff and flood danger and the potential for undesirable long-term local regional and climatic and economic changes." The preamble of the Act cited problems largely associated with aquatic, wetland and riparian habitats, and directed the BLM to "restore a viable ecological system that benefits both range users and wildlife. Similar concerns occur on private land, which contain sixty-five percent of vegetated wetlands and thirty percent of linear wetlands in Nevada. A rare fish species, Big Spring spinedace, occurs on BLM and TNC lands in the Condor Canyon portion of Meadow Valley Wash. The management goal is long-term viability of the species and its habitat. NNHP staff photo

The BLM also protects riparian wetlands of environmental significance and public benefit through realty actions (e.g., land acquisition or exchange) or Congressional action that establishes national conservation, wilderness, or other special status areas. Approval for land transactions or exchanges comes in special federal legislation (e.g., Southern Nevada Public Land Management Act) or consultation with local government and private landowners during the resource management plan process. Resource management plans also identify public lands where continued federal management may not be necessary. The realty strategy continues to bring important spring and stream riparian areas with watershed, biodiversity, and outdoor recreation values into public management throughout the state.

The Nevada BLM has employed for several years the Proper Functioning Condition (PFC) assessment method to evaluate riparian and wetland conditions for site-specific management decisions. Valuable resource condition data are collected from stream, spring, meadow, marsh and other wetland areas. Site data collected are not entered into an information management system that would enable the BLM or

others to apply the data to trend, regional, and other strategic analyses. One option available to Nevada BLM is use of the Nevada Wetland Information System (NVWETIS). The NVWETIS was designed to accommodate PFC data. An overview of the PFC method and summarized annual results for Nevada are presented in the section on Losses and Gains in Part 1.

U.S. Forest Service. Forest Service lands are scattered throughout Nevada and managed under the auspices of the unified Humboldt-Toiyabe National Forest (HTNF). On the Nevada side of the Lake Tahoe Basin, the USFS administrative unit is the Lake Tahoe Basin Management Unit, wherein protection and restoration is the management strategy for riparian and wetland resources. Forest Service lands generally encompass upper elevation watersheds in the tallest ranges receiving the highest precipitation. The USFS manages not quite six million acres (about eight percent), consisting of many small watersheds that hold a comparatively large share of the total linear wetlands and smaller wetlands, but a relatively small portion of the larger vegetated wetland resource.

Wetland Statistics – USFS Land				
<40 Acres (count)	Linear (miles)	Vegetated (acres)	Playa (acres)	USFS Acres in Nevada
4,862	4,437	4,156	447	5,812,698

Most of the scarce timberland in Nevada grows on USFS land, but sagebrush and mountain shrub/steppe communities constitute the majority cover type. Grazing is the predominant commodity land use, and where excessive in and around meadows and riparian corridors, has contributed to poorly functioning watershed and riparian conditions. Forest Service lands contain a comparatively large number of perennial stream and spring resources, which have been developed and/or diverted for farming, ranching, and mining. Roads for off-highway travel and recreation significantly effect riparian systems too. The USFS emphasizes implementation of best management practices for water quality protection or improvement in association with grazing, road construction and maintenance, logging, and other land use activities.

The National Forest Management Act of 1976 and subsequent administrative regulations have established protection of watersheds; streams, streambanks, shorelines, lakes, wetlands and other bodies of water; diversity of plant and animal communities; and fish and wildlife habitat for native invertebrate population viability, as top priority management objectives. According HTNF standards and guidelines for aquatic-riparian areas, land use permit prescriptions must:

- Implement Best Management Practices for the protection of water quality and soil productivity;
- Manage riparian areas to achieve or maintain medium to high ecological function;
- Give preferential consideration to riparian area-dependent resources in a management situation;
- Place new livestock water developments and move existing developments outside of riparian zones;
- Activities and uses will be conducted to minimize impacts to riparian areas; and,
- Conduct watershed and landscape analysis to identify problem areas and set priorities for soil and water improvement projects.

Forest plans formerly were required to ensure watershed and riparian conditions are maintained, improved or restored while administering resources for outdoor recreation, grazing, timber harvesting, and fish and wildlife. The forest plan for the Toiyabe National Forest in the early 1990s stated, "in the event of conflicts between resource uses, the protection of riparian areas would be given 'preferential consideration.'" Whether management direction set by forest plans still guides USFS treatment of wetlands is unclear. The status of forest plans in Nevada has been up in the air for years.

Table 5.8 Humboldt-Toiyabe NF Priority Wetland/Riparian Management Actions, 2003

Watershed	Wetland/Riparian Site	Management Activity
Carson River	Bagley Valley	Stream relocation and gully stabilization
Walker River	Rosachi Ranch	Terrace, floodplain, and riparian revegetation
Quinn River	Quinn River	Head cut stabilization
Quinn River	Greddette Meadow	Restoration
Queen Springs	Schell Creek	Head cut stabilization
Duck Creek	Gilford Meadow	Restoration
Martin Basin	Camus Spring/Channel	Restoration
Big Smokey Valley	Kingston Meadow	Incision stabilization
Reese River	Cottonwood Creek	Restoration assessment

Source: Correspondence, Forest Hydrologist, HTNF. November 2003.

The wetland and riparian management and restoration activities on the HTNF are planned and implemented according to the order of priority watersheds. Wetland and riparian sites identified in 2003 (Table 5.8) were selected for priority action based on the rate and extent of deteriorating conditions, threatened or endangered species occurrence, water quality and quantity (augmentation of early season storage and late season release to base flow), downstream beneficial uses, and socioeconomic impacts.

U.S. Fish and Wildlife Service. Management of wetlands that are especially important habitats for fish, waterfowl, and other wildlife is a major focus for the FWS. The agency is responsible for implementation of the North American Wetland Conservation Act, the Endangered Species Act, and the National Wildlife Refuge (NWR) System Administration of 1966 (and the 1997 amendment known as the NWR System Improvement Act). The FWS also administers the Federal Aid to Wildlife and to Sport Fish programs that distribute millions of dollars generated by taxes paid on fishing and hunting equipment to state fish and wildlife agencies, including NDOW. State wildlife management areas and water rights have been acquired with the funds, securing significant wetland tracts for hunting, fishing, and wildlife watching.

Wetland Statistics – FWS Land				FWS Acres in Nevada
<40 Acres (count)	Linear (miles)	Vegetated (acres)	Playa (acres)	
400	610	6,158	22,621	1,377,457

The FWS manages a 95-million-acre National Wildlife Refuge System (NWRS), of which 1.3 million acres occur in Nevada. Nine national wildlife refuges and ranges have been established here, containing important aquatic-wetland habitats for common, rare, and threatened and endangered species. Among them are the internationally acclaimed Ash Meadows and Stillwater NWRs. The purpose of the National Wildlife Refuge System Improvement Act of 1997 is to ensure that the biological integrity, diversity, and environmental health of lands in the system are maintained for the benefit of present and future generations. Compared to BLM and USFS lands, the range of multiple uses is limited. Typically, uses include wildlife viewing and education, hunting, and fishing, but other uses compatible with the public purpose for refuge creation may be permitted on a refuge. Non-wildlife related commercial and recreational activities in refuges (e.g., jet skiing, boating) are discouraged. To identify conservation threats and manage for protection, the FWS has a program to conduct inventories and monitor fish and wildlife populations and habitats. The agency has filed for federally reserved water rights and acquired water rights to maintain water for wetland and aquatic habitats. Generally, the management strategy for wetlands within the refuge system is protection.

The Endangered Species Act affords protection of land supporting habitat for a listed threatened or endangered plant or animal species. Regulations prohibit taking a listed plant or animal without a permit. Of the thirty-seven species listed as threatened or endangered in Nevada, thirty-six are wetland dependent (Appendix 5.2). Recovery of imperiled species is the main goal of the ESA, which motivates wetland habitat protection and restoration on public and private land. Quite often, recovery of listed species will come through voluntary cooperative partnerships. To protect species and habitat, cooperative measures are essential, such as Habitat Conservation Plans, Safe Harbor Agreement, or Candidate Conservation

Agreements (see Part 4). In addition, voluntary partnership/agreement programs such as the Partners for Fish and Wildlife program provide incentives (50/50 co-fund) to restore and maintain wetland, riparian, and aquatic habitats where threatened, endangered or other species of concern live while the land remains in private use and ownership. The FWS reports of its Partners for Fish and Wildlife program that almost 500,000 acres of wetlands and almost 3,000 miles of riparian and in-stream habitat (and upland habitat also) has been restored, involving almost 22,000 landowners. At least one project has been implemented in Nevada, involving spring system and riparian habitat restoration that secures habitat for a rare endemic fish species on a private ranch in central Nevada.

National Park Service Land. The National Park Service in Nevada manages Great Basin National Park, Lake Mead Natural Recreation Area (NRA), and a portion of Death Valley National Park, including the Devils Hole tract within the Ash Meadows National Wildlife Refuge. The agency's Organic Act of 1916 states the fundamental purpose of national parks is to conserve their scenery, natural and historic objects, and wildlife to provide for their enjoyment and leave them unimpaired for future generations. The requirement to conserve natural objects and wildlife serves as the basis for wetland and riparian conservation and related management responsibilities. The wetland acreage on NPS land may not amount to much, but the diversity of ecotypes and biota does. Desert springs occurring within the Lake Mead NRA host small populations of relict leopard frog (*Rana onca*), a rare endemic amphibian once thought to be extinct. Great Basin NP contains alpine ecological systems, exceptionally large aspen groves, and the highest peak in Nevada with watersheds underlain by limestone formations that funnel water into the carbonate aquifer-fed streams and springs in southern Nevada. A corner of Death Valley National Park juts into Nevada near Beatty contains the Grapevine Mountains the runoff and recharge from which feeds permanent and intermittent swatches of desert washes, seeps, springs, that contribute to surface flow and underflow of the Amargosa River.

Wetland Statistics – NPS Land				
<40 Acres (count)	Linear (miles)	Vegetated (acres)	Playa (acres)	NPS Acres in Nevada
114	165	733	474	654,805

Rana onca (relict leopard frog)

As with other federal land management agencies, Executive Order 11990 directs the NPS: 1) to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands; 2) to preserve and enhance the natural and beneficial values of wetlands; and 3) to avoid direct or indirect support of new construction in wetlands unless there are no practicable alternatives to such construction and the proposed action includes all practicable measures to minimize harm to wetlands. The NPS adopted a goal of no net loss of wetlands, in the long term a net gain. The National Wetland Inventory branch of the FWS assists the NPS with the agency's plan to inventory all wetlands and to help assure proper planning with respect to management and protection of wetland resources (including review of state priority wetland conservation plans). Additional large-scale (more detailed) wetland inventories are conducted in areas proposed for development or prone to degradation/loss due to land use activities, such as Lake Mead NRA. The NPS uses the "Classification of Wetlands and Deepwater Habitats of the United States" to define, classify, and inventory wetlands.

The NPS wetland protection policy appears to aim higher than other federal agencies. For all new development or land use activities that have the potential for direct or indirect adverse impacts on any wetlands (including isolated wetlands), the agency applies the ACOE sequencing protocol of avoiding adverse wetland impacts; minimizing impacts that could not be avoided; and, mitigating to compensate for unavoidable adverse impacts by restoring degraded wetlands. Projects, plans or programs proposed by the NPS that may adversely affect wetlands are assessed using NEPA protocol (Environmental Assessment or Environmental Impact Statement). Where wetlands have been degraded or lost due to previous or ongoing human activities, the NPS will restore them to pre-disturbance conditions to the extent appropriate and practicable. Similarly, the NPS will protect and enhance natural wetland values used for educational, recreational, scientific, and similar purposes so as not to disrupt natural wetland functions. Of course outdoor recreation is the dominant land use activity allowed in national parks. Wetlands are less prone to misuse in the remote national parks of Nevada, when compared to the Lake Mead NRA, where wetland resources are threatened by the manipulation of the Colorado River and Lake Mead; surging recreation use from Las Vegas swelling population; increased motorized recreation; and the invasion of nonnative plants that these activities induce.

NPS Refuge for A Rare Aquatic Species

Devils Hole is a 40-acre tract administered by Death Valley National Park within the confines of Ash Meadows National Wildlife Refuge. It is one of many springs and wetlands stranded in the Amargosa desert region for enough millenia for evolutionary processes to redesign various species of fishes, snails, and plants. A limestone cave holds the endangered Devils Hole pupfish *(Cyprinodon diabolis)*, protected under federal and state regulations. The aquifer that floods the Devils Hole limestone cave has origins in the limestone formations that outcrop in the high, isolated Snake Range watersheds, within Great Basin National Park. The carbonate aquifer determines the water level in the cave. Near extinction of the Devils Hole pupfish triggered a lawsuit involving Nevada water law, the federal Endangered Species Act, and federal reserved water rights. The U.S. Supreme Court ruled that a minimum water level must be maintained at the cave, which required termination of nearby groundwater pumping in the aquifer, a vast region-wide underground water body. According to the NPS Death Valley General Management Plan completed in 2002, water level monitoring by the NPS, and previously by the USGS, indicated the water level was recovering until 1990 and since has trended downward. Photo courtesy of The Native Fish Conservancy, http://www.nativefish.org/

Bureau of Reclamation. The primary mission of the BOR is to store water and manage the supply for irrigation while also supplying water for outdoor recreation; fish and wildlife protection; endangered species recovery; improvement of water quality; and reduction in flood and drought impacts. In Nevada, the BOR coordinates with irrigation districts, local, state and tribal governments, and NCOs to determine how to manage the quantity and maintain the quality of finite water resources in a region experiencing population growth and without impacting critical aquatic ecosystems.

Wetland Statistics - BOR Land				
<40 Acres (count)	Linear (miles)	Vegetated (acres)	Playa (acres)	BOR Acres in Nevada
160	126	40,936	2,577	168,547

The BOR is responsible for natural resource management on 582,000 acres in Nevada, which includes areas under agency ownership or management (e.g., irrigated farmland). Flow and storage in the Truckee, Lower Carson, Lower Humboldt, Colorado, and East Fork of Owyhee River basins are regulated through BOR dams, reservoirs, canals, and drains. Lake Mead, Lahontan, and Rye Patch reservoirs and several others in adjoining states store water for delivery to the largest cities and agricultural districts in Nevada. About 22,761 wetland acres occur on BOR land. Construction and operation of BOR water works contributed to the elimination and conversion of eighty-five percent of the native wetland and riparian habitats in the Truckee, Carson, and Humboldt basins. Wetlands were created appurtenant to reservoirs, conveyances, and irrigated bottom and bench lands; but overall, the water works do more to alter or disrupt the natural movement of water, sediment, nutrients, and organic material, cumulatively lowering the quantity and quality of wetland habitats. The agency manages wetland and aquatic habitats with other

federal and state wildlife management agencies in some areas to emulate natural functions and values for the benefit of native and imperiled species. However, water and vegetation on most BOR land are managed to favor waterfowl, game bird species, and introduced fishes. Provisions in the North American Wetlands Conservation Act of 1989 direct the BOR to cooperate with the FWS in the management of wetlands for waterfowl habitat and the restoration of other wetland functions and values. The BOR Lower Colorado River regional office has the lead for implementation of the Lower Colorado River Multi-Species Conservation Plan (LCRMSCP). Obligations to protect and restore habitat for fishes and wetland associated bird species covered in the LCRMSCP should result in improved wetland conditions within the historical floodplain of the Colorado River.

Wetland Resource Management on Tribal Lands

Many of the Indian Reservations in Nevada encompass or border on a variety of important wetland and aquatic resources throughout the state. While Administration of Clean Water Act water quality and wetland protection regulations (Sections 303 and 404) apply on tribal lands, unless the tribe has approval by the EPA to implement its own program. Coordination for natural resource conservation and environmental quality improvement between Indian Tribes and federal regulatory and public land management agencies (e.g., BIA, EPA, FWS, NRCS) has been improving in recent years. Indian Tribes and state resource agencies also are working together on water and wetland resource improvement projects. The emphasis has been on nonregulatory program implementation, primarily federal grant programs. Some of the wetland management activities tribes have undertaken are highlighted below.

The Yerington Paiute Tribe will use a $52,500 grant from the EPA CWA Section 319 Program with $17,500 in matching funds to evaluate land use effects on tribal wetlands and restoration opportunities. Water pollution risks associated with mining and agriculture that may have impaired wetlands will be assessed. The tribe will also complete a wildlife habitat, vegetation, and soil assessment, and implement a quarterly water-quality monitoring program.

The Duck Valley/Shoshone-Paiute Tribe received a grant for the purpose of inventorying fish and wildlife resources and their habitats on tribal lands under the Tribal Landowner Incentive Program and the Tribal Wildlife Grant Program. The $150,000 grant will go toward development of a wetland management plan for the Blue Creek Wetlands in the Upper Owyhee River watershed along the Idaho/Nevada border.

Several tribes have developed plans and/or identified and implemented projects to improve water quality through riparian and wetland management. The Washoe Tribe has rehabilitated a half-mile of the eroding Carson River channel and a quarter mile of the tributary Clear Creek, including revegetation with native plants, and the installation of fencing to aid in control livestock access to riparian habitat. The Walker River Paiute, Pyramid Lake Paiute, and Fallon Paiute Shoshone tribes have implemented similar rehabilitation and recovery measures on their lands in the lower river reaches. Here, invasive salt cedars are being removed and the areas replanted with native trees and shrubs.

The Pyramid Lake Paiute tribe has engaged in extensive riparian and channel improvements along the lower Truckee River, measures necessary to aid the recovery of endangered cui-ui and threatened Pyramid Lake Lahontan cutthroat trout. The tribe is also working on recruitment of populations of the northern leopard frog (*Rana pipiens*). The tribe is in the final phase of obtaining EPA approval for the establishment of water quality use criteria and standards for wetland and riparian habitats, as provided in Section 303 of the Clean Water Act.

Undoubtedly there are many more tribes in Nevada engaged in managing wetland and riparian habitats for fishes, wildlife, water quality, and compatible economic uses. However, we do not have information about those activities.

Nonprofit Conservation Organizations

Nonprofit conservation organizations (NCO) have accomplished much individually and jointly with government and landowners to improve the wetland resources and advance conservation in Nevada. The opportunities for groups and individuals to be involved in wetland resource efforts are quite extensive. In general, the purposes served include:

- Make important technical, promotional, and financial contributions to the implementation of wetland and riparian restoration and enhancement programs and projects;
- Participate in society as influential motivators, that through their expertise and public awareness campaigns, promote wise use, management and conservation of wetlands; and,
- Provide relevant information and offer opportunities to contribute to the formulation and implementation of governmental wetland policy, laws, and incentive programs.

Among the actions NCOs undertake on their own, or in conjunction with agencies or community groups, there is wetland education and awareness, conservation site planning and management, inventorying and monitoring biological resources, the study of ecosystems and species, grant writing to obtain restoration and acquisition funds, and advocacy at all levels of government for wetland-conscious land use and management.

Prominent wetland concerns addressed by the NCOs in Nevada involve habitat for game animals and fishes, preserving biodiversity and ecological diversity, water quality improvement, and outdoor recreation. A short list of the NCOs active throughout Nevada includes:

The Nature Conservancy	Ducks Unlimited
Red Rock Audubon Society	Nevada Waterfowl Association
Lahontan Audubon Society	Nevada Wildlife Federation
Nevada Land Conservancy	Rocky Mountain Elk Foundation
Trust for Public Lands	Trout Unlimited
American Land Conservancy	Sierra Club Great Basin Group

Numerous formal and ad hoc groups exist, consisting of experts in the public and private sectors that routinely work on wetland and related resource conservation matters. The sphere and scale of interest varies, from migratory birds of continental importance, to watershed conditions of a river basin, to a particular water body or species. A sampling of these public/private collaboratives include:

- Carson River Coalition, Carson Water Subconservancy District
- Muddy River Regional Environmental Impact Alleviation Committee
- Lahontan Wetlands Coalition
- Partners in Flight
- Intermountain West Joint Venture
- Walker Lake Working Group
- Las Vegas Wash Coordination Committee
- Amargosa Toad Working Group
- Fish and Wildlife Service Recovery Implementation Teams for ESA-listed species
- Q-1 State Conservation Bond Program (NDSL, NDSP, NDOW, Carson River Water Subconservancy, Washoe County/Truckee River, Clark County/Las Vegas Wash, Springs Preserve)

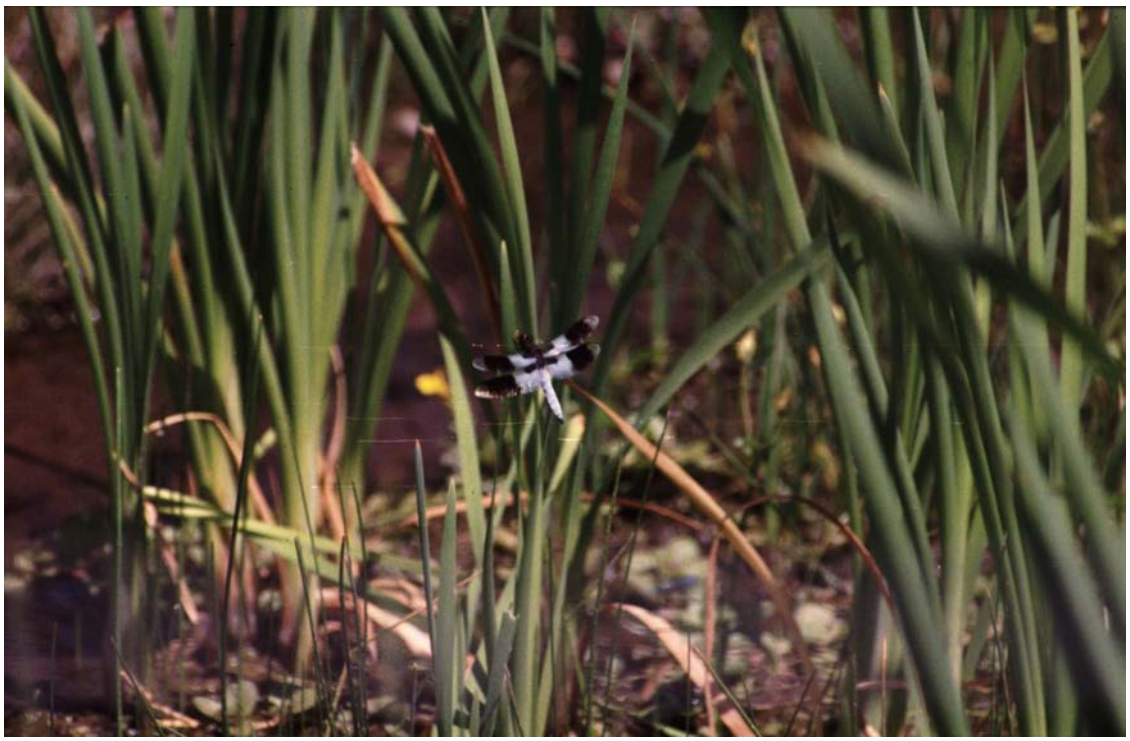
Many other nonprofit organizations and quasi-public entities that work on various other natural resource issues that also advance protection and recovery of the state's wetland heritage through research, resources inventory, environmental monitoring, project design and implementation, and advocacy to enhance conservation strategies.

Desert Research Institute
Universities of Nevada (Environmental, Natural Resources, and Biological programs)
Cooperative Extension, University of Nevada
Friends of Nevada Wilderness
Nevada Wilderness Project
Great Basin Bird Observatory
League to Save Lake Tahoe
Outside Las Vegas Foundation
Great Basin Mine Watch
Truckee River Yacht Club

Several Conservation Districts have remained active in wetland and riparian improvement and monitoring projects (e.g., channel stabilization, revegetation, invasive weed removal, project results monitoring) for several years: Washoe-Storey, Dayton Valley, Carson Valley, Lahontan, Smith Valley, Mason Valley, Southern Nye County, and Southern Nevada. Water bodies of focus include the Carson River and tributaries, Steamboat Creek and tributaries, lower Truckee River, Walker River, upper Muddy River, Las Vegas Wash, and Amargosa River Valley.

We cannot say enough to recognize the tremendous contributions that NCOs have made and continue to make toward the acquisition, protection, restoration, and improved management of wetlands. Clearly, however, their affirmative involvement in the various affairs of government and industry are at the heart of wetland conservation in Nevada.

Commentary – Wetland Ecosystem Stewardship



Barbara Rhode photo, courtesy of Nevada Biodiversity Initiative

Fundamental to any successful natural resources stewardship program is the awareness that ecosystems are interconnected. Land managers will fail at stewardship if they manage landscape components in a piecemeal fashion, complying with the individual environmental regulations but never tying the different parts of the ecosystem into an integrated whole.

In order to properly manage wetlands, one must recognize their role in the landscape: they are the active interface between terrestrial and aquatic components of a drainage basin. Water, sediment, nutrients, toxins, organic matter, and seeds from upstream or upslope move into wetlands where they may be changed in energy or biochemical status before eventually being removed further downstream. Animals move in and out of wetlands, using them as sources of food, water, and habitat, and transferring energy and chemical components between terrestrial and aquatic ecosystems. Because of these interrelationships, activities upstream or upslope have profound effects on wetlands and on aquatic sites downstream. Consequently, management activities within wetlands can have substantial impacts on communities downstream or within the radius of movement of organisms.

Active stewardship of wetlands, then, requires attention to activities elsewhere in the drainage basin. These activities may not be regulated under wetland laws, or even substantially regulated under narrow interpretations of other environmental rules. However, impacts to wetlands may be considerable, especially as they accumulate over time. Particularly common impacts on wetlands are erosional sedimentation from upslope traffic or construction projects. Erosion is often greater than planned, and sediment may move further than anticipated or even than monitored. Nevertheless, when wetlands fill faster than natural erosion would cause, their ecological equilibrium with the surrounding landscape is disturbed and the wetland is degraded. All rules may have been complied with, but the stewardship mission has failed.

The interrelationships between wetlands and adjacent systems upstream and downstream are complicated enough that it is not practical to write quantitative regulations for integrative management of the entire landscape. It is the role of the professional resources steward to integrate activities in various components of the ecosystem so that those activities do not substantially degrade other components, even if that integration requires going to the extra lengths of managing activities more stringently than required by the formal regulations with which the base must comply.

[Although] off-site impacts can have significant impacts on wetlands, rules regulating them are seldom interpreted broadly enough to protect adjacent wetlands from such secondary impacts. It is the role of the professional resources steward to recognize site-specific implications of individual upstream activities and modify those activities so as to minimize the secondary wetland impacts.

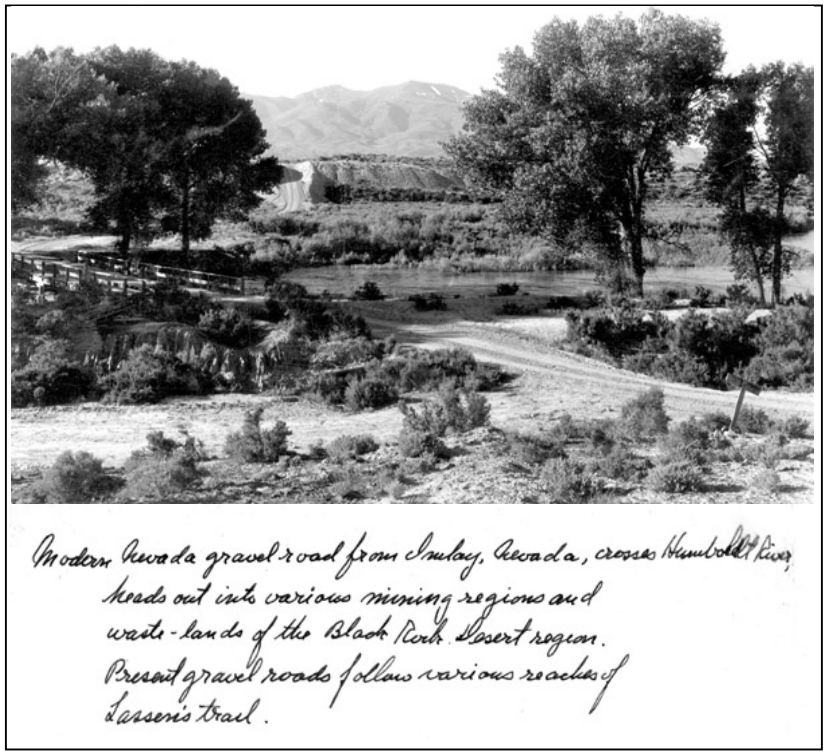
Wetlands Management Handbook
Carolyn B. Schneider, Steven W. Sprecher
Environmental Laboratory, U.S. Army Engineer Research and Development Center
December 2000

APPENDIX 5.1

A GUIDE TO NEVADA REVISED STATUTES CONCERNING WETLANDS AND ASSOCIATED NATURAL RESOURCES

Nevada Natural Heritage Program

A Guide To Nevada Revised Statutes Concerning Wetlands and Associated Natural Resources



Nevada Department of Conservation and Natural Resources

January 2004

A Guide
Nevada Revised Statutes Concerning Wetlands and Associated Natural Resources

The Guide is a tabulation of Nevada Revised Statutes (NRS) and legislated policies, responsibilities, and duties of state agencies and political subdivisions of the state concerning the conservation and development of wetlands and associated natural resources. The intent of The Guide is to present and expand awareness of the various state statutes that provide agencies and conservation workers with tools and opportunities to advance wetland resource protection and conservation. By "associated natural resources" we mean riparian and aquatic resources, flora and fauna dependent upon wetland resources, and various functions and services wetlands provide with singular adeptness. Associated resources include fish and wildlife, rare plant and animal species, water quality and nonpoint pollution reduction, watershed and water supply, erosion and flood control, and outdoor recreation. Therefore, the NRS sections compiled go beyond wetland statutes. Summarized are statutes that agencies and political subdivisions of the state must or could implement to regulate, conserve, or manage wetlands resources. In other words, the policies and statutes represent the potential for state resource and other agencies to directly or indirectly take actions or make decisions that will result in the protection, conservation, restoration, or enhancement of wetlands and associated resources.

Organized sequentially by NRS Chapter, the Guide identifies the agencies authorized to administer statutory provisions and the content relevant to wetlands and qualities, as mentioned above. The reader will note that few statutes employ the term wetland, marsh, or other commonly related terms. Wetlands are presumed to be included under the auspices of "natural resources," and other generic terms that could reasonably be interpreted to encompass wetland resources. Where the association to wetlands is implicit, key words have been italicized. NRS sections appearing in the Guide are excerpts. The intent of the Guide is to provide sufficient content to give readers a comprehensive list of wetland related statutes. Acronyms are used extensively, so a list is provided. Key words with particular state statutory definitions appear in bold/italics and are defined in the glossary.

If you find errors or wish to suggest changes, please notify Ed Skudlarek, Nevada Natural Heritage Program; 687-4245; skudlarek@heritage.nv.gov.

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278	Local Government	**land improvement, use** – regulation, natural resource responsibilities, conservation planning
321	Division of State Lands	**state land, navigable waters** – use, acquisition, resource inventory, areas of critical environmental concern
322	Division of State Lands	**state land, navigable water** – policy, lease, permits
407	Division of State Parks	**state park land** – acquisition, protection, development, statewide recreation planning
408	Department of Transportation	**transportation** policy coordination with social, economic and environmental goals
445A	Division of Environmental Protection	**water quality** – policy, pollution control, standards, planning, State Environmental Commission powers, duties
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533	Division of Water Resources	**surface water** – appropriation policy, permit, reuse, beneficial use, waste prohibition
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Acronyms

BLM	U.S. Bureau of Land Management
DCNR	Department of Conservation and Natural Resources
NDCD	Nevada Division of Conservation Districts
NDEP	Nevada Division of Environmental Protection
NDF	Nevada Division of Forestry
NDHR/HD	Nevada Department of Human Resources, Health Division
NDM	Nevada Division of Minerals
NDOA	Nevada Department of Agriculture
NDOW	Nevada Department of Wildlife
NDSL	Nevada Division of State Lands
NDSP	Nevada Division of State Parks
NDWP	Nevada Division of Water Planning
NDWR	Nevada Division of Water Resources
NRS	Nevada Revised Statute(s)
PUCN	Public Utility Commission of Nevada
SBWC	State Board of Wildlife Commissioners
SCC	State Conservation Commission
SEC	State Environmental Commission
UEPA	Utility Environmental Protection Act
USFWS	United States Fish and Wildlife Service
USDOI	United States Department of Interior

Excerpts from Nevada Revised Statutes Concerning Wetlands and Associated Natural Resources

NRS	Subject	Agency	NRS Section
244.388	wetland mitigation bank established by county	county	1. The board of county commissioners of a county may by ordinance establish, use and operate a ***wetlands*** mitigation bank in accordance with the guidelines set forth in Federal Guidance for the Establishment, Use and Operation of Mitigation Banks, as issued by the United States Army Corps of Engineers, Environmental Protection Agency, National Resources Conservation Service, Fish and Wildlife Service and National Marine Fisheries Service in 60 Federal Register 58,605 on November 28, 1995. 3. As used in this section: (c) "Mitigation bank" means a system in which the creation, enhancement, restoration or preservation of wetlands is recognized by a regulatory agency as generating compensatory credits allowing the future development of other wetland sites.
278.020	regulation of land improvements/use, planning for natural resource conservation	city, county	1. For the purpose of promoting health, safety, morals or the general welfare of the community, the governing bodies of cities and counties are authorized and empowered to regulate and restrict the improvement of land and to control the location and soundness of structures. 2. Any such regulation, restriction and control must take into account: (a) potential impairment of *natural reso*urces and the total population, which the available natural resources will support without unreasonable impairment.
278.150	master plan adoption by planning commission		1. The planning commission shall prepared and adopt a comprehensive, long term general plan for the physical development of the city, county or region. 2. The plan must be known as the master plan and must be so prepared that all or portions thereof, except as provided in subsection 3, may be adopted by the governing body as provided in NRS 278.010 to 278.630.
278.160	master plan contents may include natural resources conservation plan		1. The master plan may include the following subject matter or portions thereof as are appropriate to the city, county or region, and as may be made the basis of physical develop thereof: ... (b) Conservation plan - for the conservation, development and utilization of natural resources, including water and its hydraulic force, underground water, water supply, forests, soils, *rivers and other waters*, harbors, *fisheries, wildlife*, minerals and other natural resources. The plan must also cover the reclamation of land and *waters, flood control,* prevention and control of the *pollution of streams and other waters,* regulation of the use of *land in stream channels* and other areas required for the accomplishment of the conservation plan, prevention, control and correction of the erosion of soils through proper clearing, grading and landscaping, *beaches and shores,* and protection of *watersheds*. The plan must also indicate the maximum tolerable level of pollution; ... (j) recreation plan - comprehensive system of recreation areas, including natural reservations, parks, parkways, *reserved riverbank strips, beaches*, playgrounds and other recreation areas;...
321.0005	state lands best use, multiple use, sustained yield, legislative policy	NDSL	1. State lands must be used in the best interest of the residents of Nevada, for recreation, production of revenue and other public purposes. In determining the best use of state lands, the appropriate state agencies shall give primary consideration to the principles of ***multiple use*** and ***sustained yield*** as the status and the *resources of the lands* permit.
321.001	use of state lands permitted		The NDSL must authorize all use of lands owned by the state, including the *beds and banks of all* ***navigable*** *bodies of water*, with the exception of lands held by the University system, the Department of Transportation and the Legislature...The division may acquire and hold land and interests in land required for any public purpose, including the

NRS	Subject	Agency	NRS Section
			production of public revenue.
321.640	local government land use planning responsibility, legislative policy	NDSL, county, city	1. It is in the public interest to place the primary authority for the planning process with the local government. 2. Unregulated growth and development of the state will result in harm to the public safety, health, comfort, convenience, *resources* and general welfare. 3. Cities and counties have a responsibility for guiding the development of areas within their respective boundaries for the common good. 4. City, county, regional and other planning must be done in harmony to ensure orderly growth and preservation of the state. 5. State participation in land use planning should be limited to coordination of information and data, acquisition and use of federal lands within the state, and providing land use planning assistance in ***areas of critical environmental concern*** when directed by the governor or requested by a local government, and providing assistance in resolving inconsistencies between land use plans of local governments, when requested.
321.720	inventory land and natural resources, federal land use planning coordination duties	NDSL	The administrator shall develop and make available to cities and counties information useful to land use planning, including: 1. Prepare and update statewide inventory of land and natural resources of Nevada. 2. Compile and update status and trend data, on a statewide basis, related to population distribution, economic characteristics and projections, environmental conditions, and extent and direction of urban and rural growth. 3. Projections of the nature and quantity of land suitable for: recreation and aesthetic appreciation, conservation and preservation of natural resources, agriculture, mineral development and forestry, industry, commerce, generation and transmission of energy, transportation, urban development, rural development, and governmental services. 4. Prepare and continuing revision of an inventory of environmental, geological and physical conditions, including types of soil, which influence the desirability of various uses of land. 5. Prepare and update an inventory of state, local government and private needs and priorities concerning the acquisition of federal lands in Nevada. 8. Coordinate and exchange of land use information and data among agencies and the public. 9. Coordination of planning for state and local acquisition and use of federal lands.
321.770	areas of critical environmental concern	NDSL	1. The NDSL shall provide assistance in land use planning for areas of critical environmental concern when the governor directs the division to assist in land use planning for an area he finds to be of critical environmental concern and when one or more local government entities request that the division advise and assist in land use planning for an area which affects them and which they consider to be of critical environmental concern. 2. The administrator shall study the problems of the area and meet with affected local government to receive their initial comments and recommendations, and then submit the matter to the executive council of the land use planning advisory council for consideration and recommendation. 3. The executive council of the land use planning advisory council shall consider and make recommendations for land use planning policies, including proposed land use regulations.
322.100	permit, license, or other authorization for use of state land	NDSL	The state land registrar may issue a permit, license or other authorizations for any lawful use of state land administered by the division and charge a fee for the issuance of the authorization in the amount found to be reasonable based upon fair market value of the use. The recipient of the authorization must still comply with any other provision of law regarding the use to which the authorization applies, including requirements to obtain other permits or licenses.
322.1007	work in navigable river		1. In an emergency causing immediate threat to life, health or property a person may perform work below the

NRS	Subject	Agency	NRS Section
	permitted		***high water mark*** of a ***navigable river*** to the extent necessary to protect life, health and property without first applying or securing a permit from the state land registrar. Upon completion of the work, the person initiating the work shall file an application as required for the work completed. 2. Neither an application nor permit from the state land registrar is required for work performed below the high water mark of a navigable river which constitutes routine maintenance and/or minor repairs of an irrigation diversion structure or outfall structure that is regulated by an individual permit issued pursuant to NRS 445A.300 to 445A.730, if the structure is not altered beyond existing size, configuration and location and the river bed is not disturbed. 3. Except as provided in subsections 1 and 4, a person must file an application with the state land registrar and pay an application fee, but is not required to obtain a permit to perform work below the high water mark of a navigable river for the following types of projects: clearance of vegetation that restricts the capacity of the channel and/or flow of water; clearance of debris or temporary obstructions that restrict channel capacity and/or the flow of water; bank stabilization or restoration where all materials are appropriate natural materials as determined by state land registrar. 5. Work authorized by section 2 and 3 must be performed in accordance with best management practices to protect water quality and must not significantly disturb or alter the river bed or banks or the flow of water or alter the capacity of the channel. 6. Except as provided in subsection 1,2 and 3, a person must secure a permit from the state land registrar before proceeding with any work below the high water mark of a navigable river, including but not limited to dredging or filling, bank stabilization or restoration, where all materials used are not appropriate natural materials as determined by the state land registrar, channel clearance, or construction of irrigation diversions.
407.013	outstanding scenic, recreational, scientific, and historic areas protection, legislative policy	NDSP	It is the intention of the legislature that the division shall acquire, protect, develop and interpret a well-balanced system of *areas of outstanding scenic, recreational, scientific, and historical importance* for the inspiration, use and enjoyment of the people of Nevada and shall be held in trust as irreplaceable portions of the state's natural and historical heritage.
407.0475	state park regulatory authority of Administrator		1. The administrator shall adopt regulations found to be necessary to carry out the provisions of Chapter 407 and other pertinent laws, including prohibitions and restrictions relating to activities at state parks or facilities. 2. Regulations must be directed toward preventing damage to or misuse of a facility, and/or promote the inspiration, use and enjoyment of the people through preservation and use of a facility.
407.063	state parks land acquisition		1. The administrator may acquire land for the division with approval of the director and concurrence of the interim finance committee within the limit of legislation appropriation. The right of eminent domain may be exercised by the Division as provided by NRS Chapter 37. 2. Before approving the acquisition of land contiguous to a state park in which development is to be restricted, the interim finance committee shall consult with the affected local governing bodies.
407.065	state parks administrator powers		1. Designate, establish, name, plan, operated, control, protect, develop and maintain state parks, monuments and recreational areas for public use. 3. Allow multiple use of state parks and real property controlled and administered by the DSP, including grazing, mining, development of natural resources, hunting and fishing, subject to regulations adopted by the NDSP.
407.205	Statewide Comprehensive Outdoor Recreation Plan		1. The division shall prepare and maintain a comprehensive statewide outdoor recreation plan containing: (a) an evaluation of the demand for and supply of *outdoor recreation resources* and facilities, and (b) a program for the implementation of the plan. 2.The plan shall: (a) take into account relevant federal resources and programs and (b) be correlated with other state,

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			regional and local plans so far as practicable.
408.233	transportation policy, environmental balance	NDOT	The primary responsibilities of the [NDOT] planning division is to…develop and coordinate balanced transportation policy and planning which are consistent with the social, economic and environmental goals of the state.
445A.010	laws on altering vegetation, land apply to state agency, political subdivision	Local, state agency	In performing any work which alters the material condition of land or vegetation, the state, its agencies and all political subdivisions in this state shall comply with all the state laws or regulations and local ordinances which are applicable to private persons performing the same type of work.
445A.060	water treatment works, legislative policy	NDEP	1. The legislature finds that, (a) modern and efficient treatment works and other pollution control projects are essential for the protection and improvement of the ***waters of the state*** and public health, (b) protection of the waters of this arid state justifies the state's participation and assistance in a program which provides long term financing to aid municipalities and interstate agencies in the construction of treatment works and the implementation of pollution control projects.
445A.170	Lake Tahoe permits required for activities in shorezone, lake	DCNR, NDSL	1. It is unlawful, without a permit from DCNR, to (a) construct a pier, breakwater or marina or alter the *shoreline of Lake Tahoe*, (b) to remove gravel, sand or similar material from Lake Tahoe, or (C) deposit fill or deleterious material in Lake Tahoe. 2. Construction or alteration of the *Lake Tahoe shoreline* below the high water elevation requires a permit from DCNR (Note: Authority delegated to NDSL).
445A.305	water pollution control and quality, legislative policy	NDEP	1. The legislature finds that pollution of *water of the state* adversely affects public health and welfare; is harmful to wildlife, fish and other aquatic life; and impairs domestic, agricultural, industrial, recreational and other beneficial uses of water. 2. The legislature declares that it is the policy of the state and purpose of NRS 445A.300 to 445A.730 to maintain the quality of the waters of the state consistent with the public health and enjoyment, the propagation and protection of terrestrial and *aquatic life*, the operation of existing industries, the pursuit of agriculture and the economic development of the state; and to encourage and promote the use of methods of waste collection and pollution control for all significant sources of water pollution (including point and ***diffuse sources***).
445A.425	state environmental commission, powers and duties	SEC	1. The SEC shall, among other duties: (a) carry out the provisions of NRS 445A.300 to 445A.730, including standards of water quality and amounts of waste which may be discharged into the *waters of the state*; 3. The SEC shall recognize the historical irrigation practices in the river basins, the economy and their effects in the adoption of regulations, standards of water quality and effluent limitations.
445A.440	state water pollution control agency designation	DCNR, NDEP	1. DCNR is designated as the state water pollution control agency for all purposes of federal water pollution control legislation, except the SEC has exclusive power to promulgate rules and regulations. (Note: Authorities and duties in NRS 445A.300 to 445A.730 have been delegated to NDEP.)
445A.445	Groundwater pollution control	DCNR, NDEP	The director of DCNR shall: 3. Develop comprehensive plans and programs for preventing, reducing or eliminating pollution and controlling injections through a well to prevent the degradation of existing or potential underground sources of drinking water, with due regard to the improvements which are necessary to conserve water for the protection and propagation of *fish and aquatic life, wildlife*, recreational purposes, public water supply, agricultural, industrial and other purposes.
445A.520	water quality standards for	SEC, NDEP	1. The SEC shall establish water quality standards at a level designed to protect and ensure the continuation of

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	designated beneficial uses		the designated beneficial use(s) which the SEC has determined to be applicable to each stream segment or other body of surface water. 2. The standards shall be based on numeric or descriptive criteria, which define the conditions necessary to maintain the designated beneficial use(s) of the water. The water quality standards must reflect water quality criteria, which define the conditions necessary to support, protect and allow propagation of *fish, shellfish, and other wildlife* and to provide for recreation in and on the water if these objectives are reasonably attainable.
445A.565	surface water requirement to maintain higher quality	NDEP	1. Any surface waters of the state whose quality is higher than the applicable standards of water quality as of the date when those standards become effective must be maintained in their higher quality. No waste discharges may be made which lower water quality unless it has been demonstrated that the lower quality is justifiable because of economic or social considerations.
445A.580	water quality continuing planning process	DCNR, NDEP	The department shall establish a Continuing Planning Process consistent with federal requirements for plans which results in plans for all *waters of the state* and include: 1. adequate effluent limitations and compliance schedules; 2. incorporation of elements of applicable areawide plans for management of waste; 3. total maximum daily load for pollutants and contaminants; 4. procedures for plan revision; 5. adequate authority for intergovernmental cooperation; 6. adequate implementation for revised or new water quality standards; and 7. control over disposal of residual waste from any treatment of water.
472.040	watershed management and protection duties	NDF	1. The state forester firewarden shall, among other duties,: (a) Supervise or coordinate all forestry and watershed work on state and privately owned lands, including fire control, with agencies and private organizations...(c) Enforce provisions of state law respecting forest and watershed management or the protection of forests and other lands.
472.043	establishment and preservation of vegetative cover in forest and watershed		1. The purpose of this section is to provide for maintenance of forest and vegetative cover on forest and watershed land, to conserve water and soil and to prevent destructive floods. 2. The State forester firewarden, with approval of the director, may: (a) enter into contracts with agencies, corporations or persons to establish and preserve forest and vegetative cover on forest or watershed lands, and (b) conduct surveys and studies to formulate plans and perform acts to establish and maintain forest cover on forest and watershed lands. 3. In entering into contracts the state forester firewarden shall give priority to situations where: (a) natural vegetation has been destroyed or denuded to the extent that precipitation may create floods and serious soil erosion; (b) the denuded area is of a size that soil loss and floods will have a significant effect on watershed values and public welfare; (c) vegetative cover will not be naturally restored quickly enough to prevent undue erosion and flood runoff; and (d) natural succession may be detrimental to public welfare.
501.100	wildlife preservation, protection, management and restoration, legislative policy	SBWC, NDOW	1. ***Wildlife*** in this state not domesticated and in its *natural habitat* is part of the natural resources belonging to the people of the State of Nevada. 2. The preservation, protection, management and restoration of wildlife within the state contribute immeasurably to the aesthetic, recreational and economic aspects of these natural resources.
501.105	wildlife and habitat policy and regulatory duty		The State Board of Wildlife Commissioners (SBWC) shall establish policies and adopt regulations necessary to the preservation, protection, management and restoration of *wildlife and its habitat*.

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501.181	wildlife policy establishment authority and implementation		The SBWC shall: 1. establish broad policies for: (a) protection, propagation, restoration, transplanting, introduction and management of wildlife... 2. guide the division in its administration and enforcement of the provisions of Title 45, Wildlife, and of chapter 488 NRS by the establishment of such policies 3. establish policies for areas of interest including: (a) management of big and small game mammals, upland and *migratory game birds*, fur-bearing mammals, *game fish*, and protected and unprotected mammals, birds, *fish*, reptiles and *amphibians*; (b) control of wildlife depredations; (c) acquisition of lands, water rights and easements and other property for the management, propagation, protection and restoration of wildlife; (d) entry, occupancy, access to and use of such property, including leases of grazing rights, sales of agricultural products and the sale of timber if the sale does not interfered with wildlife management, hunting or fishing;...
501.337	NDOW director duties		The director shall: 1. carry out the policies and regulations of the SBWC 5. submit technical and other reports to the commission as necessary or as requested which will enable the commission to establish policy and regulations
502.300	hunting migratory game birds, stamps required	NDOW	1. Except as otherwise provided in subsection 2, it is unlawful for any person to hunt migratory game birds, except jacksnipe, coot, gallinule, western mourning dove, white-winged dove and bandtailed pigeon, unless at the time he is hunting he carries an unexpired, validated state duck stamp or equivalent official documentation.
502.326	fishing for trout, stamps required		1. Except as otherwise provided in subsection 2, it is unlawful for any person to take or possess trout unless at the time he is fishing he carries on his person a validated state trout stamp affixed to his fishing license.
502.390	permit for certain artificial water bodies	NDOW	1. Any (a) person who develops or maintains an artificial or man-made body of water, other than for agricultural or recreation purposes, containing chemicals or substances in quantities which causes or will cause the death of any wildlife, or (b) operator of a mining operation which develops or maintains an artificial body of water containing chemicals directly associated with the processing of ore, must first obtain a permit from the NDOW authorizing the development or maintenance of the body of water.
503.135	hunting migratory waterfowl	NDOW	It is unlawful for any person subject to the federal migratory bird hunting stamp tax to hunt migratory waterfowl unless an unexpired, validated federal migratory bird hunting stamp is carried on his person.
503.270	fishing during open season		1. It is unlawful to fish in or from waters of the state except during open season designated by the SBWC.
503.400	fishways and fish ladders construction and maintenance	NDOW	Every person who has erected, or who may hereafter erect, any dams, water weirs or other obstructions to the free passage of fish in the rivers, streams, lakes or other waters of the State of Nevada shall construct and keep in repair fishways and fish ladders so that at all seasons of the year fish may ascend above such dams, water weirs and other obstructions to deposit their spawn.
503.410	free flow of water through fish ladder		It shall be unlawful for any person to dry up, impede or interfere with the free flow of water through any fish ladder upon any stream in this state, when there is sufficient unappropriated or unused water in such stream for use therein
503.425	dredging operations, permit required	NDOW	1. Before a person may use any vacuum or suction dredge equipment in any river, stream or lake, he must submit an application to the NDOW which must specify the type and size of the equipment to be used and its location. If the NDOW determines that the operations will not be deleterious to fish it shall issue a permit. 2. A permit issued pursuant to subsection 1 does not authorize the recipient to use any equipment in any navigable

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			body of water unless the recipient has obtained the appropriate permit from the State Land Registrar. 3. It is unlawful for any person to: (a) conduct dredging operations without securing a permit pursuant to subsection 1; (b) operate any equipment other than that specified in the permit; and (c) conduct a dredging operation outside the area designated on the permit.
503.430	water pollution deleterious to fish, wildlife regulated	NDOW, NDEP	It is unlawful to place or allow to pass, or to place where it can pass or fall, into or upon any of the waters of the state at any time, any refuse, sewage, garbage or any substance deleterious to fish or wildlife, except as otherwise provided in NRS 445A.615.
503.584	native wildlife species conservation, protection and propagation, legislative policy	NDOW, SBWC NDOW	1. The legislature finds that: (a) the economic growth of Nevada has been attended with some serious and unfortunate consequences. Nevada has experienced the extermination or extirpation of some of her *native species of animals, including fish and vertebrate wildlife*. Serious losses have occurred and are occurring in other species of native wild animals with important economic, educational, historical, political, recreational, scientific and aesthetic values, and (b) the people of Nevada have an obligation to conserve and protect the various species of native fish and wildlife that are threatened with extinction. 2. The purpose of this section is to provide a program for the (a) conservation, protection, restoration and propagation of selected species of native fish and other vertebrate wildlife, including migratory birds and (b) the perpetuation of the populations and habitats of such species.
503.585	species threatened with extinction, special permit required for capture, removal, or destruction		A species or subspecies of native fish, wildlife and other fauna must be regarded as threatened with extinction when the SBWC, after consultation with competent authorities, determines that its existence is endangered and its survival requires assistance because of overexploitation, disease, or other factors, or its habitat is threatened with destruction, drastic modification or severe curtailment. Any animal so declared to be threatened with extinction must be placed on the list of fully protected species, and no member of its kind may be captured, removed or destroyed except with special permit from the division.
503.587	species threatened with extinction habitat protection		The SBWC shall use its authority to manage land to carry out a program for conserving, protecting, restoring and propagating selected species of native fish, wildlife and other vertebrates and their habitats which are threatened with extinction and destruction.
503.620	Migratory Bird Treaty Act		Except as provided by Title 45, it is unlawful for any person to hunt or posses any dead or alive birds, nests of birds or eggs of birds protected by the Migratory Bird Treaty Act.
504.140	wildlife management area establishment	NDOW, SBWC	1. The division is authorized, subject to SBWC approval, to enter into agreements with landowners, to establish wildlife management areas and to enforce regulations for the purpose of providing greater areas for the public to hunt and fish on private lands and to protect the landowner or lessee from damage due to trespass or excessive hunting or fishing pressure.
504.143	SBWC powers to create, regulate wildlife management area		1. To effectuate a coordinated and balanced program resulting in the maximum revival of wildlife in the state and in the maximum recreational advantages to the people of the state, the SBWC has created and maintains state-owned wildlife management areas, and in cooperation with the U.S. Fish and Wildlife Service (USFWS), the Department of Interior (DOI) and other federal agencies, has created and maintains other cooperative wildlife management areas. 2. The SBWC may permit hunting, fishing or trapping on or within, or access to wildlife management areas.
519A.010	mining reclamation,	NDEP	1. The legislature hereby finds that: (a) the extraction of minerals by mining is a basic and essential activity

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	legislative policy		making an important contribution to the economy of Nevada; (b) proper ***reclamation*** of mined land, areas of exploration and former areas of mining or exploration is necessary to prevent undesirable land and *surface water conditions* detrimental to the ecology and to the general health, welfare, safety and property rights of the residents of Nevada; (c) the success of reclamation efforts is dependent upon cooperation among state and federal agencies. 2. The legislature directs all agencies and political subdivisions within Nevada which are involved in or whose work is related to the administration or enforcement of the provisions of Chapter 519A shall cooperate fully with all other state and federal agencies in any related matter.
519A.140	mining reclamation plan on public land		The division shall: 3. Enter into a memorandum of understanding with the U.S. BLM and USFS concerning the adoption of plans of reclamation that: (a) apply to mining operations or exploration projects conducted on a site which includes public land and privately owned land, and (b) substantially provide for the reclamation and security required by this chapter. 6. Approve, reject or impose conditions upon the approval of any reclamation plan.
519A.200	mining operation permit required		A person who desires to engage in a mining operation must: 1. file an application with the NDEP for a permit for each location at which he will conduct operations. The application must include, among other items, a completed checklist pertinent to a plan for reclamation.
519A.230	plan for reclamation required		1. A plan for reclamation must provide, among other things: (a) that reclamation activities must be conducted simultaneously with the mining operation to the extent practicable and otherwise must be initiated promptly upon the completion or abandonment of the mining operation; (b) for vegetative cover if appropriate to future use of the land; (c) for reclamation of all land disturbed by the exploration project or mining operation to a stability comparable to adjacent areas. 3. Except in an emergency, an operator shall not depart from an approved reclamation plan without prior written approval from NDEP. 4. Reclamation activities must be economically and technologically practicable in achieving a safe and stable condition suitable for the use of the land.
527.050	trees or flora removal or destruction permit	NDF, DSP	1. It is unlawful for any person, firm, company or corporation, willfully or negligently: (a) to cut, destroy, mutilate, pick or remove any *tree, shrub, plant, fern, wild flower*, cacti, desert or montane flora, or any seeds, roots or bulbs from any private lands without a written permit from the owner/occupant or agent; (b) to cut destroy, mutilate, pick or remove any flora on any state land under the jurisdiction of NDSP except in accordance with regulations of the NDSP; and (c) to cut, destroy, mutilate, pick or remove any flora declared endangered by the state forester firewarden from any lands, other than NDSP lands, owned by or under control of the State or the U.S. without a written permit from the state forester firewarden, or designate. For the purpose of this subsection the state forester firewarden may establish regulations for enforcement, including the issuance of collecting permits and designation of state and federal agencies from which permits may be obtained. 3. The state forester firewarden and his representatives, public officials charged with administration of federal public land and peace officers shall enforce the provisions of this section. 4. The provisions do not apply to Indians that are native to Nevada who gather flora, other than endangered flora, for food or medicinal use for personal use.
527.260	native species of flora protection and conservation,	NDF	1. The legislature finds that (a) the economic growth of Nevada has been attended with some serious and unfortunate consequences. Nevada has experienced the extermination or extirpation of *native species of flora*. Serious

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	legislative policy		losses have occurred and are occurring in other species of flora with important economic, educational, historical, political, recreational scientific and aesthetic values. (b) People of Nevada have an obligation to conserve and protect species of flora threatened with extinction.
527.270	native flora threatened with extinction designation and permit for removal or destruction		2. The purpose of NRS 527.260 to 527.300 is to provide a program for the conservation, protection, restoration and propagation of selected species of flora and for the perpetuation of their habitats. A species or subspecies of native flora shall be regarded as threatened with extinction when the state forester, after consultation, determines that its existence is endangered and its survival requires assistance because of overexploitation, disease or other factors or because its habitat is threatened with destruction, drastic modification or severe curtailment. Any species declared to be threatened with extinction shall be placed on the list of fully protected species. No member of its kind may be removed or destroyed except under special permit issued by the state forester.
527.300	native species of flora threatened with extinction, cooperative area management		The state forester, with approval of the director, shall cooperate to the maximum extent practicable with, and may enter into agreements with other states and Nevada counties and with other legal entities for the administration and management of any area established for the conservation, protection, restoration and propagation of species of native flora which are threatened with extinction.
527.310	renewable resources inventory report		1. The state forester shall cause to be prepared before December 31, 1980, and at least every 10 years thereafter, a report showing the total amount of forest and range renewable natural resources in Nevada. 2. The report shall include (a) an inventory of all nonfederal commercial forests [***timberland***], pinon pine and juniper ***woodlands***, *river bottom woodlands*, higher elevation noncommercial forests and other forest and range renewable natural resources in Nevada and (b) all species of flora within the state that are in danger of extermination or extirpation.
528.030	forest practice act, water supply and quality protection	NDF	1. NRS 528.010 to 528.090 are adopted to: (a) establish minimum standards of forest practice and require compliance by every timber owner or operator; (b) promote the sustained productivity of the forests of the Sierra Nevada Mountains in Nevada; and (c) preserve the *natural water supply* of the state in the interests of economic welfare. 2. Provisions of the act shall not be construed to condone any activity which causes significant degradation of water quality.
528.040	forest practices and logging authority of state forester		The state forester firewarden shall administer the provisions of NRS 328.010 to 528.090, and may exercise all powers necessary to accomplish their purposes and intent.
528.042	permit to log		1. Prior to any logging or cutting operation, any timber owner shall secure a logging permit from the state forester.
528.053	logging activities prohibited near bodies of water, variance granted by committee		1. No felling of trees, skidding, rigging or construction of tractor or truck roads or landings, or the operation of vehicles, may take place within 200 feet, measured on the slope, of the high water mark of any *lake, reservoir, stream or other body of water* unless a variance is first obtained from a committee composed of the state forester firewarden, the director of the department of wildlife, and the state engineer. 2. The committee may grant a variance authorizing any of the activities prohibited by subsection 1 within a 200-foot buffer area if the committee determines that the goals of conserving forest resources and achieving forest

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			regeneration, preserving watersheds, reaching or maintaining water quality standards adopted by federal and state law, continuing water flows, preserving and providing for the propagation of fish life and stream habitat and preventing significant soil erosion will not be compromised. 3. In acting on a request for such variances the committee shall consider the following factors: (a) the extent to which the requested activity is consistent with good forestry management for the harvesting of timber; (b) the extent to which the requested activity significantly impedes or interrupts the natural volume and flow of water; (c) the extent to which the activity significantly affects a continuation of the natural quality of the water pursuant to state and federal water quality standards; (d) the extent to which the activity is consistent with the prevention of significant soil erosion; (e) the extent to which the activity may significantly obstruct fish passage, cause sedimentation in fish spawning areas, infringe on feeding and nursing areas and cause variations of water temperatures; and (f) the filtration of sediment-laden water as a consequence of timber harvesting on adjacent slopes.
532.165	duties, studies and inventories	NDWR	The state engineer shall: 1. conduct necessary studies and inventories; 2. review and evaluate proposals by federal, state and local agencies for flood control and water development projects to ensure that such proposals are compatible with the state water resource plan and are in compliance with Nevada water laws
532.170	agreements concerning measurement of water resources		1. Subject to provisions of subsection 2, and with the approval of the director, the state engineer is authorized to enter into agreements with the U.S. Geological Survey, the U.S. Soil Conservation Service and any state agency, subdivision or institution having jurisdiction in such matters, for cooperation in making stream measurements, underground water studies, snow surveys or any investigations related to the development and use of the water resources of Nevada.
532.220	channel clearance, maintenance and restoration program		1. The channel clearance, maintenance, restoration, surveying and monumenting program is established and must be administered by the state engineer. 2. This program is to aid local governments in such activities on ***navigable rivers***.
533.024	effluent reuse, legislative policy	NDWR	The legislature declares that it is state policy: 1. to encourage and promote the use of effluent, where not contrary to the public health, safety or welfare and where reuse does not interfere with federal obligations to deliver water of the Colorado River.
533.025	water belongs to the public		The water of all sources of water supply within Nevada, above or beneath the ground surface, belongs to the public.
533.030	recreational purposes declared a beneficial use		1. subject to existing rights, and except as otherwise provided in this section, all water may be appropriated for beneficial use as provided in this chapter and not otherwise 2. the use of water from any *stream* system and from underground water for any recreational purpose is declared to be a beneficial use
533.035	beneficial use standard		Beneficial use shall be the basis, the measure and the limit of the right to the use of water.
533.040	beneficial use to remain appurtenant to place of use		All water used in this state for beneficial purposes shall be deemed to remain appurtenant to the place of use. 1. If it should become impracticable to use water beneficially or economically at the place to which it is appurtenant, the right may be severed from the place of use and simultaneously transferred and become appurtenant to another place without losing priority of right. 2. The provisions of this section do not apply to a ditch or canal company which appropriates water for diversion and transmission to the lands of private persons for an annual charge.

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533.045	right to divert subject to beneficial use		When the necessity of the use of water does not exist, the right to divert it ceases. No person shall be permitted to divert or use waters of this state except at such times as the water is required for beneficial purposes.
533.060	rights limited to amount necessary, abandonment of water right	NDWR	1. Rights to the use of water must be limited and restricted to the amount necessary for beneficial purposes, irrespective of the carrying capacity of the ditch. The balance of water not appropriated must be allowed to flow in the natural stream from which the water is diverted. 2. If the owner(s) of a diversion of the public water fail to use the water for beneficial purposes for which the right to use exists during any 5 successive years, the right shall be deemed as having been abandoned. The owner(s) forfeit the abandoned water rights, and those waters may then be appropriated for beneficial use.
533.070	quantity of water appropriated limited		1. The quantity of water appropriated from either a surface or underground source of water shall be limited to the amount reasonably required for the beneficial use to be served.
533.305	distribution of water among users regulated	NDWR	1. The state engineer shall divide or cause to be divided the waters of the *natural streams* or other sources of supply in the state among the several ditches and reservoirs taking water therefrom, according to the rights of each, respectively, in whole or in part, and shall shut or fasten, or cause to be shut or fastened, the headgates or ditches, and shall regulate or cause to be regulated, the controlling works of reservoirs, as may be necessary to insure a proper distribution of the water.
533.325	appropriation of public water permitted		Any person who wishes to appropriate public waters, or to change the place of diversion, manner of use or place of use of water already appropriated, shall first apply to the state engineer for a permit.
533.365	protest against granting of application to appropriate		1. Any person interested may, within 30 days from the date of the last publication of the notice of application, file with the state engineer a written protest against the granting of the application, setting forth with reasonable certainty the grounds of protect.
533.367	wildlife ensured access to water	NDWR	Before a person may obtain a right to use water from a *spring or seepage* to the surface, he must ensure that wildlife which customarily uses the water will have access to it.
533.368	environmental studies required by state engineer		1. The state engineer may determine that a hydrological, environmental, or other study is needed before he makes a final determination on an application to appropriate water or change the place of use of water already appropriated.
533.490	livestock watering declared a beneficial use	NDWR	1. The use of water for livestock watering is a beneficial use, except as otherwise provided, and may be acquired in the same manner as the right to use water for any other beneficial use.
533.530	waste of water unlawful		1. It is an unlawful use and waste of water for any person during the irrigating season to divert water from a stream and retain it without making any other use of the water or to allow the water to run to waste on the land.
534.020	underground waters belong to the public, waste prohibited, legislative policy	NDWR	1. All underground waters within the state belong to the public. Subject to existing rights, ground water is subject to appropriation for beneficial use according to the state laws relating to appropriation and use of water. 2. The legislature's intent by chapter 534 is to prevent the waste of underground water and pollution and contamination and provide for the administration of ground water by the state engineer.

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534.030	designation of ground water basin		The state engineer may determine there is a need for administration of a ground water basin and issue an order to that effect. Before making such a determination, the state engineer must hold a public hearing on the need for administration and after seeking the advice of the water conservation board or water district within which a ground water basin is being considered for designation.
534.120	depletion of ground water in designated area		1. Within an area designated by the state engineer where, in his judgement the ground water basin is being depleted, the state engineer is empowered to make rules, regulations and orders deemed essential for the welfare of the area involved 2. In the interest of public welfare, the state engineer is authorized and directed to designate preferred uses of water within a designated area where ground water is being depleted.
534A.040	geothermal well, appropriation of water	NDM	1. A consumptive use of water brought to the surface outside of a geothermal well is subject to the appropriation procedures of chapters 533 and 534 of the NRS, except as otherwise provided.
534A.060	geothermal well, permit to drill, operate		1. No person may drill or operate a geothermal well or drill an exploratory well without first obtaining a permit from the administrator of the division of minerals.
535.010	dam, construction, reconstruction or alteration	NDWR, SBWC, NDOW	1. Any person proposing to construct a dam shall, before beginning construction, obtain from the state engineer a permit to appropriate, store and use the water to be impounded or diverted. 2. Any such person obtaining or possessing such a permit shall notify the state engineer before commencing work on the dam and submit plans and specifications to the state engineer for his approval, where the dam is or will be 20 feet or more in height, or is less than 20 feet high and will impound more than 20 acre-feet of water.
535.020			1. The state engineer shall file a copy of an application to construct, alter or enlarge a dam in any stream with the board of wildlife commissioners. 2. The owner shall conform with the provisions of law for the installation of fishways over or around dams and for the protection and preservation of fish in streams obstructed by dams.
535.060	dam project, application to construct filed with SBWC beaver dam removal	NDWR, NDOW	1. On streams where beaver dams are found to interfere with the lawful and necessary distribution of water to the proper users, the state engineer, upon complaint shall investigate or cause an investigation. 6. The state engineer may remove or cause the removal of any beaver dam found to be obstructing the proper and necessary flow of water to the detriment of water users, except as otherwise provided.
540.011	water resource planning, legislative policy	NDWP	1. The legislature determines that it is the policy of the state to continue to recognize the critical nature of the state's limited water resources. It is acknowledged that many of the surface water resources are committed to existing uses, under existing water rights, and in many areas the available ground water supplies have been appropriated for current uses. It is the policy of the state to recognize and provide for the protection of existing rights. It is also the policy to encourage efficient and nonwasteful use of water. 2. The legislature recognizes the relationship between the critical nature of the state's limited water resources and the increasing demands placed on these resources as population continues to grow. 3. The legislature recognizes the important role of water resource planning and that such planning must be based upon identifying current and future water needs. 4. The purpose of the state's water planning is to assist the state, its local governments and its citizens in

NRS	Subject	Agency	NRS Section
			developing effective plans for the use of water.
540.041	administrator duties		The administrator shall, by the fifth calendar day of each regular legislative session, submit to the director of the legislative counsel bureau for distribution to the legislature a written report summarizing the actions of the NDWP taken pursuant to the provisions of NRS 540.051 and NRS 540.101.
540.101	state water plan, legislative authority and applicability of recommendations		1. The NDWP shall develop a plan to provide guidance and coordination for the development, management, conservation and use of water resources in Nevada. 2. The division shall coordinate with local governments in developing the plan. Each local government shall cooperate with and assist the NDWP in plan development. 3. The plan must include provisions designed to protect identified water needs for current and future development in the rural areas of the state, giving consideration to relevant factors, including the economy and quality of life in affected areas. 4. The provisions of the plan must not be construed to supersede, replace, amend or add to the law of the state. 5. A state or local governmental agency shall consider the plan when developing or implementing its mission, programs, plans and responsibilities regarding water resources, and is not bound by recommendations or provision of the plan unless it formally adopts those. 6. The NDWP shall submit to the legislature the plan and recommendations provided to the division by the Advisory Board on Water Resources Planning and Development.
540.131	plan of water conservation	NDWP	1. Except as otherwise provided in subsection 5, each supplier of water for municipal, industrial, or domestic purposes shall, on or before July 1, 1992 adopt a plan of water conservation based on the climate and living conditions of its service area in accordance with provisions of NRS 540.141.
540.141	plan of water conservation contents division review		1. A plan of water conservation submitted to the division for review must include provisions relating to: (a) methods of public education; (b) specific conservation measures required to meet the needs of the service area and many measures required by law; (c) the management of water to reduce leakage, meter inaccuracies and high pressure in water supplies, and increased effluent reuse; (d) a contingency plan for drought conditions that ensures a supply of potable water; (e) a schedule for carrying out the plan; (f) measure to evaluate the effectiveness of the plan. 3. The supplier of water shall file a copy of the plan with NDWP for informational purposes.
541.030	districts for water and land conservation and development, legislative policy	water conservancy districts, NDWR	1. It is declared that to provide for the conservation and development of the water and land resources of the state and for the greatest beneficial use of water within the state, the organization of water conservancy districts and the construction of works as herein defined by such districts are a public use and will: (a) be essentially for the public benefit and advantage of the people of the state; (b) indirectly benefit all industries of the state; (c) indirectly benefit the state in the increase of its taxable property valuation; (d) directly benefit residents of the state by providing adequate supplies of water for domestic, municipal and industrial use; directly benefit lands to be irrigated or drained from works to be constructed; (f) directly benefit lands now under irrigation by stabilizing stream flow and by increasing flow and return flow of water to streams; (g) directly benefit urban use of water or development of water resources by flood control. 2. It is therefore declared to be the policy of the state to: (a) control, make use of, and apply to beneficial use unappropriated waters to a direct and supplemental use of such waters; (b) to cooperate with the U.S. and agencies

NRS	Subject	Agency	NRS Section
			under the federal reclamation laws or other federal laws.
541.140	water conservancy district board powers	water conservancy district, NDWR	The board shall have power on behalf of the district to, among other powers,: 2. to take by appropriation, or otherwise acquire water, water works, water rights and sources of water supply and any and all real and personal property, and to sell, lease or otherwise dispose of, water, water works, water rights and sources of water supply, and to acquire, construct, operate, control and use any and all works, facilities and means, as necessary or convenient to the exercise of its powers. 3. to have and to exercise the power of eminent domain 4. to construct and maintain works and establish and maintain facilities across or along and public street or highway, and in, upon or over any vacant public lands, and across any *stream or watercourse* in accordance with the laws of the state. 5. to contract with U.S. government or agency thereof, the state or any political subdivision, for the construction, preservation, operation and maintenance of water works and to acquire perpetual rights, or dispose of perpetual rights, to the use of water and energy from such works. 6. to make an allotment of water to all land susceptible of irrigation within the district, which shall not exceed the maximum amount of water that the board determines could be beneficially used on such lands; and to levy assessments upon such lands 10. to appropriate and acquire water and water rights; to develop, store and transport water; to acquire, construct, operate and maintain dams, reservoirs, power plants and other water works 15. to construct works for the drainage of lands within the district and to levy assessments
541.145	flood control, drainage projects		The board shall have the following powers concerning management control, operation and use of any district irrigation, *flood control, drainage*, safety or health project: 1. to make and enforce reasonable rules and regulations for any such project; 2. to restrict or suspend the right of any person or corporation to benefit from any such project if such person or corporation has violated any rule or regulation
543.020	control of floods, legislative policy	DCNR, NDWR	It is State of Nevada policy to cooperate with the U.S. and its departments and agencies, and with the counties, cities and public districts of the state in preventing life and property, disruption of commerce, interruption of transportation and communication and waste of water resulting from floods, and in furthering the conservation, development, utilization and disposal of water.
543.030	flood control projects, authority of DCNR director		The director is authorized to give all assurances and perform any other acts required by the Secretary of the Army and the U.S. Congress in connection with flood control projects in the state, when and as directed by acts of the legislature of the state.
543.170	flood control districts, legislative declaration concerning	flood control district, county	The legislature finds and declares that: 1. facilities to alleviate flooding in any district, whether located in a city, an unincorporated area of the county, benefit all the residents and owners of property in the district; 2. these facilities provide protection for life and property throughout the district, and usually require planning and development throughout a drainage basin.
543.260	flood control district formed		The organization of a district must be initiated by the adoption of an ordinance by the board of county commissioners.
543.360	district board authority		The flood control district board may: 1. By affirmative vote of two-thirds of the members voting on the matter, acquire, construct, improve, extend

NRS	Subject	Agency	NRS Section
			maintain and operate: (a) projects and improvements for the control of flood and storm waters of the district and of streams, provided such project or improvement is in the master plan; (b) projects which mitigate adverse effects of the acquired projects; (c) projects which are required as a result of the proposed alteration or diversion of a *natural watercourse* identified in the master plan for the control of drainage. 2. Conserve such waters for beneficial and useful purposes by spreading, storing, retaining, and causing them to percolate into the soil within or without the district. 3. Save and conserve in any manner all or any of such waters and protect from floods or storm waters the *watercourses, watersheds*, public highways, life and property in the district.
543.410	storage and reclamation of flood water, pollution prevention	flood control district, county, NDWR	The board may: 1. store *floodwater* in surface or underground reservoirs within or without the district 2. conserve and reclaim *floodwaters* for present and future use within the district 3. subject to limitations contained in NRS 543.170 to 543.830 to appropriate and acquire water and water rights, and import water into the district and conserve it within or without the district for any useful flood control purpose. 7. prevent contamination and pollution of the *surface or subsurface waters* used in the district
543.590	survey and report of flood problems, master plan		1. The district board shall make a survey of the problems of controlling floods in the district and to prepare a report setting forth information about existing facilities, needed facilities, description of property to be acquired or damaged and other facts. 3. The chief engineer for the district shall prepared for each hydrographic area a master plan for the control of floods which must set forth the most effective structural and regulatory means for correcting existing problems and dealing with the probable effects of future development.
548.095	renewable natural resources, legislative policy	NDCD	It is declared as a matter of legislative determination that: 1. the ***renewable natural resources*** of the State of Nevada are basic assets. 2. *renewable natural resources* are being affected by the ever-increasing demands of farm and ranch operations and by changes in land use from agriculture to non-agriculture uses. 3. conservation, protection and controlled development of these renewable natural resources are necessary at such rate and such levels of quality as will meet the needs of the people of Nevada.
548.100	renewable natural resources conservation planning, legislative policy		The legislature declares as a matter of legislative determination that the consequences of failing to plan for and accomplish the conservation and controlled development of the renewable resources of Nevada are to handicap economic development and cause degeneration of environmental conditions important to future generations.
548.105	local conservation planning and development, legislative policy		The legislature declares as a matter of legislative determination that persons in local communities are best able to provide basic leadership and direction for the planning and accomplishment of the conservation and development of renewable natural resources through organization and operation of ***conservation districts***.
548.110	conservation of renewable resources, legislative policy		The legislature declares the policy to recognize the ever-increasing demands on the renewable natural resources of the state and the need to conserve, protect and develop such resources at levels of quality as will meet the needs of the people of the state.

NRS	Subject	Agency	NRS Section
548.115	state conservation commission creation	SCC, NDCD	The state conservation commission (SCC), consisting of two ex officio members and seven members appointed by the governor, is hereby created.
548.175	state conservation commission duties and powers	SCC	The SCC has the following duties and powers: 1. carry out the policies of the state in programs at the state level for the conservation of renewable natural resources 2. offer assistance to the supervisors of conservation districts, propose programs, review district programs, and facilitate, promote, assist, harmonize, coordinate and guide the programs and activities of districts as they relate to other special-purpose districts, counties and other public agencies 3. keep supervisors of each district informed of activities and experiences of other districts and to facilitate exchange of advice and experience and promote cooperation between districts 4. secure the cooperation and assistance of the U.S., U.S. agencies and other agencies of the state in the work of the conservation districts 5. serve, along with conservation districts, as the official state agency for cooperating with the Natural Resources Conservation Service (NRCS) 6. enlist the cooperation and collaboration of governmental and private agencies with conservation districts and facilitate arrangements under which conservation districts may serve county government and agencies in the administration of any activity concerned with the conservation of renewable natural resources. 7. make available, with assistance of NDCD, information concerning needs and work of the districts and SOC to the director of DCNR, legislature, federal, state and local agencies, and the public. 8. cooperate with and give assistance to local governments and special districts for the purpose of cooperating with the U.S. Dept. of Agriculture in the furtherance of conservation, pursuant to the *Watershed Protection and Flood Prevention Act*, and requirements of other special programs of the U.S. Dept. of Agriculture. 9. review and comment on federal, state and local plans, programs and activities for the use and conservation of renewable natural resources, for purposes of coordination with the conservation districts' programs, and confer with other agencies to avoid conflict, attend to omissions and avoid duplication of effort.
548.340	conservation district powers of	conservation districts, NDCD	A conservation district organized under the provisions of chapter 548 shall constitute a governmental subdivision of the state and a public body, exercising public powers.
548.345			A district may conduct surveys, investigations and research which shall be initiated with appropriate state and federal agencies, and publish results.
548.355			A district may carry out preventative and control measures with the consent of the occupier of the land or the state agency administering the land.
548.375			A district may develop comprehensive plans for conservation of renewable natural resources within the district, and publish such plans.
548.380			A district may: 1. manage or administer any renewable natural resources project undertaken by federal or state agencies; 2. act as an agent for federal or state agencies in connection with a resource project; 3. accept money, services or materials from federal and state agencies; and 4. participate in cost sharing on federally financed projects.

NRS	Subject	Agency	NRS Section
548.410	district regulation of land use	SCC, NDCD, conservation districts	1. The supervisors of any district may file petitions with the SCC to request it to formulate land use regulations applicable to the district. 3. The SCC shall have authority to formulate regulations based upon the petition, governing the use of lands within a district in the interest of conserving renewable natural resources and preventing and controlling soil erosion and sedimentation.
555.130	noxious weed designation	NDOA, county	The State Quarantine Officer may declare by regulation the weeds of the state that are ***noxious weeds***, but a weed must not be designated as noxious which is already introduced and established in the State to such an extent as to make its control or eradication impracticable in the judgment of the State Quarantine Officer.
555.150	eradication of noxious weeds required		Every railroad, canal, ditch or water company, and every person owning, controlling or occupying lands in this state, and every county, incorporated city or district having the supervision and control over streets, alleys, lanes, rights-of-way, or other lands, shall cut, destroy or eradicate all weeds declared and designated as noxious as provided in NRS 555.130, before such weeds propagate and spread, and whenever required by the State Quarantine Officer.
555.160	noxious weed investigation, state quarantine officer duties		1. The State Quarantine Officer shall make or cause to be made a careful examination and investigation of the spread, development and growth of noxious weeds in this state. Upon the discovery of those weeds he shall ascertain the name of the owner or occupant of the land and the description of the land where the weeds are found. The State Quarantine Officer may serve notice in writing upon the owner or occupant of the land to cut, eradicate or destroy the weeds within such time and in such manner as designated and described in the notice. One such notice shall be deemed sufficient for the entire season of weed growth during that year.
555.202	weed control, legislative policy		The legislature declares that it is primarily the responsibility of each owner or occupier of land in Nevada to control weeds on his own land, but in certain areas this responsibility can best be discharged through organized districts.
555.203	weed control district creation		1. Creation of a weed control district may be initiated by the board of county commissioners or by a petition. The board of county commissioners shall appoint a district board of directors composed of three persons who are landowners within the district and fairly represent the agricultural economy of the district.
561.015	protection of agriculture, legislative policy	NDOA	The legislature declares the purpose of chapter 561, Department of Agriculture is: 1. to benefit and to promote the welfare of all the people of the State of Nevada 2. to promote the efficient, orderly and economical conduct of the various activities for the encouragement, advancement and protection of the livestock and agricultural industries of Nevada
561.218	natural resources and land use planning		1. The administrator shall appoint a person to manage the activities of the DOA pertaining to natural resources, land use planning and the management of wild horses and estrays. 2. The person appointed shall: (a) establish and carry out a policy for the management and control of estrays and the preservation and allocation of natural resources necessary to advance and protect the livestock and agricultural industries in this state; (b) develop cooperative agreements and working relationships with federal, state and local agencies for land use planning and the preservation and allocation of natural resources necessary to advance and protect the livestock and agricultural activities in Nevada;... (e) inform the general public and advisory groups about the activities of the NDOA; (f) make assessments of the level of competition between livestock and wildlife for food and water, collect data concerning the movement of livestock and perform activities necessary to control noxious weeds;

NRS	Subject	Agency	NRS Section
			and (g) participate in land use planning relating to the competition for food and water between livestock and wildlife to ensure the maintenance of the *habitat of both livestock and wildlife*.
561.301	aquatic agriculture regulation	NDOA, NDOW	Aquatic agriculture, which includes the propagation, cultivation and harvesting of plants indigenous to water in a controlled or selected aquatic environment for the commercial production of food, is one of the agricultural enterprises conducted in Nevada. The NDOA shall promote, protect and regulate aquatic agriculture to the extent that the NDOA is authorized to regulate other forms of agriculture and other agricultural products. The division shall confer with the NDOW regarding aquatic agriculture to prevent any adverse effects on existing aquatic animals.
568.330	livestock herding or grazing unlawful near water supply	NDOA, county	1. It is unlawful for any person…having charge of livestock to herd, graze, pasture, keep, maintain or drive livestock over or across any lands lying within an area that has been identified by the board of county commissioners as unsuitable for such uses in order to protect and surface intake(s), water boxes or surface reservoirs into which water is diverted for use by municipal, drinking or domestic purposes. A determination by the board of county commissioners must be based upon scientific evidence and must be adopted by ordinance after consultation with affected persons and state agencies.
704.662	water conservation plan required by public utility	PUCN	1. Except as otherwise provided in subsection 5, each public utility which furnishes, for compensation, any water for municipal, industrial or domestic purposes shall adopt a plan of water conservation based on the climate and living conditions present in its service area, according to provisions of NRS 704.6622.
704.6622	plan of water conservation		1. A plan for water conservation shall include provisions relating to: (a) methods of education to increase public awareness of the state's limited water supply and to encourage reduction in the size of lawns and encourage use of plants adapted to arid to semiarid climates; (b) specific conservation measures; (c) the management of water to reduce leakage and increase the reuse of effluent; (d) a contingency plan for drought conditions that ensures a supply of potable water; (e) schedule for carrying out the plan; (f) measure to evaluate the effectiveness of the plan.
704.6624	Plan to provide incentives for water conservation		1. Each public utility which furnishes, for compensation, any water for municipal, industrial or domestic purposes shall adopt a plan to provide incentives: (a) To encourage water conservation in its service area; (b) To retrofit existing structures with plumbing fixtures designed to conserve the use of water; and (c) For the installation of landscaping that uses a minimal amount of water.
704.825	Utility Environmental Protection Act (UEPA), legislative policy	PUCN	1. The legislature hereby finds and declares that: (a) there is a growing need for electric, gas and water services which will require construction of new facilities. It is recognized that such facilities cannot be built without affecting the physical environment; (b) it is essential in the public interest to minimize any adverse effect upon the environment and quality of life which such new facilities might cause; (c) present laws and practices relating to the location of such utility facilities should be strengthened to protect environmental values and to take into account the total cost to society of such facilities; (d) existing provisions of law may not provide adequate opportunity for people, groups interested in conservation and the protection of the environment, and governmental agencies, to participate in proceedings regarding the location and construction of major facilities. (Note: See 704.820 – .900 for more on UEPA)
704.865	UEPA permit required for utility facility construction		1. A person, other than a local government, shall not commence to construct a ***utility facility*** without first having obtained a permit from the Public Utility Commission of Nevada. (Note: Facility exemptions at subsection 3.)
704.870	environmental impact studies, utility facility construction permit	PUCN, NDEP	1. Except as provided in subsection 2, a person who wishes to obtain a permit for a utility facility must file with the PUCN an application containing, among other information: (a) description of the location and utility facility to be built; (b) summary of studies which have been made of the environmental impact of the facility and a description of the

NRS	Subject	Agency	NRS Section
	application		comparative merits and demerits of each location, and a statement of the reasons why the primary proposed location is best suited; and, (c) description of reasonable alternative location(s) for the proposed facility and a description of the comparative merits or detriments of each location, with a statement of the reasons the primary location is best suited for the facility. Copy(ies) of the studies must be filed with the PUCN. 2. If a person wishes to obtain a permit for a utility facility and a federal agency is required to conduct an environmental analysis of the proposed utility facility, the person must: (a) file with the PUCN and each other permitting entity an application containing: (1) a general description of the proposed utility facility; and, (2) a summary of studies which the applicant anticipates will be made of the environmental impact of the facility; and, (b) a final environmental assessment or environmental impact statement relating to construction of the utility facility: (1) file with the PUCN an amended application that complies with the provisions of subsection 1; and, (2) file with each permitting entity an amended application for a permit, license or other approval for construction of the utility facility. 3. A copy of each application and amended application filed with the PUCN must be filed with the NDEP. 5. Not later than 5 business days after the Commission receives an application or amended application, the Commission shall issue a notice. Any person who wishes to become a party to a permit proceeding must file with the Commission the appropriate document required by NRS 704.885 within the time frame set forth in the notice.
704.890	grant or denial of UEPA application; environmental findings, conditions required		1. Except as provided in subsection 3, the commission may not grant a permit for the construction, operation and maintenance of a utility facility, either as proposed or modified by the PUCN, unless it finds and determines: (a) the nature of the probable effect on the environment; (b) the extent to which the facility is needed to ensure reliable utility service to customers in this state; (c) the need for the facility balances any adverse effect on the environment; (d) the facility represents the minimum adverse effect on the environment, considering the state of available technology and the nature and economics of the various alternatives; (e) the location of the facility as proposed conforms to applicable laws and regulations issued there under and the applicant has obtained, or is obtaining, all permits, licenses and approvals required by statutes, regulations and ordinances; and (f) the facility will serve the public interest. 2. If the PUCN determines the location of all or part of the proposed facility should be modified, it may condition its permit upon such a modification. If the applicant has not obtained all permits, licenses and approvals required by federal, state and local statutes, regulations and ordinances as of the date on which the commission decides to issue a permit, the commission shall condition its permit upon the applicant obtaining those permits and approvals.

Glossary of Nevada Revised Statutes Terms

Agroforestry. The intentional integration of agriculture and forestry practices to attain more productive, profitable, and sustainable ecosystems. Agroforestry practices in Nevada include alley cropping, windbreaks, riparian buffers, streambank bioengineering, living snowfences and wildlife habitat. Agroforestry is a key component of the NDF Forest Stewardship Program. (*Nevada Forest Stewardship Program, Five Year Plan, 1997 - 2002*, prepared by NDF Forest Stewardship Coordinating Committee, December 1997).

Areas of Critical Environmental Concern. Means any area in this state where there is or could develop irreversible degradation of more than local significance but does not include an area of depleting water supply which is caused by the beneficial use or storage of water in other areas pursuant to legally owned and fully appropriated water rights. (NRS 321.655)

Conservation district. Means a governmental subdivision of this state, and a public body which is organized in accordance with he provisions of NRS Chapter 548. (NRS 548.032) It is a special purpose district for the purposes of developing and implementing a program for the conservation, use and development of soil, water, vegetation and other renewable natural resources of local interest. Chapter 548 also provides for the establishment of the State Division of Conservation Districts and the State Conservation Commission. The Commission is empowered to carry out the policies of the state in programs at the state level for the conservation of renewable natural resources and to represent the state in matters affecting such resources. Duties of the Commission are implemented with the support by DCD staff, and include facilitating, promoting, assisting, harmonizing, coordinating and guiding the programs and activities of districts as they relate to other special-purpose districts, counties and other public agencies.

Diffuse source. Diffuse source" means any source of water pollution, which is diffused to the extent that it is not readily discernible and cannot be confined to a discrete conveyance. This term is intended to be equivalent to the term "nonpoint source" as used in federal statutes and regulations.

Environmental permit (to appropriate water). Means a temporary permit to appropriate water to avoid the pollution or contamination of a water source. (NRS 533.437)

High water mark. Means the mean high water line to which high water ordinarily reaches, not including flood waters. (NRS 322.1007)

Multiple use. Multiple use includes: (1) management of state lands and their resources so the combination of uses will best meet the needs of the residents of this state; (2) use of state lands and some or all of the resources or related services in areas large enough to allow for periodic adjustments in the use of the land to conform to changing needs and conditions; (3) use of certain state lands for less than all of their available resources; (4) balanced and diverse use of resources which takes into account the long-term needs of residents of Nevada for renewable and nonrenewable resources, including without limit recreational areas, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historic areas; (5) harmonious and coordinated management of state lands and their various resources without the permanent impairment of the productivity of the lands and the quality of the environment, giving consideration to the relative values of the resources and not necessarily to the combination of uses that will produce the greatest yield or economic return for each parcel of land. (NRS 321.0005)

Navigable rivers. A navigable river means a river of stream that is used, or is susceptible of being used in its ordinary condition for trade or travel in the customary modes of trade or travel on rivers or streams. (NRS 532.220) The rivers and lakes recognized as *navigable* water bodies in Nevada are the Carson, Colorado, Truckee, and Virgin rivers; and Lake Tahoe, Walker Lake, and Washoe Lake.

Noxious Weed. Means any species of plant which is, or is likely to be, detrimental or destructive and difficult to control or eradicate (NRS 555.005).

Reclamation. Actions performed during or after an exploration project or mining operation to shape, stabilize, revegetate or otherwise treat the land in order to return it to a safe, stable condition consistent with the establishment of a productive post-mining use of the land and the abandonment of a facility in a manner which ensures the public safety as well as the encouragement of techniques which minimize the adverse visual effects. (NRS 519A.100)

Reforestation. Means planting and cultivation of conservation plant material which are indigenous or adaptable to forests, plains, meadows, deserts and urban areas of Nevada. (NRS 528.097)

Renewable natural resources (or resources). Includes land, soil, water, vegetation, trees, natural landscape and open space. (NRS 548.069)

Solid waste. Means all putrescible and nonputrescible refuse in solid or semisolid form, including but not limited to, garbage, rubbish, junk vehicles, ashes or incinerator residue, street refuse, dead animals, demolition waste, construction waste, solid or semisolid commercial and industrial waste. The term does not include hazardous waste managed pursuant to 459.400 to 459.600, inclusive.

Sustained Yield. Sustained yield means the maintenance of a high-level annual or other periodic yield from the various renewable resources of state lands consistent with multiple use. (NRS 321.0005)

Timberland. Forest land where tree species such as ponderosa pine or white fir traditionally used for industrial wood products, make up at least 10 percent stocking. (*Nevada Forest Stewardship Program, Five Year Plan, 1997 -2002*, December 1997, NDF Forest Stewardship Coordinating Committee)

Utility Facility. Means: 1. Electric generating plants and their associated facilities, other than plants and their associated facilities that are or will be located entirely within the boundaries of a county whose population is 100,000 or more. "Associated facilities" includes, without limitation, any facilities for the storage, transmission or treatment of water, including, without limitation, facilities to supply water or for the treatment or disposal of wastewater, which support or service an electric generating plant. 2. Electric transmission lines and transmission substations that: (a) Are designed to operate at 200 kilovolts or more; (b) Are not required by local ordinance to be placed underground; and (c) Are constructed outside any incorporated city. 3. Gas transmission lines, storage plants, compressor stations and their associated facilities when constructed outside: (a) Any incorporated city; and (b) Any county whose population is 100,000 or more. 4. Water storage, transmission and treatment facilities, other than facilities for the storage, transmission or treatment of water from mining operations. 5. Sewer transmission and treatment facilities. (NRS 704.860)

Waters of the State. All waters situated wholly or partly within or bordering upon this state, including but not limited to all stream, lakes, ponds, impounding reservoirs, marshes, water courses, waterways, wells, springs, irrigation systems and drainage systems and all bodies or accumulations of water, surface and underground, natural or artificial. (NRS 445A.415)

Watershed areas. NRS 473.020

Wetland. Wetland" means land that: (1) Has a predominance of hydric soil; (2) Is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions; and, (3) Under normal circumstances does support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions. As used in this section: "Hydric soil" means soil that, in its undrained condition, is saturated, flooded or ponded long enough during a growing season to develop an anaerobic condition that supports the growth and regeneration of hydrophytic vegetation. (b) "Hydrophytic vegetation" means a plant growing in: (1) Water; or (2) A substrate that is at least periodically deficient in oxygen during a growing season as a result of excessive water content. (NRS 244.388)

Wildlife. Wildlife means any wild mammal, wild bird, fish, reptile, amphibian, mollusk or crustacean found naturally in a wild state, whether indigenous to Nevada or not and whether raised in captivity or not. (NRS 501.097)

Woodland. All forest land consisting of non-timber species not traditionally used for industrial products. Such species include juniper, pinyon pine, cottonwood, willow, aspen, as well as others. (*Nevada Forest Stewardship Program, Five Year Plan, 1997 -2002*, December 1997, NDF Forest Stewardship Coordinating Committee)

Appendix 5.2 Wetland-Associated Threatened and Endangered Species Listed by the Fish and Wildlife Service, Grouped by County in Nevada

Group	Federal Status	Common Name	Species Name
CARSON CITY			
Bird	Threatened	Bald eagle[+]	*Haliaeetus leucocephalus*
Amphibian	Candidate	Mountain yellow-legged frog (Sierra Nevada DPS)	*Rana muscosa*
Fish	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
Invertebrate	Endangered	Carson wandering skipper	*Pseudocopaeodes eunus obscurus*
Plant	Candidate	Tahoe yellowcress	*Rorippa subumbellata*
CHURCHILL COUNTY			
Birds	Candidate	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*
	Threatened	Bald eagle [+]	*Haliaeetus leucocephalus*
Fish	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
CLARK COUNTY			
Birds	Candidate	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*
	Endangered	Southwestern willow flycatcher	*Empidonax traillii extimus*
	Threatened	Bald eagle [+]	*Haliaeetus leucocephalus*
	Endangered	Yuma clapper rail	*Rallus longirostris yumanensis*
Reptile	Threatened	Desert tortoise [~] (Mojave population)	*Gopherus agassizii*
Amphibian	Candidate	Relict leopard frog	*Rana onca*
Fishes	Endangered	Devil's Hole pupfish	*Cyprinodon diabolis*
	Endangered	Pahrump poolfish	*Empetrichthys latos*
	Endangered	Humpback chub *	*Gila cypha*
	Endangered	Bonytail chub [~]	*Gila elegans*
	Endangered	Virgin River chub [a]	*Gila seminude*
	Endangered	Moapa dace	*Moapa coriacea*
	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
	Endangered	Woundfin [~]	*Plagopterus argentissimus*
	Endangered	Colorado pikeminnow *	*Ptychocheilus lucius*
	Endangered	Razorback sucker [~]	*Xyrauchen texanus*
DOUGLAS COUNTY			
Bird	Threatened	Bald eagle [+]	*Haliaeetus leucocephalus*
Amphibian	Candidate	Mountain yellow-legged frog (Sierra Nevada DPS)	*Rana muscosa*
Fish	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
Plants	Candidate	Webber ivesia	*Ivesia webberi*
	Candidate	Tahoe yellowcress	*Rorippa subumbellata*
ELKO COUNTY			
Birds	Candidate	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*
	Threatened	Bald eagle [+]	*Haliaeetus leucocephalus*
Amphibian	Candidate	Columbia spotted frog (Great Basin population)	*Rana luteiventris*
Fishes	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
	Endangered	Independence Valley speckled dace	*Rhinichthys osculus lethoporus*
	Endangered	Clover Valley speckled dace	*Rhinichthys osculus oligoporus*
	Threatened	Bull trout (Jarbidge River DPS)	*Salvelinus confluentus*

Group	Federal Status	Common Name	Species Name
ESMERALDA COUNTY			
Bird	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Reptile	Threatened	Desert tortoise ó (Mojave population)	*Gopherus agassizii*
EUREKA COUNTY			
Birds	Candidate	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*
	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Amphibian	Candidate	Columbia spotted frog (Great Basin population)	*Rana luteiventris*
Fish	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
HUMBOLDT COUNTY			
Birds	Candidate	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*
	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Fishes	Threatened	Desert dace ~	*Eremichthys acros*
	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
Invertebrate	Candidate	Elongate mud meadows pyrg	*Pyrugulopsis notidicola*
Plant	Candidate	Soldier Meadow cinquefoil	*Potentilla basaltica*
LANDER COUNTY			
Birds	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Fish	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
LINCOLN COUNTY			
Birds	Candidate	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*
	Endangered	Southwestern willow flycatcher	*Empidonax traillii extimus*
	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Reptile	Threatened	Desert tortoise ~ (Mojave population)	*Gopherus agassizii*
Fishes	Endangered	White River springfish ~	*Crenichthys baileyi baileyi*
	Endangered	Hiko White River springfish ~	*Crenichthys baileyi grandis*
	Endangered	Pahranagat roundtail chub	*Gila robusta jordani*
	Threatened	Big Spring spinedace ~	*Lepidomeda mollispinis pratensis*
Plant	Threatened	Ute lady's tresses *	*Spiranthes diluvialis*
LYON COUNTY			
Birds	Candidate	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*
	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Fish	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
MINERAL COUNTY			
Bird	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Fishes	Endangered	Hiko White River springfish	*Crenichthys baileyi grandis*
	Threatened	Railroad Valley springfish	*Crenichthys nevadae*
	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
NYE COUNTY			
Birds	Endangered	Southwestern willow flycatcher	*Empidonax traillii extimus*
	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Reptile	Threatened	Desert tortoise ~ (Mojave population)	*Gopherus agassizii*
Amphibian	Candidate	Columbia spotted frog (Great Basin population)	*Rana luteiventris*
Fishes	Threatened	Railroad Valley springfish ~	*Crenichthys nevadae*
	Endangered	Devils Hole pupfish	*Cyprinodon diabolis*
	Endangered	Ash Meadows Amargosa pupfish ~	*Cyprinodon nevadensis mionectes*

Group	Federal Status	Common Name	Species Name
	Endangered	Warm Springs pupfish	*Cyprinodon nevadensis pectoralis*
	Endangered	White River spinedace ~	*Lepidomeda albivallis*
	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
	Endangered	Ash Meadows speckled dace ~	*Rhinichthys osculus nevadensis*
Invertebrate	Threatened	Ash Meadows naucorid ~	*Ambrysus amargosus*
Plants	Threatened	Ash Meadows milkvetch ~	*Astragalus phoenix*
	Threatened	Spring-loving centaury ~	*Centaurium namophilum*
	Threatened	Ash Meadows sun ray ~	*Enceliopsis nudicaulis* var. *corrugata*
	Threatened	Ash Meadows gumplant ~	*Grindelia fraxinopratensis*
	Threatened	Ash Meadows ivesia (mousetail) ~	*Ivesia eremica (= I. kingii* var. *eremica)*
	Threatened	Ash Meadows blazing star ~	*Mentzelia leucophylla*
	Endangered	Amargosa niterwort	*Nitrophila mohavensis*
PERSHING COUNTY			
Bird	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
STOREY COUNTY			
Bird	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Fishes	Endangered	Cui-ui	*Chasmistes cujus*
	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
WASHOE COUNTY			
Birds	Candidate	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*
	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Amphibian	Candidate	Mountain yellow-legged frog (Sierra Nevada DPS)	*Rana muscosa*
Fishes	Threatened	Warner sucker	*Catostomus warnerensis*
	Endangered	Cui-ui	*Chasmistes cujus*
	Threatened	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
Invertebrate	Endangered	Carson wandering skipper	*Pseudocopaeodes eunus obscurus*
Plants	Endangered	Steamboat buckwheat	*Eriogonum ovalifolium* var. *williamsiae*
	Candidate	Webber ivesia	*Ivesia webberi*
	Candidate	Tahoe yellowcress	*Rorippa subumbellata*
WHITE PINE COUNTY			
Bird	Threatened	Bald eagle +	*Haliaeetus leucocephalus*
Fishes	Endangered	Pahrump poolfish	*Empetrichthys latos*
	Endangered	White River spinedace	*Lepidomeda albivallis*

Source: U. S. Fish And Wildlife Service, Nevada Office. (Updated October 30, 2003)
Notes: + Proposed for delisting; ~ Designated Critical Habitat in County; * Believed extirpated from Nevada;
[a] Endangered only in the Virgin River; population in Muddy River is Species of Concern

PART 6. ISSUES AND STRATEGIES CONCERNING CONSERVATION OF THE WETLAND RESOURCES OF NEVADA

Overview

The preparation of the Nevada Wetland Priority Conservation planning process presents an opportunity to generate a contemporary record of wetland issues and potential strategies to address the issues. The provisions of the Emergency Wetlands Resource of 1986 or the National Wetland Priority Conservation Plan do not require a state to re-evaluate and recommend changes to extant protection and conservation strategies if such are sufficient to affect the purpose of Land and Water Conservation Fund program – in this case, to acquire wetland property or water resources that are on the state's priority list. Though Part 6 is an optional element of the NvWP, the intent in undertaking issue/strategy-scoping and compiling the information is to contribute to the other resource conservation efforts of other agencies in which enhanced wetland protection and conservation has relevance. The preparation of Part 6 is contingent upon obtaining technical feedback and input from reviewing agencies, organizations, and others with expertise, followed by public comment and input. To facilitate the process of generating an updated slate of issues and potential approaches to address them, an overview of resource concerns and management issues reported by agencies and conservation organizations is reproduced from select plans summarized in Part 4. Summaries of extant regulatory and nonregulatory strategies can be found in Part 5.

Part 6 of the technical review draft of the NvWP presents issues identified or inferred from the wetland and related resource planning reports summarized in Part 4. These plans cover matters related to the conservation status and the management of wildlife habitats, wildlife diversity, water quality, water resources, and some modes of outdoor recreation. In particular, we reference issues from:

- Nevada Statewide Comprehensive Outdoor Recreation Plan, Nevada Division of State Parks, 2003
- Wetland Conservation Plan Applicable to Nine State Wildlife Management Areas, Nevada Department of Wildlife, 1998
- Nevada Clean Water Act 305(b) Water Quality Assessment Report and 303(d) List of Impaired Waters, Nevada Division of Environmental Protection, 2004
- Nevada State Water Plan, Nevada Division of Water Planning, 1999

Beaver Dam in Rainbow Canyon, Meadow Valley Wash, A Proposed Priority Wetland Area

Riparian areas and wetlands are some of the most diverse and productive portions of the land base. Benefits produced from these areas are essential, and invoke in us a sense of responsibility to ensure their health and continued ability to provide necessary and desired values. Often they are among the first landscape features to show impact from management activities and reflect overall watershed condition. More and more, people are coming together through recognition of the importance of watershed function for long-term water supplies and maintenance of water quality. Our environmental and economic well-being is dependent on the sustainability of these systems, and as the demands on our natural resources increase, we are compelled to restore and protect them.

National Riparian Service Team

Barbara Rhode photo

- Coordinated Implementation Plan for Bird Conservation in Nevada, Nevada Steering Committee of the Intermountain West Joint Venture, 2002
- Regional Wetlands Concepts Plan, Fish and Wildlife Service, Pacific Region Office, 1990
- Mojave and Great Basin Ecoregional Conservation Plans, The Nature Conservancy, 2002
- Nevada Comprehensive Wildlife Conservation Strategy, Nevada Department of Wildlife, 2005

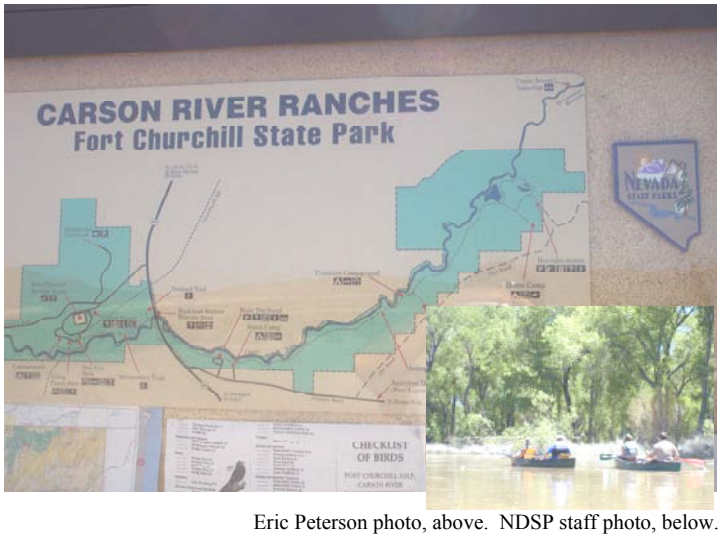
The issues identified in and inferred from these plans span a fairly wide cross section of wetland conservation issues, but we do not see the list as a complete rendition of the subject areas. Reciting the issues from the selected plans is intended to provide background information for conducting the issue-scoping task. We are requesting that scientists, managers, and other people knowledgeable about the wetland resources of Nevada review the draft NvWP and add their expertise and experience to framing the issues concerning the loss and conservation of wetlands. The information received from technical reviewers will be included in the public review draft of the NvWP, which will be prepared and sent out for review later in 2006.

Issues Identified in Nevada Wetland and Related Resource Plans

Nevada Statewide Comprehensive Outdoor Recreation Plan (NDSP, 2003). The NvWP is an element of the Nevada SCORP. State law (NRS Chapter 407) calls on the Administrator of the Division of State Parks (NDSP) to prepare and maintain a SCORP to insure that the state maintains its eligibility to participate in the federal Land and Water Conservation Fund. The planning process included an outdoor recreation survey in which participants were asked to identify and prioritize issues and recommend solutions. Following in order of priority are the issue statements prepared for the 2003 SCORP based on the prevalent themes appearing in participant responses.

- There is a growing need to protect, maintain, and increase public access to public lands for the greatest diversity of outdoor recreation users while protecting the natural resources.
- Existing levels of outdoor recreation funding are inadequate to meet the recreation needs of Nevada. The maintenance of outdoor recreation areas and facilities at the federal, state, and local levels in Nevada has not kept pace with demands created by the rapid increases in population in Nevada and the increasing number of out-of-state visitors. Federal agencies report that improvements need to be made in the management of public lands in Nevada entrusted to them for multiple-use.
- There is a growing need to provide recreational trails and pathways throughout the state, in both urban and rural areas. Trail construction costs and long term maintenance funding coupled with obtaining easements are lacking.
- Protection of natural, cultural and scenic resources needs to be put in balance with use/users. There is no such thing as non-consumptive outdoor recreation. The "degree of resource consumption" must be evaluated as a part of outdoor recreation planning and management to balance conservation and use.
- Water resources must be protected and conserved to meet the demands and expectations of outdoor recreationists. Recreation has a

Fort Churchill State Park Features a New Carson River Water Trail



Eric Peterson photo, above. NDSP staff photo, below.

strong tie to wildlife, and wildlife depend on water resources in native habitats. Water and wetlands are the basis and main attraction for the most popular activities (e.g., boating, fishing, water skiing, waterfowl hunting, sailing, wildlife watching, nature study, walking, hiking, camping, and picnicking). However, recreational use of water competes with human consumption and agricultural uses under current management strategies.

- Environmental, cultural, and heritage interpretation and educational programs are lacking at outdoor recreation venues. About eighty-eight percent of residents live in a metropolitan area, so most youth receive little or no exposure to natural or rural environments. Many people moving to Nevada are unfamiliar with ecological sensitivities and proper outdoor recreation stewardship.
- Nevada's growing population places increasing demand on outdoor recreation resources and suppliers at all levels statewide. New resources need to be identified, acquired, funded, and developed. Meeting increasing outdoor recreation demand will require coordinated public/private planning, particularly given funding shortfalls and the lower priority status placed on recreation compared to other social needs.
- Vigorous, sustained support from private citizens, user groups, and governmental entities are important to developing and maintaining outdoor recreation resources and sites. Elected officials who understand and can advocate the importance of outdoor recreation to society must be involved. Nonprofit organizations play are strong allies, playing effective roles at all levels of government in regard to planning, obtaining grants, and implementing projects.

Wetland Conservation Plan Applicable to Nine State Wildlife Management Areas (NDOW, 1998). The NDOW wetland conservation plan identifies management issues applicable to wildlife management areas (WMA), and which pertain to wetland and wildlife management concerns elsewhere in Nevada.

- The purpose of the NDOW WMA wetland plan was to develop a written policy and comprehensive management plan delineating mechanisms to achieve a goal of no net loss of wetlands by area and function, within the state WMA system.
- The prominent wetland wildlife and habitat management issue for WMAs is water management. State water law declares maintaining fish and wildlife resources a "beneficial use," and the State Engineer has permitted instream and minimum pool water rights for that purpose within state WMAs and elsewhere. Still, inefficient supply management, inadequacy/intermittency of supply, and junior priority minimizes the effectiveness of available water. Severe water reductions occur during drought especially where the supply is "surplus" water. Improvements in water management efficiency and water supply characteristics are needed.
- Tamarisk, tall whitetop, and other introduced plant species have invaded WMA wetlands, displacing native communities. Nonnatives are difficult to control after established. Recreation use, recreation experience quality, and habitat quantity and quality are reduced. Tamarisk lowers groundwater tables and diminishes ecological functions.
- The WMAs contain game, nongame, and sensitive species. Integrated management plans may be devised to reconcile differing habitat needs among species.

Nevada CWA 305(b) Water Quality Assessment Report and 303(d) List of Impaired Waters (NDEP, 2004). These biennial reports document monitoring data and analysis for the purpose of identifying water bodies and watersheds requiring additional water quality management. The analysis shows widespread nonpoint source water quality impairment problems, which are discussed in the supporting State Nonpoint Pollution Source (NPS) State Management Plan.

- The conversion of wetlands to agricultural lands and to urban development is a major concern. The NPS plan suggests restoring wetlands, minimizing or preventing their loss, and protecting wetland buffer zones to reduce nonpoint pollution from farm, ranch, grazing, and urban lands. Hydrologic

and wetland modifications (e.g., channelization, dredging, land development, dams/impoundments, flow regulation, stream bank shaping, or conversion or removal of vegetation) also cause substantial water quality degradation. These concerns are prevalent in these priority watersheds: Truckee River Basin; Middle Carson River Sub-watershed; Carson Desert Region; Las Vegas Wash; Upper Carson River Sub-watershed; Lake Tahoe Basin; Walker River Basin; and, the Humboldt River Basin. The NPS Program relies on voluntary participation by other agencies, landowners, and nongovernmental conservation organizations. (NDEP, 1999).

- Riparian corridor restoration is a key strategy to improve quality-impaired waters. However, restoration may be infeasible in severely altered fluvial settings, particularly where entrenched land uses alter vegetation and channel morphology. A study of the physical conditions of the Carson River for setting the total maximum daily load (TMDL) for phosphorus reports that "…the degree of form and function that can be recreated in a riparian corridor fragmented by urbanization and infrastructure may be minimal because of societal constraints, such as local water lawn or zoning ordinances. When these constraints restrict restoration activities, stretches of the river that have been rehabilitated are alternated with sections where efforts to revegetate, restore floodplain or mitigate erosion have not occurred. Fragmentation may hinder stakeholder ability to improve water quality and habitat for aquatic life. Localized reaches may be repaired, but because restoration projects are not contiguous, watershed wide improvements may be moderate at best. There must be an understanding that the constraints placed on a river system by the community will limit the extent of restoration and biological function that can be achieved." (NDEP, 2004)
- In addition to identifying irrigation return flow and grazing influences on soil, water, and vegetation as major nonpoint sources, the 305(b) report points to flow reduction in rivers to account for the magnitude of water quality impairment. Irrigation-depleted low flow conditions correspond with higher pollutant concentrations, warmer water temperatures, greater algal growth, and depressed dissolved oxygen content, all of which are exacerbated by the coincident narrowing or disappearance of riparian vegetation. The causal link between water quantity and water quality is a matter not addressed in state water law or water pollution control law.
- Monitoring of wetland water quality is limited to five sites representative of one general wetland type. Three sites, Indian Lakes, Carson Lake, and Stillwater Marsh, occur in the terminal basin of the Carson River. The others are in Mason Valley (Walker River) and the isolated Ruby Marsh. The sites are marshlands with a migratory waterfowl management emphasis. Only Ruby Marsh does not receive water impaired by urban and agricultural nonpoint sources. The Mason Valley and Stillwater marshes appear on the Nevada 303(d) list of impaired waters. The applicability of water quality standards to these wetlands is unclear. State water law or water pollution control law does not identify wetland or riparian zone maintenance as a beneficial use. Water quality criteria for native, obligate plant or animal species are not quantified. The applicability of narrative and/or numeric water quality standards to wetlands, under Clean Water Act provisions, should be addressed.

Nevada State Water Plan (NDWP, 1999). Wetland resource related issues are presented in Part 3 of the state water plan that address "Water for Wildlife and Environmental Purposes," "Maintenance of Recreation Values." In summary, relevant issues include:

- A disproportionately large share of the state's at-risk, threatened, and endangered species inhabit or are strongly associated with wetlands. Sixty-two of the ninety-one native fish taxa are ranked as at-risk. Twenty-five are designated as threatened or endangered and seven are presumed extinct. Six of sixteen native amphibian taxa are imperiled and three are candidates for endangered species status. Species casualties correspond with wetland ecosystem losses and deterioration, particularly riparian corridors and spring systems.
- The magnitude of the decline in wetland ecosystems combined with the number of wetland dependent species at-risk or endangered indicates additional emphasis on proactive planning and management of water supplies for natural resource conservation is a matter of urgency in areas of the state.

- The Nevada Board of Wildlife Commissioners has adopted policies that support NDOW efforts to secure water from willing sellers for the maintenance of adequate instream flow, minimum pools, and wetlands, springs and seeps for wildlife and their habitats. Funding, staff, and administrative procedures limit the agency's ability to compete with other participants in water markets. The NDOW is hampered in its ability to acquire suitable water rights.
- Obtaining instream flow rights may be a cost effective and durable strategy to achieving multiple resource conservation objectives simultaneously. With surface water resources fully allocated, appropriate incentives must be devised to simulate implementation of measures enabling water users to practicably and legitimately make water available for resource conservation (e.g., water use efficiency, fallowing marginal cropland, nonnative phreatophyte control, watershed improvements). Agricultural water uses account for approximately seventy percent of total statewide surface water withdrawals.
- The listing and management of threatened or endangered fish, wildlife, and plant species is complex, controversial, and costly both for the private and the public sector. Proactive local wetland and water resource planning could protect or enhance the conditions needed for survival of at-risk species and their habitats, thus avoiding restrictive federal regulatory actions.
- Communities located along rivers (and washes) are incurring increasing costs due to flooding. Growth and development in floodplains exacerbates flood damages and costs. Experience shows structural controls are not always effective and studies throughout the West show the benefits of incorporating non-structural (natural) measures, including preservation and restoration of floodplain areas, zoning and conservation easements, and relocating structures out of floodplains.
- Outdoor recreation is an important beneficial use of water resources. Recreationists expect a diverse range of choices in a variety of settings. Maintenance of water-related recreation values depends upon a balance between developing facilities to accommodate a diversity of recreational uses while protecting aquatic systems and wetlands from overuse. Generally, recreation has been managed by state and federal agencies to avoid or minimize negative impacts. However, increasing recreational activity presents the need for more monitoring to ensure outstanding and sensitive resources are adequately protected.
- With increased recreation, there is growing public interest in enhancing and maintaining stream flow, reservoir and lake levels, good water quality conditions, high quality riparian zones and wetlands for fish and wildlife habitat, and public access to waters and adjacent land. However, surface waters are fully appropriated and during droughts water based recreation resources and opportunities are negatively impacted. Innovative water management approaches will be needed to keep up with water-based recreation demand.

Coordinated Implementation Plan for Bird Conservation in Nevada (Nevada Steering Committee of the IWJV, 2002). Habitat loss and adequacy of fresh water supply are the prominent wetland related issues identified in the national, regional, and state bird conservation plans rolled together into the coordination implementation plan. The Nevada plan identifies wetland landscape units that are conservation priorities because: numerous bird species of statewide importance inhabit them; opportunities (funding, partnerships, and feasibility) exist for habitat protection, restoration, enhancement; and, wetlands occurring within the landscape unit are experiencing loss or degradation due to various land and water resource uses.

First Priority Sites

Wetlands. (Includes marsh, wet meadow, bog, fen, ephemeral and permanent waterways and bodies.) The strategic location of Nevada's wetlands make them particularly important resting, feeding and breeding habitat for migrating waterfowl, shorebirds and waterbird, as well as a host of resident fish and

wildlife. Some wetlands are adequately protected; others are inadequately maintained by water and/or are threatened by land and water development.

Lowland Riparian. (Floodplains of Nevada's major river systems occurring below 5,000 feet in northern Nevada and below 4,000 feet in southern Nevada, including the Humboldt, Truckee, Carson and Walker Rivers and the Colorado River.) Lowland riparian systems are among the most productive and critical habitat for a wide range of resident and migratory birds and other wildlife. They are also among the most drastically altered by human intervention and development, including irrigation diversion, livestock grazing, and pollution. Statewide, lowland riparian systems are degraded and declining in both quality and quantity of habitat available to birds.

Mesquite/Catclaw. (Distributed along washes and riparian areas in the Mojave Desert ecoregion of southern Nevada, generally below 3,000 feet in elevation.) A number of priority bird species use these habitats, including loggerhead shrike, Lucy's warbler and phainopepla. Mesquite and catclaw communities have been decimated by lowered water tables and other human-caused factors such as gravel mining, woodcutting, wildfire and direct development of the landscape. Many stands of mesquite and catclaw have also been replaced by exotics such as red brome, cheatgrass, and salt cedar. Habitat quality and quantity continues to decline with rapid commercial and residential development in southern Nevada.

Aspen. (Found statewide between 6,000 and 8,000 feet, as riparian stringers or more commonly as disjunct patches in stream bottoms, ridgelines, or talus slopes.) Aspen stands are diminished in both number and quality due to a number of factors, including overgrazing, fire suppression, and severe recreational use. This declining trend continues.

Montane parkland – Great Basin. (High-elevation mountain meadows in the sagebrush-covered mountains of interior Nevada, at 5,000 to 10,000 feet, primarily found in valley bottoms and associated with streams, springs, and glacial lakes.) Meadows are important for a number of priority bird species, including juvenile Sage Grouse, which depend on them for both insect and plant foods. Montane parklands are threatened by improper grazing practices, recreation, and encroachment by pinyon-juniper.

Second Priority Sites

Montane Riparian. (Occurs along streams and drainages of most mountain ranges in Nevada, generally above the alluvial fans of major valleys.) Montane riparian sites include cottonwood, alder, birch, willow, wild rose and red-osier dogwood. Aspen is described above as a separate habitat type. Obligate bird species include Wilson's and MacGillvray's Warblers, but Montane riparian habitat is locally important to other species including Cooper's Hawk, Northern Goshawk, Calliope Hummingbird, Lewis's Woodpecker and Red-naped Sapsucker. Montane riparian systems have been degraded for many years by improper grazing practices, hydraulic mining, road building and off-road vehicular use. Fire suppression has also contributed to the progression of riparian tree stands toward mature, non-regenerative conditions.

Montane parkland – Sierra Nevada. (High-elevation mountain meadows, east slope of the Sierra Nevada range, at 5,000 to 10,000 feet, primarily found in valley bottoms and associated with streams, springs, and glacial lakes.) Meadows are important for a number of priority bird species. Montane parklands in the Sierra Nevada ecoregion are threatened by improper grazing practices, recreation and encroachment by lodgepole pine.

Regional Wetlands Concept Plan (FWS, Pacific Region Office, 1990). The Regional Concept Plan describes issues associated with acquisition as a strategy to protect wetlands and buffer areas from onsite and offsite development pressures. The issues were:

- Direct acquisition may be infeasible due to high land costs, lack of available funding, or lack of funding and personnel for management.
- Political opposition due to large public land base in federal ownership.
- Wetlands are threatened by a lack of water resulting from diversions for agricultural purposes.
- Acquisition of water rights for wetlands on public land, such as wildlife management areas. The land base may be managed for protection, but prime water rights may not accompany the land.
- Prime water rights must accompany wetlands to be acquired with L&WCF grants, which may be used to acquire water.
- Many land owners express an interest in preserving and restoring wetland resources on their property if they can receive some form of economic incentive.
- At the state level of L&WCF grant administration, the acquisition of wetlands compete with acquisition of outdoor recreation development.

The regional plan also notes that:
- Losses of wetlands have resulted in significant economic expense through development of artificial control systems (flood control, water and wastewater treatment, groundwater recharge, erosion control, water supply augmentation) reductions in water quality, and payments for damages associated with flooding and erosion.
- An estimated one-half of the animals and one-third of the plants listed (in 1990) in the U.S. as endangered or threatened depend on wetlands for their survival.
- Most riparian areas in the region have been highly modified. Little data is available to quantify the extent of loss, but available studies indicate significant losses.
- Overall, loss of freshwater marsh habitat has been significant, with a corresponding reduction in waterfowl and other wetland dependent populations.

Mojave and Great Basin Ecoregional Conservation Plans (TNC, 2002). The ecoregional plans prepared by TNC identify target conservation sites that overall are inhabited by rare or imperiled species, prone to negative impacts from human activities, and lack appropriate protection or management.

- Activities that impact biodiversity include urbanization, rural sprawl, intensive agriculture, livestock grazing, construction of roads and utility corridors, recreation, mining, military activities, groundwater withdrawals, and stream diversions. Structural and compositional changes to ecological systems include destruction or alteration of habitat, habitat fragmentation, and exotic species introduction. Functional changes to ecological systems include increased fire frequency and intensities, decreased instream flow and ground water, and increased soil erosion and compaction.

- The greatest impacts to biodiversity in this desert ecoregion have revolved around the extraction of its most limiting resource, water. Desert agriculture demands ground water withdrawals and stream diversions for irrigating croplands. These uses and changes to hydrologic systems have led to ground water depletions and reduced or otherwise altered instream flows, which has led to decreases in aquatic ecological systems and their associated species. Agricultural reservoirs have replaced stream systems, which has changed aquatic faunas associated with flowing water to those associated with standing water, and has favored an increase in the number of exotic aquatic species. Agriculture has degraded water quality through siltation and pollution, in addition to depleting water supplies.

- Agriculture has displaced large acreages of native vegetation and replaced it with cultivated plants and weeds. This occurred historically only at the western and eastern periphery of the ecoregion, but more recently has impacted areas along the Humboldt River corridor and other interior locations. The spread of noxious weeds is increasing as a result of historic and some current grazing management.

- There is a clear functional linkage between aquatic and riparian habitats and it is shortsighted, if not impossible to conserve one system type and not the other.

Mojave Aquatic Ecosystems

- The [climatic] process of desiccation and subsequent isolation of once well dispersed aquatic fauna has created an ecoregion with an unsurpassed degree of endemism among its aquatic taxa. This isolation has also made aquatic biodiversity in the Mojave extremely vulnerable to extirpation.

- Often times, conserving aquatic species in the Mojave does not come with the luxury of choice among several sites. Instead, the ecoregion is, to a large degree, made up of one and only occurrences and many of these may be of questionable viability; threatened more frequently by impending water withdrawal and development. Nonetheless, these locations may remain the only option for conserving the species in question, and the only alternative to extinction may be restoration.

- Hampering efforts at developing an aquatic classification system is the absence of comprehensive data on springs and seeps ecoregion wide. The small size of springs and seeps often eludes detection via remote sensing, so even properly locating spring sources in the Mojave is a challenge. Inventory work on spring snails has provided a starting point for characterizing these small aquatic environments, but it is estimated that the vast majority of springs and seeps in the Mojave and the invertebrates that inhabit them, are yet to be described.

- Declines and even extinction of several western fishes have been correlated with introductions of non-native fish species. These introductions result in habitat, trophic, and spatial alterations of aquatic environments for which native fishes of the Mojave have little tolerance. Sources of exotic fish include intentional planting of game fish, transport of baitfish and dumping of aquaria species. Additionally, exotic invertebrates, in particular crayfish, pose a significant threat to many of the Mojave's fish and invertebrate fauna.

- The explosive growth of the human population in the Mojave places heavy demands on the region's water supply. In addition to withdrawals from the Colorado River, increasingly, local and regional aquifers are being staked out and prepared for pumping. Tapping regional aquifers will seriously threaten the instream flows of riverine systems and spring outflows throughout the ecoregion.

- Historic development of springheads and streams has already destroyed much of the critical aquatic habitat in the Mojave, turning natural pools and creek beds into concrete wells and ditches. Meanwhile, those habitats that remain intact are under increasing risk of conversion in the face of urban and recreational development pressures as noted above.

- Remotely sensed and/or digital spatial information depicting spring sites and wetlands varied substantially in quality across the ecoregion, and rarely provided enough information to make informed decisions about the viability of spring habitats. Consequently, data on important spring areas came exclusively from expert opinion.

Mojave Wetland [and Riparian] Ecosystems

- Riparian habitats play an important role in the health and function of aquatic ecosystems. Riparian zones are critical to regulating temperature, energy inputs, water chemistry, and flow regimes of aquatic systems.

- Cover and foraging habitat supplied by riparian areas provide migratory corridors for many species that move through the otherwise exposed and arid landscape of the Mojave Desert. Activities that degrade or destroy linear riparian zones, even in cases where only a small portion of the corridor is affected, threaten to sever critical ecological linkages.

- In addition to providing critical stop over points for migratory bird species, riparian zones in the Mojave Desert contain essential foraging and nesting habitats for listed or declining species such as Southwest Willow Flycatcher, Bell's Vireo, and Yellow-Billed Cuckoo. While several of the target bird species are considered widespread, the loss of riparian habitat could result in precipitous population declines rangewide.

- By definition, riparian vegetation depends on the availability of perennial water, both surface and subsurface. Pumping from surface water sources, as well as from regional and local aquifers, will result in significant habitat loss for this system.

- Historic development of springheads and channelization of streambeds has already severely altered much of the riparian habitat in the Mojave Desert. Meanwhile, those habitats that remain intact are under increasing risk of conversion in the face of rapidly increasing urban and recreational development pressures.

- Inappropriate livestock grazing practices combined with trampling and grazing pressures from feral ungulates such as wild horses and burros continues to severely degrade vegetation and soil stability along riparian zones.

- The combination of soil erosion and soil compaction along stream banks and pool edges caused by off road vehicular traffic can significantly impair vegetation growth in riparian areas. Even when seemingly localized, such impacts may sever important connectivity along migration corridors.

- One of the most prolific threats to riparian areas of the southwest is the spread of alien invasive species such as salt cedar (*Tamarix ramosissima*). The Mojave Desert is no exception with tamarisk invading riparian areas, particularly in the wake of disturbance. Resultant negative impacts include the displacement of native vegetation, reduced biodiversity, stream bank armoring (which impedes the natural process of steam meandering), and loss of instream water through increased rates of evapotranspiration.

<u>Great Basin Ecoregion At Large</u>

- Hydrologic alteration impacts riparian and wetlands systems as well as aquatic systems. Unfortunately, riparian and wetland systems have experienced huge losses and degradation. Springsnails, other aquatic invertebrates, and fishes are especially vulnerable to hydrologic alteration. There are several known recent fish and springsnail extinctions in the Great Basin. Federally listed threatened and endangered aquatic species are numerous here and Nevada holds the national record for highest number of federally listed fishes. Several of the listed fishes in the Great Basin are perilously close to extinction.

- Rangeland use has provided the greatest economic contribution from Great Basin landscapes. Most of the land has been subject to grazing and much of that has been heavy. Significant impacts from grazing have occurred at springs and seeps, along riparian corridors, and on bottomland meadow vegetation. Grazing impacts that change ecological systems include displacement of plant species, which decreases their areal extent, increases soil erosion, and increases less palatable species.

- Grazing has impacted rare and endangered species in the Great Basin, such as Lahontan and Bonneville cutthroat trout by decreasing riparian plant cover, which leads to increases in water temperature. Several associated grazing activities, including trampling, introduction of diseases carried by livestock, pollution of aquatic systems from fecal material, range improvement projects, and invasion by exotics introduced by livestock, imperil rare species.

Great Basin Riparian and Wetland Ecosystems

- The areal extent of riparian and wetland communities in this desert ecoregion is exceedingly small, but they are exceedingly important for many species. They are considered biodiversity hotspots because the water, cover, and food availability are attractive and often essential to wildlife. For example, about 80% of the birds and 70% of the butterflies in the Great Basin are associated with riparian areas.

- Much of the riparian has been degraded or destroyed from water diversions, livestock grazing, and agriculture. Degraded riparian is comprised of widespread ecological generalists and introduced species that are adapted to highly disturbed conditions. Composition and structure of degraded riparian is diminished. Many parts of the Walker River are now dominated by nonnative aggressive tamarisk (*Tamarix* spp.) where the composition, structure, and function of this major river course have been dramatically altered. Tamarisk uses more water, create more saline conditions, and tolerate more frequent fires than the native cottonwoods and willows. Other areas have been invaded by Russian olive (*Elaeagnus angustifolia*), which also alters riparian structure and composition. Restoration is costly and time consuming, but it is possible in smaller isolated areas, and there have been lasting restoration successes at isolated spring systems.

- Desert riparian [shrubland and woodland] vegetation occurs on floodplains that naturally undergo lateral adjustments as they meander and form new alignments. This process is important for new recruitment of riparian plant species. Inappropriate development in floodplains destroys riparian habitat, while flood control projects curtail the natural meandering process. An unaltered hydrologic regime is key to maintaining the diversity and viability of desert riparian areas.

- Montane riparian vegetation has had a history of poor grazing management, which has degraded, and in some cases, destroyed montane riparian systems by eventually lowering the water table. An unaltered hydrologic regime is key to maintaining the diversity and viability of montane riparian areas.

- Riparian associated butterflies evolved and diversified in these isolated wet Great Basin habitats since the Holocene Epoch. For example, the common wood nymph butterfly has differentiated into nine endemic subspecies within Great Basin riparian habitats.

Great Basin Aquatic Ecosystems

- There are 151 species conservation targets in aquatic systems, the most number of target species of all system groups, which highlights the biological significance of aquatic systems within this desert ecoregion. The targets include amphibians, aquatic invertebrates, fishes, one mammal, and one reptile

- Aquatic habitats occupy separate and often minute drainages within the Great Basin and are fully isolated from neighboring drainages. Isolation of aquatic habitats since the Pleistocene Epoch has

provided a forum for the evolution of neo-endemics in terminal lakes, spring systems, streams, and rivers. Consequently, fishes and aquatic invertebrates are astoundingly diverse and rare in the Great Basin's desert environment

- Sixty-four percent of the species conservation targets are endemic to the ecoregion, and 78% are imperiled. Fishes and mollusks (primarily springsnails), which have been subjects of recent inventories, make up the majority of the endemic and imperiled species. Additionally, other aquatic invertebrates and amphibian targets are important because of their dependence on specialized wet habitats. All of the ecoregion's amphibian targets occur in aquatic systems, as well as in the riparian and wetlands group.

- Terminal lakes are unique to the Basin and Range province, which includes the Great Basin, Columbia Plateau, and Mojave Desert ecoregions. The largest terminal lakes occur in the Great Basin. All of the Great Basin's terminal lakes are biologically important.

Nevada Comprehensive Wildlife Conservation Strategy (NDOW, 2005). The statewide wildlife conservation strategy document identifies species of conservation priority and key habitats. The following concerns were extracted from subsections that address "problems facing the species and habitats" pertinent to wetland and riparian habitats discussed in the section "Conservation Strategies for Nevada's 27 Key Habitats and Their Associated Wildlife."

<u>Aspen Woodlands</u>
- Exceedingly high biodiversity
- Decline of 60 to 90 percent throughout the West and in Nevada
- Predominantly old-age or single-age trees, which have not successfully regenerated in over 80 years
- Conifer encroachment
- Improper livestock grazing
- Heavy browsing by wild ungulates (e.g., elk, mule deer)
- Suppression of fire
- Spring developments
- Climate change

<u>Rivers and Streams (Intermountain, Mojavean, Sierran)</u>
- Scarce habitat but essential to 75 percent of wildlife species
- Ongoing, widespread, and permanent or temporary loss or modification of associated riparian habitat
- Deteriorated watershed conditions due to land use and resource extraction/utilization
- Loss and decline of native fishes, amphibians, invertebrates, mammals, birds, and vegetation communities
- Reduced vegetation composition, structure, and cover translate into loss of nesting and escape cover and food sources.
- Dams, reservoirs, diversions, channelization, and dewatering fragment and isolate aquatic habitat; also, alter hydrologic regimes, channel/floodplains processes, and bar fish movement/migration
- Surface flow altered by groundwater pumping
- Invasive nonnative plants, especially salt cedar, tall whitetop, and Russian olive.
- Recreation, grazing, road construction, and land development cumulatively accelerate erosion and poorly functioning hydrological conditions

<u>Wet Meadows</u>
- Essential for amphibians, sometimes singular wet, vegetated spot in arid lands adjacent to streams and springs, both perennial and ephemeral

- Lush vegetation provide source of food and shelter throughout growing season for wild ungulates, bats, birds, small mammals, amphibians
- Rutting and compaction of soil by livestock and motorized and pedestrian recreation alters hydrology, accelerates erosion and seasonal drying
- Grazing pressure from livestock and wild horses and burros on vegetation
- Modification or development of water sources
- Invasive nonnative plants
- Alteration of adjacent uplands affects meadow hydrology

Springs and Springbrooks

- Regional spring discharge systems supply water to desert streams, marshes, and meadows
- Substantial biodiversity, especially endemic mammals, amphibians, crustacean, gastropods, aquatic insects, and plants, many adapted to particular water or substrate properties peculiar to a site or location
- Dewatering, diversion works, piping, channelization for stock watering have altered spring geomorphology, hydrology, and vegetation
- Excessive groundwater withdrawal associated with mining and agricultural industries, urban development depletes spring flow
- Invasive nonnative and naturalized plant species, including emergents, such as cattails and phragmites
- Livestock grazing and trampling, also elk, wild horses and burros
- Recreation pressure increasing, often uncontrolled or poorly planned patterns of use
- Susceptibility to water pollution from recreational use, mineral development, and livestock

Marshes

- Critical to breeding and migratory needs of many species of birds
- Prolific production of plants, insects, and small mammals provides vital food chain support
- Desert marshes in particular host endemic species of plants, fishes, amphibians, and small mammals
- Marsh water supplies have been disrupted and reduced altering and simplifying vegetative communities, reducing wildlife diversity, and concentrating contaminants from various land uses
- Poor water quality conditions exist where heavy metal and micro-nutrient contaminants have accumulated from mining, irrigated agriculture, and urban runoff
- Groundwater withdrawals that affect springs and stream base flow also affect seasonal water supplies for marshes

Desert Playas and Ephemeral Pools

- Playa lakes and ephemeral pools are broadly distributed and frequently provide additional aquatic and terrestrial wetland habitat in arid valleys and upland flats or depressions. Some playas and pools have permanent sources of water, some hold surface water every year for a few days to months, and others may not receive enough runoff for a pool to form for longer periods. Like other wetlands, the plant community reflects hydrologic circumstances, changing when the substrate is moist, saturated, or inundated.
- Playa inundation is variable, but when watered and producing emergent and submergent vegetation and aquatic invertebrates, playas may contribute significantly to supporting waterfowl and shorebird migration. Some playas contain springs and/or marshes that support populations of fishes.
- Ephemeral or seasonal pools may be populated with widespread species, but species composition varies from pool to pool. Some support species endemic to particular local conditions. When wetted seasonal pools may facilitate movement and migration of amphibians, thus supporting distribution of individuals within metapopulations. The ecology of seasonal pools is poorly understood and the wildlife diversity is undocumented.

- Where land uses alter hydrologic conditions, playa and seasonal pool communities may be jeopardized. Implicit here is the fact that insufficient observational data makes it difficult to characterize the hydrology, ecology, community composition and classification, stresses, and threats to playa lake and seasonal pool habitats.
- Fundamental research remains to be undertaken with regard to invertebrate species composition and population dynamics; the life history of ephemeral pool species; and the utilization of ephemeral pools in seasonal movements of amphibians.

Composite of Wetland Issues Statewide in Scope

How fast are wetlands disappearing, how many acres are left, and what are the results of recovery and restoration programs? Experts agree that the Nevada wetland resource base has been severely reduced and much of those remaining are degraded and degenerating. Regulatory and nonregulatory programs have been in place for many years. It is important to assess which programs are effective, where the results are positive and in those other areas, what adjustments to the programs or their deployment might improve protection, conservation, and restoration strategies in other areas. Government resource agencies possess the technology, expertise, and interest to participate in an effort to gather data for generating reasonable estimates of the status and trends of wetlands throughout Nevada, but no agency in the state has authority or funding to do so.

What kinds of quantitative and qualitative data/information do agencies, research and other scientific organizations collect about wetlands; what are the unmet information needs of planners, managers, and decision makers responsible for stewardship of land, water, and biological resources; and, what might be done to meet information needs? A major impediment to improving wetland protection and conservation, both in terms of efficiency and effectiveness, is the lack of an information base. In the NvWP, we attempted to draw from the body of contemporary data/information sources sufficient information to make an educated estimate of wetland gains and losses in Nevada and to characterize whether wetland quality in balance was improving or not as a result of management activities. Clearly, we were not able to achieve that result. It is difficult for planners, managers, and decision makers to make educated and prudent use/conservation choices about dwindling renewable natural resources, impaired environmental quality, and assessing the importance of socioeconomic services (e.g., flood control, outdoor recreation) deriving from wetland resources if data are not readily available, or if the quality, currency, spatial context, and deliverability of the data are insufficient.

What are the gaps and weaknesses in the Clean Water Act Section 404 Program as administered in Nevada and what are the options for improvements? The most effective tool for deterring, minimizing and mitigating wetland loss and degradation is the federal Section 404 Program. The ACOE and NRCS administer the federal wetland permit regulations that cover dredge and fill activities associated with land and water development projects. The regulations were loosened in 2001 following a Supreme Court decisions (SWANCC, 2001). The ruling has the effect of removing more of Nevada's isolated wetlands from protective regulations. Even prior to SWANCC, the effectiveness of the regulatory program had notable limits. Regulatory uncertainties include a wetland definition and delineation protocol that screens out valuable desert wetland acreage; confusion over which water bodies are "waters of the U.S."; exemptions to "prior converted wetlands" on land used for agriculture; insufficient agency resources for enforcement and follow-up on mitigation projects and nationwide permit activities; and, omission of provisions to assess the negative impacts of projects that substantially alter the hydrology and/or vegetation of wetlands. Clear understanding of gaps and weaknesses in the Section 404 program is needed to develop alternative strategies.

What are the strategic opportunities in the administration, regulation, and management of water resources to support wetland recovery and restoration? The prevailing influence of diversions, dams,

and impoundments on the hydrology of surface waters has profoundly altered wetlands and renewable natural resources directly dependent on or influenced by wetlands. Traditionally, water resource and supply managers have concentrated their efforts on the administration of water law, the regulation of stream flow, and the management of water supply sources to optimize water system operations (i.e., procedures and structures used to divert, store, transport, and return flow). Changes in the demography, land use, and economy of Nevada are imposing changes in the use, administration, distribution, and economics of water resource and supply management. Shifts in water use patterns, urban and agricultural conservation programs, and watershed management improvements represent potential opportunities for identifying modest but measurable increments of water that might be acquired for recovery or restoration of priority riparian or wetland resources. (We should note the potential for water resource benefit to accrue following improved riparian wetland conditions.) However, institutional mechanisms may be needed to facilitate alternative strategies. For example, relatively recently Nevada Water Law was updated to permit water rights for "in situ" beneficial uses, i.e., recreation and related natural resource values such as water quality, fish and wildlife, and wetlands. State agencies, with state funds and with financial support from NCOs and federal programs, have acquired water rights and obtained State Engineer approval to transfer water to such uses. However, the administrative and logistic impediments agencies must overcome to compete in the open water market have limited their efforts to acquire water of sufficient quantity, quality, and priority to achieve resource management or improvement objectives.

What are the successes and weaknesses of nonregulatory conservation and restoration programs, including those administered by government entities, by individual nonprofit conservation organizations, and those based on coordination between agencies and NCOs, and is it important to track the overall achievements? Nonregulatory conservation and restoration strategies complement regulatory approaches, but it is unclear to what extent the former contributes to a reduction in wetland loss or wetland gains, both quantitatively and qualitatively. While the regulations for protection, and effort to implement them, have remained somewhat static, nonregulatory strategies have increased. For instance there are more incentive programs administered by the U.S. Departments of Agriculture and Interior, publicly funded grant programs for acquisition or restoration projects, "privately" funded programs and projects operated by nonprofit conservation organizations, and government programs set up to coordinate with NCO or private landowners. Knowing more about the deployment and performance results of the various nonregulatory programs would be useful in assessing and evaluating options for improving the conservation status of wetlands. Nonregulatory conservation programs might be especially important as a means for conserving the large portion of the state's wetland base not covered by CWA Section 404 regulations and for facilitating adjustments to agricultural land uses for wetland recovery.

What are the advantages and disadvantages of Nevada adopting a wetland resource protection policy and policy implementation plan? A host of concerns are associated with changes in the distribution and condition of wetland resources and publicly funded conservation and protection efforts. The NvWP discusses some of them, mostly in the context of how wetlands are integrated in ecological functions and socioeconomic services. Notable challenges before the state of Nevada articulated in various state resource plans involve the substantial role of wetlands in maintaining water quality, wildlife diversity, rare and sensitive species, watershed water productivity and delivery functions, floodplain water retention and recharge functions, beneficial wetland/upland ecosystem interactions, beneficial wetland/aquatic ecosystem interactions, outdoor recreation resources, and compatible economic activities. In a state that is arid, possesses limited water supply, rapidly growing, and there are benefits and costs to heightening the level of wetland protection as well as to ignoring the problems. What has not occurred yet is the conduct of a comprehensive dialogue among state legislators, top administrators, and affected parties concerning the fate of wetland resources and the prospects for addressing an array of other environmental and natural resource issues that significantly influence the health, safety, well being, economy, and public finances of the communities of Nevada.

To what extent are state and federal agency efforts to maintain native flora and fauna dependent upon the successful maintenance and enhancement of the wetland resource base, and what is the outlook for priority and imperiled animals, plants, and wetland ecosystems without a coherent approach to wetland protection? Federal and state agencies tasked with the planning and management of wildlife and habitats all target wetland resource improvements as a key strategy to achieve various wildlife objectives. Hundreds of wetland dependent species spanning all taxonomic groups are classified as conservation priorities or imperiled. Habitat loss is a major factor for most declining or vulnerable species. The seriousness of the wetland/wildlife conservation issue is highlighted in various assessments and programs: the priority species of conservation concern and key habitats identified in the Nevada Comprehensive Wildlife Conservation Strategy; the NNHP database of rare and sensitive species and the Scorecard of Highest Priority Conservation Sites; species listed as threatened, endangered, proposed and candidate species under the Endangered Species Act and Nevada statute; the priority bird species targeted by the Nevada affiliate of Intermountain West Joint Venture; and, the state-protected plant species under the protection of regulations administered by the NDF. Whether or not federal and state agencies can achieve the biological resource protection and management goals and objectives for wetland dependent birds, fishes, amphibians, mammals, aquatic invertebrates, plants, and ecological systems given the current state of affairs in wetland resource protection seems to be an open question worthy of assessment.

How is the relationship between outdoor recreation use of aquatic and wetland resources compatible with conservation objectives, and where might improvements be in outdoor recreation development and use standards be necessary to protect wetland? As the 2003 Statewide Comprehensive Outdoor Recreation Plan points out, Nevada's population is growing rapidly and so are the number of visitors, a trend which is putting a strain on the capacity of outdoor recreation providers to meet increasing demand. Water based and oriented recreation activities are highly popular and there are more ways of recreating on and surrounding water bodies. Public input to the SCORP also emphasizes the importance of managing outdoor recreation use and development so as not to sacrifice natural resources. Many conservation acquisition programs are predicated upon the future outdoor recreation use of the property purchased or placed under easement. Different outdoor recreation activities may be more or less compatible with different types of wetlands, and management of wetlands and water resources may require more logistical inputs than recreation in less sensitive upland areas.

Are there data sufficient in quantity and quality to estimate the status and trend of nonnative plant species invasions in wetland and aquatic ecosystems and the potential economical and ecological costs; and, if not, what level of priority should be given to the inventory and study of invasive nonnative species affecting wetlands compared to other impacted areas? The invasion of nonnative plants (species regulated and beyond practicable regulatory effort) has taken on disastrous proportions in many valleys. Individual and coordinated inventory and management efforts tend to concentrate on upland landscapes, often with farm and ranchland resources. While some species such as salt cedar and tall whitetop are widely recognized problem species, information on the extent and causes of the spread of nonnative species in wetland and aquatic system is needed in conjunction with planning and management for wildlife diversity, imperiled species, water resource development, and outdoor recreation.

A desert is good because it holds the mountains apart...

Ann Zwinger
Audubon, April 1996

…a wetland is good because it is habitat for water. Stan White photo

Nevada Wetlands Priority Conservation Plan
Technical Review Draft

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