4.9 RESOURCES MANAGEMENT AND RESTORATION

Natural resources abound within the Lahontan Region. Surface and ground waters are of high quality and in abundant supply relative to surrounding areas. Large expanses of coniferous forests, woodlands and sagebrush lands intermixed with meadows, riparian areas and wetlands are found throughout the Region. Much of this land is publicly owned and managed.

Activities which extract, export, restore or otherwise manage these natural resources can impact beneficial uses and water quality. For instance, water exports from the Region can impact water quality. Diversion of tributaries can result in increased salinity or alkalinity and decreased volume of lakes. Sediment discharges from reservoirs used to store water for export have resulted in fish kills. Ground water pumping for export can impact the quality of the Region's ground water as well as the quantity. Timber harvest operations and related road construction can impact water quality through increased sediment load and changes in water temperature. Ranching activities can adversely affect water quality by contributing excessive sediment, nutrients, and pathogens. Additional examples of land management activities which can impact water quality are: controlled burning, recreation management, and habitat management for threatened, endangered or rare species.

Water quality protection policies, resource management and restoration activities, their related water quality problems and control actions are all described in this section.

Special Designations to Protect Water Resources

Certain waters within the Region are considered exceptional resources for a variety of reasons. The special designations described below are available to protect these exceptional resources.

Wild and Scenic River

The federal Wild and Scenic Rivers Act of 1968 (P.L. 90-542) declared that "the established national policy of dam and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes."

Federal Wild and Scenic status prohibits construction of new dams and major water diversions. Eligible and designated rivers may include both public and private land. The Act does not prohibit development on private property along designated rivers, but allows for the acquisition of such lands to protect Wild and Scenic values. On public lands, both eligible and designated river segments are specifically managed to protect identified Wild and Scenic values. River segments designated as components of the Wild and Scenic River System may be classified as either wild, scenic, or recreational. The Lahontan Region contains several waterbodies that are components of the National Wild and Scenic River System, which include portions of the Owens River Headwaters, Cottonwood Creek, Amargosa River, Surprise Canyon Creek, and Deep Creek and its tributary, Holcomb Creek. Up-to-date information about the Wild and Scenic River system and current designations is available at: https://www.rivers.gov/.

Numerous river segments in the Region are eligible for federal Wild and Scenic status (see Table 4.9-1). Federal guidelines require that rivers eligible for National Wild and Scenic River designation be managed to protect their outstandingly remarkable values and free-flowing character until Congress makes a decision concerning designation. A condition (No. 7) of the Nationwide Permit under Clean Water Act Section 404 for dredge and fill activities states that no activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status.

In 1972, the California Legislature passed the California Wild and Scenic Rivers Act (California Stats. 1972, c. 1259, p. 2510, § 5093.50 to 5093.69), which is very similar to the federal legislation. The Act prohibits the construction of dams, reservoirs, and most water diversion facilities on river segments designated by the Legislature to be included in the system. Reaches of two rivers in the Lahontan Region, the West Walker and East Fork Carson, are currently designated as California Wild and Scenic Rivers:

- **West Walker River** -- Approximately 37 river miles from Tower Lake at the headwaters downstream to the confluence with Rock Creek,

near the town of Walker on the edge of Antelope Valley, as well as about one mile of one tributary (Leavitt Creek).

- **East Fork Carson River** -- Approximately ten river miles from the town of Markleeville to the California/Nevada state line.

Outstanding National Resource Water

The federal antidegradation regulation (40 CFR § 131.12), initially adopted in 1975, establishes requirements for protection of high quality waters. Implementation of the federal antidegradation regulations includes the potential to designate certain waters of the Lahontan Region as Outstanding National Resource Waters (ONRWs).

The water quality of the waters which are designated an ONRW must be maintained and protected. No permanent or long-term reduction in water quality is allowable in areas given special protection as ONRWs (48 Fed. Reg. 51402). Examples of such waters include, but are not limited to, waters of national and state parks and wildlife refuges, waters of exceptional recreational or ecological significance, and state and federally designated wild and scenic rivers. To date, the only California waters designated as ONRWs are Lake Tahoe and Mono Lake. However, other California waters would certainly qualify. ONRWs may be designated as part of adoption or amendment of water quality control plans. It is important to note that even if no formal designation has been made, lowering of water quality should not be allowed for waters which, because of their exceptional recreational and/or ecological significance, are eligible for the special protection assigned to ONRWs.

Beneficial Use Designations

Certain beneficial use designations recognize special qualities of the waterbody which received the designation. For example, the beneficial use of BIOL (Preservation of Biological Habitats of Special Significance) is designated for waters which support designated areas or habitats such as sanctuaries and ecological reserves. The beneficial use of RARE (Rare, Threatened, or Endangered Species) is designated for waters which support habitats necessary for the survival and successful maintenance of plant and/or animal species established by state or federal law as rare, threatened or endangered. (See also “Beneficial Uses,” Chapter 2 of this Basin Plan.)

Stream Environment Zone

(Lake Tahoe Basin)

A Stream Environment Zone (SEZ) designation is used in the Lake Tahoe Basin for perennial, ephemeral and intermittent streams, lakes, ponds, areas of beach or marsh soils, areas of riparian vegetation and other similar areas. Many discharge prohibitions apply to protect SEZs. (See Chapter 5 for further details.)

Sole Source Aquifer

The U.S. Environmental Protection Agency (USEPA) has authority, under Section 1424 of the Safe Drinking Water Act, to designate certain ground waters as “sole source aquifers.” Any federal financially-assisted project proposed within an area receiving this designation will be subject to USEPA review to ensure that the project is designed and constructed to protect water quality. For a more detailed discussion, see the “Ground Water Protection and Management” section of this Chapter.

Significant Natural Areas

In 1981, Significant Natural Areas legislation (Assembly Bill 1039) was passed to promote awareness and protection of biological diversity throughout California. In response to this mandate, the California Department of Fish and Wildlife (DFW) established the Lands and Natural Areas Program (LNAP) to encourage recognition and perpetuation of California's most significant biological resources (CA Fish and Game Code 1930-1932). The LNAP issues periodically updated reports identifying Significant Natural Areas (SNAs) throughout the State. To qualify for SNA status, a site must meet at least one of the following criteria:

- the site harbors a species and/or community element that is extremely rare
- the site harbors an assemblage of three or more rare biotic elements
- the site is the “best example” of a rare community or habitat type
- the site is a center of high biological diversity

DFW has utilized the Natural Diversity Data Base to identify SNAs by county; exact boundaries of SNAs have not been established through field surveys. Numerous SNAs have been identified in the Lahontan Region. Many of these SNAs harbor special biological resources that are indicative of beneficial uses of water.

The Regional Board considers SNA and other Natural Diversity Data Base information when updating beneficial use designations for the Region's waters and when updating the Region's Geospatial Waterbody System (GeoWBS) database (see Chapter 7).

Special Aquatic Sites

Special Aquatic Sites (SASs) include wetlands, mudflats, vegetated shallows, coral reefs, riffle and pool complexes, sanctuaries and refuges (as listed in 40 CFR § 230.3), vernal pools, and riparian areas. For the purposes of the SAS definition, "riparian areas" are areas within the jurisdictional waters of the United States which are comprised of the following habitat types, as characterized by the U.S. Fish and Wildlife Service: Palustrine Emergent Wetland, Palustrine Scrub-Scrub Wetland, Palustrine Forested Wetland (Cowardin et al. 1979). U.S. Army Corps of Engineers Section 404 nationwide permits for discharges of dredge and fill materials are not certified, except under certain conditions, for discharges which will affect SAS sites (see also "Wetlands Protection" discussion later in this section). Parts of many waters of the Lahontan Region qualify for the SAS designation as wetlands, riffle and pool complexes, sanctuaries, refuges and riparian areas. The Regional Board considers SAS information when updating beneficial use designations for the Region's waters and when updating the Region's Geospatial Waterbody System (GeoWBS) database (see Chapter 7).

Research Natural Areas and Special Interest Areas

The U.S. Forest Service (USFS) uses the designation of Research Natural Area (RNA) to preserve a specific area as a representative sample of an ecological community, primarily for scientific and educational purposes. The USFS designation of Special Interest Areas (SIA) establishes areas to managed for their unique and special features including botanical and other features. The Regional Board considers USFS RNA and SIA designations when updating beneficial use designations for the Region's waters, and when updating the Region's Geospatial Waterbody System (GeoWBS) database (see Chapter 7).

Areas of Critical Environmental Concern

The U.S. Bureau of Land Management uses the Area of Critical Environmental Concern (ACEC) designation for areas where special management is needed to protect and prevent irreparable damage to important resources including fish and wildlife resources, or other natural systems. The ACEC designation signifies that the area contains significant values or resources. The Regional Board considers BLM Areas of Critical Environmental Concern designations when updating beneficial use designations for the Region's waters, and when updating the Region's Geospatial Waterbody System (GeoWBS) database (see Chapter 7).

Water Quality/Quantity Issues; Water Export and Storage

Because much of the Lahontan Region is desert, water supplies are often limited under natural conditions. Diversions of water for human use have threatened or impaired other beneficial uses in several portions of the Region. Although the authority to issue and modify water rights licenses rests with the State Water Resources Control Board rather than with the Regional Board, the Regional Board can bring water quality problems related to water diversions to the State Board's attention, and request that solutions be considered.

Most surface water in the Lahontan Region has already been allocated through court adjudications, water rights licenses, or interstate agreements (a map illustrating all adjudicated basins in the State is available from the State Board, Division of Water Rights). The California-Nevada Interstate Water Compact was negotiated in the 1960s, approved by the states in the early 1970s, and partially ratified by Congress in 1990 as P.L. 101-618. This law allocates the surface and ground waters of the Carson River and Lake Tahoe/Truckee River watersheds between the two states. Management of reservoirs and flows of regulated streams in these watersheds is the responsibility of a federal watermaster.

Large amounts of water are exported from the Mono Lake and Owens River watersheds by the Los Angeles Department of Water and Power for municipal use in Southern California. Smaller amounts are exported to the American River and Feather River watersheds from the North Lahontan Basin. Some water is imported into the Lahontan Region via the California Aqueduct. Many natural lakes in the Region have been dammed to increase storage, and are operated as reservoirs; new reservoirs have also been constructed. (See the separate discussion of "Reservoir Management," below.)

Diversions have totally or almost totally dewatered some lakes and streams in the Lahontan Region, impairing or precluding the attainment of aquatic beneficial uses (e.g., Owens Lake). Recent court decisions have required the rewatering of the Owens

River Gorge and some Mono Lake tributaries. Where diversion is not total, lower flows, or changes in the timing of flows, can stress aquatic ecosystems through higher summer temperatures, greater winter ice formation, increases in the concentrations of pollutants, and other factors.

Temperature and flow variations can affect critical life stages of aquatic organisms, and can change the nature and rate of nutrient and mineral cycles. In some cases (e.g., Mono Lake), lower water levels can increase the vulnerability of water-dependent wildlife to predators. Low streamflows stress riparian vegetation. Water diversions can aggravate natural stresses on aquatic and wetland ecosystems which result from droughts. Low flows can affect the ability of dischargers to surface waters to ensure attainment of receiving water objectives downstream of the discharge. The magnitude and timing of stormwater flows affects the concentration of pollutants, and the "first flush" of concentrated pollutants which have accumulated on urban pavement during the dry season can be especially stressful to aquatic organisms (see the "Stormwater" section in this Chapter). Diversions from lakes and reservoirs used for boating can result in increased demands for dredging to facilitate access to marinas and piers, with consequent water quality impacts related to resuspension of sediment and contaminants. In some parts of California, removal of vegetation, or conversion of vegetation to a different community type, is being used to increase surface runoff to increase water supplies. Water quality impacts of such practices, in terms of increased erosion and sedimentation, and loss of riparian/wetland values, can be significant.

Most municipal and agricultural water supplies used within the Lahontan Region come from ground water, often from individual wells. Ground water diversions are likely to increase because of new federal regulations which increase treatment requirements for surface sources of drinking water. Severe ground water overdraft has occurred in portions of the Region ranging from Surprise Valley in Modoc County to the Antelope and Victor Valleys in the South Lahontan Basin. Ground water overdraft can affect beneficial uses of surface waters such as wetlands and springs, particularly in dry areas. It can concentrate trace chemicals, both naturally occurring salts and contaminants due to human activities. Overdraft can lead to land subsidence and surface soil cracking. Some soil types (fine grained silts and clays), once compacted, can never again hold as much water upon rewatering of the aquifer. Severe cracking has occurred at Edwards Air Force Base near Lancaster, leading to the concern that cracks extending to the water table may facilitate the entry of toxic substances into water supplies. Increased ground water pumping in overdrafted aquifers can draw pollutants toward wells. Improperly constructed or abandoned wells can also act as conduits for pollutants (see the discussion of well standards in the "Ground Water" section of this Chapter). Imported water used for ground water recharge, if it is of naturally lower quality than local ground water, can be considered a discharge even if no new introduction of wastes into the environment is involved (Sawyer 1988). Some types of construction projects (e.g., placement of fill in wetlands) can reduce ground water recharge.

The potential exists for increased diversion and export of water from the Lahontan Region. The Reno and Las Vegas, Nevada areas are growing rapidly, and are considering increased ground water pumping on the Nevada side of the state line. Such pumping could affect beneficial uses of surface and ground waters in California, including springs and wetlands in Death Valley which support endangered species. Concern has also been expressed about the migration of radionuclides from the Nevada Test Site in California ground waters in the area.

Water quality problems can also occur as a result of flooding. In some areas the potential for flooding has increased due to hydrologic modification, increased impervious surface, and disturbance of wetlands and riparian vegetation. Flooding can erode streambanks, and wash out sewer lines and stored fuels and hazardous materials. (See also Section 4.3, "Stormwater, Runoff, Erosion, and Sedimentation"; and the "Floodplain and Riparian Area Protection" discussion later in this section.)

Control Measures to Prevent or Mitigate Water Quality Problems Related to Water Quantity

Regional Board and other state, as well as federal and local, control actions related to water quantity/quality are described below.

Regional Board Control Actions

Actions which can be taken by the Regional Board to prevent or mitigate the impacts of water quality problems related to water quantity include:

1. Establishment of flow-weighted numerical water quality objectives for surface waters, based on long-term hydrologic data, in order to reduce the frequency of violations due to natural drought conditions.

2. Consideration of the flow and water supply needs of aquatic organisms, riparian/wetland vegetation, and wildlife when establishing biological water quality objectives.

3. Consideration of water availability before the issuance of waste discharge requirements, and placement of conditions in requirements limiting water use in order to protect water quality. (The State Board has determined that such conditions are appropriate under limited circumstances. Because the Porter-Cologne Act provides that the Regional Board cannot specify the method of compliance, the authority to include water use limits in waste discharge requirements does not provide authority to specify water conservation measures to achieve those limits [Sawyer 1988].) One example would be placement of conditions in waste discharge requirements for hydroelectric projects to mitigate the impacts of releases from impoundments on downstream uses. (See also the "Ground Water" section in this Chapter.)

4. Issuance of waste discharge requirements for ground water recharge with imported water which is of lower quality than local ground water.

5. Issuance of waste discharge requirements for projects which would interfere with ground water recharge.

6. Encouragement of the use of Best Management Practices to minimize water use for agricultural, landscape, and turf irrigation.

7. Undertaking investigations (e.g., fact finding hearings) into ground water quality/quantity problems, and making recommendations for State Board action under Water Code Section 2100.

8. Encouragement of the use of reclaimed water wherever feasible without adverse impacts on beneficial uses. (Regional Boards are required, when establishing water quality objectives, to consider the need to develop and use reclaimed water.)

9. Recommendations to the State Board during review of construction projects which may also require water rights permits.

10. Encouragement of the adoption and implementation of wellhead protection programs. (See the discussion of well standards in the "Ground Water Protection and Management" section of this Chapter.)

11. Continued participation by Regional Board staff as observers in meetings involving proposed changes in water exportation from the Lahontan Region (e.g., changes in the Truckee River operating agreement). Staff should also attempt to stay informed on large scale diversion proposals even when no formal meetings are being held.

12. Careful review of and consideration of waste discharge requirements for any proposals to manage vegetation or convert vegetation types in order to increase water yield from a watershed.

13. Careful staff review of CEQA documents to ensure that water quality/quantity issues are adequately addressed.

Control Measures for Water Quantity/Water Quality by other State Agencies

The Porter-Cologne Act provides authority for planning in relation to water quantity/flow issues, but implementing authority is generally separate from the authority provided by State water quality plans (Sawyer 1988).

1. Under the Public Trust Doctrine (see Chapter 1 of this Plan), the State Water Resources Control Board must consider the protection of a variety of environmental values when making decisions to issue or renew water rights permits. The State Board can grant appropriative water rights for the protection of beneficial uses, and can ensure that natural flows remain in a water body to protect designated beneficial uses. For some areas, the State Board has adopted water rights policies which give direction for future actions on water rights applications. The policy affecting the Lake Tahoe Basin was adopted in 1969 and is in need of update.

2. California water rights law does not require State permits for ground water diversions, except for underground waters which flow in defined channels (e.g., the lower Mojave River). However, the State is bound by limits such as those set by the California-Nevada Interstate Water Compact on all diversions from the Carson River and Lake Tahoe/Truckee River systems. Possible means of addressing the impacts of ground water pumping and overdraft include use of nuisance law, the Public Trust doctrine, and existing State Board authority. Adjudication of ground water rights is also possible; this could result in court appointment of a watermaster, with court-defined authority

ranging from monitoring and recording to broad management powers. The State Board may also place conditions to protect ground water in grant contracts or water rights permits for surface water use (Sawyer 1988). See also the discussion of Water Code Section 2100 in Section 4.6 of this Chapter.

3. The Department of Fish and Game should continue to define instream flow requirements for fish and other aquatic organisms, and should bring water quality problems related to water quantity to the attention of the State and Regional Boards. The Wildlife Conservation Board can purchase land and acquire associated riparian water rights for the protection of fish and wildlife.

4. The Attorney General of California has authority to bring legal action for protection of the natural resources of the State. This authority could be used to correct water quality problems related to water quantity.

Federal Control Measures for Water Quantity/ Water Quality

1. The U.S. Environmental Protection Agency should continue to give special attention to water quality/quantity relationships in the arid west when giving direction to states on the adoption of water quality standards and the implementation of these standards in permits.

2. The Federal Energy Regulatory Commission should give special attention to the water quality/quantity impacts of hydroelectric projects proposed within the Lahontan Region.

3. Federal land management agencies within the Lahontan Region should define the water supply needs for all beneficial uses which occur within their jurisdictions, and should bring these needs to the attention of the State Board for consideration during the formulation of water rights policies and the revision of water rights permits.

Local Control Measures for Water Quantity/Water Quality

1. County water districts have broad authority to conserve, protect, and replenish ground water supplies. The Subdivision Map Act allows cities and counties to adopt ground water recharge facility plans, construct recharge facilities, and charge a fee for the construction of such facilities as a condition of approval for subdivision maps and building permits (Sawyer 1988).

2. State law permits the formation of local ground water management districts. A few such districts have been established within the Lahontan Region, and more may be formed in response to proposed ground water pumping on the Nevada side of the state line. Local governments should strictly enforce well construction standards. Where wellhead protection ordinances have been adopted, they should be strictly enforced.

3. The Tahoe Regional Planning Agency has adopted an “environmental threshold carrying capacity” standard to protect fisheries in the Lake Tahoe Region. This standard provides that, until instream flow standards are established in the TRPA Regional Plan, a nondegradation standard shall apply to instream flows. The threshold standards also state the policy of the TRPA Governing Body to seek transfer of existing points of water diversion from streams to Lake Tahoe. The Best Management Practices Handbook in the 208 Plan (TRPA 1988) includes lists of approved native and “adapted” grass, shrub, and tree species for use in landscaping and revegetation.

Recommended Future Actions for Water Quantity/Water Quality

1. The potential exists for physical solutions to water quality problems related to ground water overdraft, such as provision of alternative water supplies, artificial recharge, or the establishment of physical barriers or injection barriers to pollutants. Such solutions can be provided through the courts in connection with water rights adjudications, or as part of ground water management programs including regulation and augmentation of supply. Physical solutions could also be authorized during approval of water development projects. These solutions may involve conjunctive use projects where surface waters are used for ground water recharge or as a substitute supply for ground water users. It is important to manage ground and surface waters as an interconnected resource (Sawyer 1988).

2. Long drought periods beginning in the 1970s inspired a variety of legislation related to water conservation and reclamation. Local governments are now required to have ordinances regulating landscape irrigation. Local governments within the Lahontan Region should be encouraged to require use of native plants or species adapted to local conditions, which have

low requirements for irrigation, fertilizer, and pesticides for survival and maintenance.

Reservoir Management

Reservoirs and natural lakes used as reservoirs, are widely utilized throughout the Lahontan Region to store water for municipal and agricultural supply. These reservoirs also supply aquatic and wildlife habitat and meet ground water recharge, recreation, and flood control needs. Reservoir operations and maintenance activities can impact water quality and beneficial uses both within and downstream of reservoirs.

Reservoir release practices can result in the release of high levels of nutrients and sediments, deoxygenated water, or insufficient downstream flows to sustain fish and maintain aquatic habitats. The release of deoxygenated water from the bottom of reservoirs is extremely detrimental as it can result in large downstream fish kills. Likewise, the release of warmer water can also impact downstream aquatic life forms. Reservoir discharges through improperly designed spillways can increase downstream erosion.

Stored or impounded water can develop taste and odor problems caused by algal growth or other microorganisms. Water impoundment can also cause water temperature to increase. Temperature differences between inflowing water and reservoir surface water can result in the formation of density or turbidity currents. These currents plunge below the surface, carrying any sediment load to the reservoir dam.

Point and nonpoint sources of pollution within a reservoir's drainage area, such as fertilizer applications, bank erosion, timber harvesting, stormwater runoff, wastewater discharges and industrial discharges, can contribute to the sediment and nutrient load into a reservoir. High nutrient levels in a reservoir can contribute to accelerated eutrophication and/or impact downstream waters. Most reservoirs act as large sediment basins and accumulate sediments. Coarse sediments usually deposit in a delta at the head of the reservoir, while finer sediment can remain in suspension and may eventually settle in the deepest pools or be carried to the dam. Some pollutants, such as metals, can be re-suspended from the sediments into the water column. Certain conditions, such as flooding or reservoir dewatering, can cause accumulated reservoir sediments to be discharged into downstream waters.

Dredging is sometimes used to remove sediment, and to control internal nutrient cycling and macrophyte growth. However, dredging itself can impact water quality and beneficial uses. Specific impacts and regulation of dredging are discussed in the “Boating and Shorezone Recreation” discussion of the “Recreation” section of this Chapter.

Control Measures for Reservoirs

(See also Control Measures for Lake Restoration later in this Section.)

The reservoirs (both constructed and natural lakes operated as reservoirs) in the Lahontan Region and their beneficial uses are listed in Chapter 2. Past control measures for these reservoirs included adoption of waste discharge requirements (WDRs) for construction activities (regulation of discharges related to waste earthen materials, stormwater runoff, construction-related wastes, domestic wastewater generated during construction). WDRs have also been adopted for hydroelectric projects associated with reservoirs (hydroelectric projects are discussed in the “Mining, Industry, and Energy Development” section of this Chapter). The WDRs included surface water discharge limitations for a variety of water quality parameters including nutrients, turbidity, pH, taste, odor, temperature and algal growth potential, as well as Best Management Practices (BMPs) to prevent discharge of waste earthen materials. Construction of future reservoirs will be regulated in a similar manner. During review of any future proposed reservoirs, the Regional Board will coordinate closely with the State Board's Division of Water Rights, California Department of Fish and Wildlife, California Division of Dam Safety, as well as other agencies.

Recommended Future Actions for Reservoir Management

In addition to careful review of proposed new reservoirs, the Regional Board should focus on operations and maintenance of existing reservoirs to minimize impacts on water quality and beneficial uses. This regulation should incorporate relevant provisions contained in the State Board's Thermal Plan. (The Thermal Plan is summarized in Chapter 6.) Through MAAs, MOUs or WDRs, operation and maintenance activities such as dredging, discharges, and repairs should include control measures to prevent increases in nutrient levels and sediment loads, as well as BMPs to prevent downstream bank erosion and impacts to downstream aquatic habitats. The Regional Board should consider a prohibition against the release of deoxygenated water from reservoirs.

Wetlands Protection and Management

California historically supported an estimated 5 million acres of wetlands. Wetlands have not always been considered as valuable natural resources. Thus, in California, an estimated 91 percent of wetlands have been lost due to alterations in their biological, chemical and physical properties (National Research Council 1992). The remaining wetlands are considered very valuable resources. Wetland values and functions include high productivity, water purification, flood control, nutrient removal and transformation, sediment stabilization and retention, water supply, ground water recharge and erosion control. The high biological productivity of wetlands results in important wildlife habitat for both aquatic and terrestrial animals and plants, including feeding, breeding and nursery grounds. A greater than average number of rare species are found in wetland habitats. Wetlands also provide a number of other scientific, educational and aesthetic uses.

The statewide Water Quality Assessment database (see Chapter 7 of this Basin Plan) lists some of the wetlands within the Lahontan Region. The Regional Board also maintains a separate wetland database that includes general locations (maps), descriptions, and assessments of the condition of many wetlands within the Region. Because of the seasonality of rainfall in the Region, some wetlands may not be easy to identify by simple means (e.g., aerial photographs) or by obvious wetland characteristics. Thus, site-specific boundaries of the Region's wetland areas will be determined on an as-needed basis using methods in the current “Federal Manual for Identifying and Delineating Jurisdictional Wetlands” (U.S. Army Corps of Engineers, 1987) performed by certified wetland delineators (certification program established in accordance with Section 307[e] of the Water Resources Development Act of 1990) or by other qualified professionals acceptable to the Regional Board. A separate method of identifying “Stream Environment Zones” in the Lake Tahoe Basin is used for regulatory purposes in that watershed (TRPA 1988, Vol. III).

Wetlands within the Region are defined to include 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 (including) playa lakes, swamps, marshes, bogs and similar areas such as sloughs, prairie potholes, wet meadows, prairie river overflows, mudflats, and natural ponds” (40 CFR § 110.1[f]).

The federal Clean Water Act formally equates “navigable waters” with “waters of the United States” (§ 502[7]). The Code of Federal Regulations also equates “navigable waters” to “waters of the United States” and specifically incorporates wetlands in navigable waters definitions, including those for interstate and intrastate waters (40 CFR § 232.2[q]). The Porter-Cologne Water Quality Control Act (CA Water Code § 13050[e]) defines “waters of the State” to be “any water, surface or underground, including saline waters, within the boundaries of the State.” Thus, wetlands are both waters of the State and waters of the United States. Therefore, provisions of the California Water Code apply. These provisions include protection of beneficial uses and water quality. Beneficial uses of wetlands are listed in Chapter 2 of this Plan. Water quality objectives which apply to surface waters, including wetlands, are included in Chapter 3 of this Plan. (The Regional Board recognizes that the natural pH of some wetlands may not meet the pH narrative objective.)

Numeric criteria to protect one or more designated uses of surface waters have been developed by the U.S. Environmental Protection Agency (USEPA). Where appropriate, these criteria directly apply to wetlands. For example, wetlands which actually are, or recharge, municipal water supplies should meet human health criteria. The USEPA numeric criteria for protection of freshwater aquatic life, as listed in *“Quality Criteria for Water—1986*,” although not developed specifically for wetlands, are generally applicable to most wetland types (USEPA 1990).

As with other types of surface waters, such as saline or alkaline lakes, natural water quality characteristics of some wetlands may not be within the range for which the criteria were developed. Adjustments for pH, hardness, salinity, temperature, or other parameters may be necessary.

Impacts to the water quality of wetlands can negatively affect any or all of the wetlands' functions and values. Thus, the following control measures are necessary to protect wetlands.

Control Measures for Wetland Protection

As direction for implementing control measures for wetlands protection, the Regional Board will use Senate Concurrent Resolution No. 28 which states that *"It is the intent of the Legislature to preserve, protect, restore, and enhance California's wetlands and the multiple resources which depend upon them for the benefit of the people of the State."*

Regional Board and other State, as well as federal and local, wetland protection control actions are described below and apply to all wetlands which are considered "waters of the State" and/or "waters of the United States." Additional control measures applicable to "Stream Environment Zones" in the Lake Tahoe Basin are discussed in Chapter 5. Control measures specific to constructed/artificial wetlands are also included below, and in the sections of this Chapter on "Wastewater" and "Stormwater." The "Stormwater" section includes a detailed discussion of the use of wetlands for stormwater treatment. Control measures specific to wetland restoration are discussed separately, later in this section.

Regional Board Control Measures for Wetland Protection and Management

1. For proposed discharges of municipal wastewater, stormwater, solid wastes, earthen materials, or other wastes to wetlands, the Regional Board will ensure that wetlands are afforded the same level of protection as other types of surface waters with respect to standards and minimum treatment requirements. For discharges to wetlands, all applicable water quality standards for the wetland and any adjacent waters must be met. Recommended conditions pursuant to Clean Water Act Section 401 Water Quality Certification, waste discharge requirements, monitoring and inspections programs, Cease and Desist/Clean-up and Abatement Orders will be implemented as necessary. The monitoring may include water quality, sediment quality, whole effluent toxicity and biological measurements such as diversity indices. Monitoring the fate of persistent or bioaccumulative contaminants may also be required by the Regional Board.

2. Hydrology is a major factor influencing the type and location of wetlands. To protect the beneficial uses and water quality of wetlands from impacts due to hydrologic modifications, the Regional Board will carefully review proposed water diversions and transfers (including ground water pumping proposals), and require or recommend control measures and/or mitigation as necessary and applicable.

3. In conjunction with beneficial use designations and water quality objectives, the Regional Board will implement the State Board's Resolution No. 68-16 "Statement with Respect to Maintaining High Quality Waters In California" (see "Nondegradation Objective" in Chapter 3; also see Chapter 6, "Plans and Policies") to regulate point and nonpoint source discharges to wetlands, particularly for those types of impacts difficult to assess through compliance with established water quality objectives alone (e.g., impacts due to physical and hydrological modifications).

4. The Clean Water Act Section 401 program (Water Quality Certification process) gives the Regional Board extremely broad authority to review proposed activities in and/or affecting the Region's waters (including wetlands). The Regional Board can then recommend that the State Board grant, deny, or condition certification of federal permits or licenses that may result in a discharge to "waters of the United States" (e.g., U.S. Army Corps of Engineers CWA Section 404 permits, licenses from the Federal Energy Regulatory Commission). The Regional Board, in coordination with the State Board, will use this authority to prevent impacts to beneficial uses of wetlands and/or violation of wetlands water quality objectives. In addition to recommending that the State Board grant, deny or condition certification of federal permits or licenses, the Regional Board has independent authority under the California Water Code to regulate discharges to wetlands through waste discharge requirements or other orders (see No. 1 above).

5. Many beneficial uses and the water quality of wetlands can be impacted by filling and dredging. For proposed discharges due to dredging activities, and for proposed discharges of dredged and/or fill materials into wetlands regulated under Clean Water Act Section 404 (U.S. Army Corps permit program), the Regional Board will utilize the process described above in No. 4.

   Note: U.S. Army Corps Section 404 nationwide permits for discharges of dredge and fill materials are not certified, except under certain conditions, for discharges which will affect "Special Aquatic Sites." Special Aquatic Sites are defined in the "Special Designations to Protect

Water Resources," at the beginning of this Section.

During its review of projects proposing discharges of dredged and/or fill materials into wetlands, the Regional Board will consider whether the project is water dependent and whether there are viable project alternatives. For projects where no viable alternatives exist, the Regional Board will consider whether wetland impacts can be made acceptable through certification and/or permit conditions. The Regional Board may elect to use its independent authority under the California Water Code to regulate discharges to wetlands through waste discharge requirements or other orders (see No. 1 above).

6. The Regional Board now coordinates wetlands permitting with other agencies. Staff will work with local governments toward further streamlining of the permitting process by facilitating earlier consultation with and coordination among all permitting agencies, including the U.S. Army Corps of Engineers and the California Department of Fish and Wildlife. Improved coordination may also include measures such as development of a single permitting package containing necessary forms and instructions for all appropriate agencies, with coordinated review times, and development of Memoranda of Understanding with local governments.

7. The Regional Board will also explore the feasibility of streamlining permitting by defining wetland values and mitigation requirements on an areawide basis (e.g., for an existing subdivision) and then issuing general waste discharge requirements, waiving waste discharge requirements, or recommending waiver of Water Quality Certification for subsequent individual projects in that area. Areawide permits, or new Regional Board policy language, would define the specific types of wetland disturbance covered and the extent of mitigation required. This process could be coordinated with the U.S. Army Corps of Engineers' Special Area Management Plan (SAMP) process and/or with local governments' wetlands plans and policies (see the section below on "Local Control Measures for Wetland Protection and Management"). Areawide general permits or new Regional Board policies would require CEQA compliance, with project level detail on required mitigation.

8. For proposed fill activities or other discharges which will result in wetland loss, the Regional Board will require compensatory mitigation so that there will be no net loss of wetland acreage and no net loss of wetland functions and values when the project and mitigation lands are evaluated together. The Regional Board may require an inventory of wetland characteristics to take place prior to wetland disturbance to determine wetland size, functions and values, to serve as a guide for wetland restoration or creation, and to form a comparative basis for evaluating the success of the mitigation project.

   In determining the functions and values of the wetland, the Regional Board will consider integrated physical, chemical and biological wetland parameters including water purification, flood control, nutrient removal and transformation, sediment stabilization and retention, water supply, ground water recharge/discharge, erosion control, recreation, wildlife diversity/abundance and aquatic diversity/abundance. Suggested methods to determine wetland function and values are shown in Table 4.9-2. The Regional Board will consider wetland function and value determinations made by other methods such as the Wetland Evaluation Technique (WET) developed by Adamus et al. (1987) for the U.S. Army Corps of Engineers. Wetland function and value determinations made using other methodologies will be considered by the Regional Board on a case-by-case basis. In recognition that determining wetland function and value uses relatively new methods, the Regional Board will carefully and judiciously make wetland function and value determinations. The Regional Board will also track the development of new methodologies, and review such methodologies for application in future wetland function and value determinations.

   The Regional Board will consider wetland boundaries determined by using the U.S. Army Corps of Engineers' 1987 "Federal Manual for Identifying and Delineating Jurisdictional Wetlands." Delineation of wetlands shall be performed by certified wetland delineators (certification program established in accordance with Section 307[e] of the Water Resources Development Act of 1990) or by other qualified professionals.

The Regional Board will coordinate all wetland mitigation requirements with those of the U.S. Army Corps of Engineers.

9. The Regional Board prefers avoidance of wetland disturbance to disturbance followed by mitigation such as restoration or creation. In its review of projects with potential wetland impacts, the Regional Board will follow the sequence of: Avoid; Minimize; Mitigate. Through a thorough analysis of project alternatives, the project proponent must first demonstrate to the Regional Board that wetland impacts are not avoidable. If the impacts are not avoidable, the proponent must then demonstrate that the impacts to the wetland area are the minimum necessary for the project. The project proponent must then propose mitigation to compensate for any wetland impacts.

   When mitigation is necessary, the Regional Board prefers in-kind, on-site mitigation whenever possible. If not possible, the Regional Board will then consider in-kind, off-site mitigation. As a last choice, the Regional Board will consider out-of-kind mitigation. “In-kind” means that the mitigation wetland site will have similar function and value to that of the disturbed wetland site in terms of physical, chemical and biological wetland parameters including water purification, flood control, nutrient removal and transformation, sediment stabilization and retention, water supply, ground water recharge/discharge, erosion control, recreation, wildlife diversity and abundance, and aquatic species diversity and abundance. “Out-of-kind” means that the mitigation wetland site will substantially differ from the disturbed wetland site in regard to these same parameters.

   Regional Board staff is available to assist the project proponent by identifying potential mitigation opportunities. The Regional Board may accept payment by the project proponent to a mitigation bank or to another entity that will provide the required mitigation.

10. Restoration of an historic wetland (once functioning wetland but now damaged or destroyed) generally will have a greater chance of success in terms of restoration of wetland functions and long-term persistence than constructed wetlands at an upland site (Kusler and Kentula 1990). Thus, for mitigation purposes, the Regional Board prefers wetland restoration rather than wetland creation.

11. For restored or created wetlands, measures may be necessary to protect the wetland from excessive sedimentation, foot traffic, offroad vehicles, exotic species, or other factors that may inhibit wetland functions or degrade wetland values. Protective measures may include buffers (between the mitigation site and the surrounding area), fences or other barriers, and sedimentation basins. Thus, the Regional Board will require that the proposed mitigation provide for buffer zones or other protective measures, as appropriate.

12. When mitigation is necessary, the Regional Board will require, as a waste discharge permit condition, or as a recommended condition for Clean Water Act Section 401 Water Quality Certification, that a mitigation plan be prepared and executed. The plan must demonstrate that no net loss of wetland acreage and no net loss of wetland functions and values will occur when the project and mitigation lands are evaluated together. Proof of ownership, easement, or similar documents for the mitigation site must be provided in the mitigation plan. The plan should also clearly establish specific goals of the mitigation that can be targeted in subsequent evaluations. Wetland restoration or creation proposed as compensatory mitigation, which could or will result in a waste discharge, will be regulated as necessary by the Regional Board to ensure compliance with all provisions of this Basin Plan (see also “Wetland Restoration” discussion later in this Section, as well as “Constructed Wetlands” discussion in Section 4.4 of this Chapter). For both restored or created compensatory wetlands, the mitigation plan should include details of establishing and maintaining the restored wetland, as well as a monitoring program to evaluate the status and success of the restoration or creation.

13. Created wastewater treatment wetlands designed, built, and operated solely as wastewater treatment systems are generally not considered to be waters of the United States (USEPA 1990). Water quality standards that apply to natural wetlands generally do not apply to such created wastewater treatment wetlands. However, many created wetlands are designed, built, and operated to provide, in addition to wastewater treatment, functions and values similar to those provided by natural wetlands. Under these circumstances, such created multiple use wetlands may be considered waters of the U.S. and applicable water quality standards would apply. The applicability of water

quality standards to created wetlands will be determined by the Regional Board on a case-by-case basis. In its determination, the Regional Board will consider factors such as size, type of waste to be treated, location, degree of isolation of the created wetlands, and other appropriate factors. Any discharge from a created wetlands which does not qualify as “waters of the U.S.” must meet applicable water quality standards of its receiving water(s).

Control Measures for Wetland Protection and Management by Other State Agencies

1. Through required conditions in its Lake/ Streambed Alteration Permits, the California Department of Fish and Wildlife can provide some wetland protection, especially for fish and wildlife resources, and other aquatic resources.

2. The California Resources Agency, including the Departments of Fish and Game and Water Resources, is developing a comprehensive wetlands conservation plan. State Board staff is participating in the Resources Agency's planning process. An implementation strategy is to be included in the conservation plan. The strategy may include specific legislation, bond acts, administrative law changes, and other means as necessary to accomplish the goals of the conservation plan.

3. The California Department of Parks and Recreation has developed a Wetlands Protection Policy.

4. The California Department of Forestry utilizes a streamside protection zone system which provides some wetlands protection.

Federal Control Measures for Wetland Protection and Management

1. The United States Army Corps of Engineers (COE) addresses intrusions into navigable waters and issues permits for discharge of fill and dredge material to navigable waters (including wetlands). These permits are referred to as Clean Water Act (CWA) Section 404 permits. In its permitting process, the COE considers comments from other federal agencies, such as the U.S. Fish and Wildlife Service and from state agencies, such as the Regional Board and the California Department of Fish and Wildlife. The permits are reviewed by the U.S. Environmental Protection Agency. The USEPA has veto authority over COE CWA Section 404 permits for discharges to navigable waters.

2. Under the Emergency Wetlands Resources Act of 1986, the U.S. Fish and Wildlife Service (USFWS) is required to complete the mapping of wetlands within the lower 48 states by 1998 through the National Wetlands Inventory and to assess the status of the nation's wetland resources every ten years. The maps, status and trends resulting from the USFWS's work will provide necessary documentation to support additional wetlands protection measures if necessary.

3. The U.S. Forest Service utilizes a streamside protection zone system which provides some wetlands protection.

Local Control Measures for Wetland Protection and Management

1. The Tahoe Regional Planning Agency, in cooperation with the Regional Board, implements discharge prohibitions and other protection measures for “Stream Environment Zones,” including wetlands, in the Lake Tahoe Basin (see Chapter 5 of this Plan).

2. Mono County is developing a Wetland Preservation Policy. The draft policy includes wetlands protection or “buffer” zones, development guidelines and mitigation requirements including provisions for the development of a local mitigation bank.

3. The Mojave River Task Force, with members from the staff of the Town of Apple Valley, the Cities of Hesperia and Victorville and San Bernardino County Regional Parks, is developing a multiple objective resource management plan for the Mojave River Corridor (San Bernardino County). One main objective of the plan is to balance the many uses of the riparian corridor such as wetland habitat, recreation and flood control while still providing the necessary level of resource protection.

Recommended Control Measures for Wetland Protection and Management

1. When practical, where wetland restoration or creation is required as mitigation, the Regional Board should consider requiring that the mitigation be completed **before** allowing wetland disturbance to occur.

2. Because of the risks inherent in restoring or creating certain wetland types, such as those which support threatened or endangered species or unique biological communities, area ratios of disturbed to restored/created wetlands

should be 1:1.5, 1:2, or higher, for some mitigation projects. Larger mitigation areas increase the likelihood of successfully restoring or creating the wetland function and value of the disturbed wetland.

3. Design of wetland restoration and creation should consider the relationship of the wetlands to the watershed (including water sources, other wetlands, adjacent upland and deep water habitats).

4. The Regional Board should encourage local government entities to develop and execute wetland protection policies. The policies should include provisions to develop local mitigation banks whose primary focus is on the restoration of historic wetland sites (once functioning wetland sites that are now damaged or destroyed).

5. The Regional Board should encourage evaluation of past wetland mitigation efforts to guide future efforts.

6. The Regional Board should discourage wetland disturbance in areas designated by the California Department of Fish and Wildlife as Significant Natural Areas (see “Special Designations to Protect Water Resources” at the beginning of this Section).

Floodplain and Riparian Area Protection

(See also “Wetlands” discussion above, and the discussion of discharge prohibitions in Section 4.1.)

A 100-year floodplain is defined as the extent of a flood that has a statistical probability of occurring once in 100 years. Floods of this extent may occur more than once every 100 years, and floods of even greater extent are possible. Most state, federal and local floodplain protection planning is based upon the 100-year floodplain. Floodplains often include wetland and riparian areas which may extend beyond the limits of the 100-year floodplain. Riparian areas are typically defined as the terrestrial moist soil zone immediately adjacent to wetlands, lakes, and both perennial and intermittent streams.

Undisturbed floodplains and riparian areas provide natural storage for flood waters and thus moderate downstream flood flows and augment dry season (base) flows. The wetland and riparian areas of floodplains can provide water treatment including settling of suspended matter as flood flows are slowed, physical filtration of sediment and associated chemicals by vegetation, uptake of nutrients by roots and foliage, adsorption of chemicals on soil particles, and uptake and chemical transformation of substances by soil microorganisms. Riparian areas are important habitat for fish and other wildlife (including significant habitat for threatened or endangered species), providing drinking water, abundant food, a moderate climate (with more shade and cooler temperatures than many upland areas), and shelter. Riparian areas support abundant and diverse mixtures of plant and animal life. An estimated 25 percent of California's mammals, half of its reptiles, and three-fourths of its amphibians are closely associated with riparian areas (Warner and Hendrix 1984). Riparian vegetation is important in providing streambank stability and shading, temperature control, and food for aquatic systems.

In addition to the values of flood control, water quality protection, base flow augmentation, and wildlife habitat, floodplains and riparian areas can provide opportunities for dispersed recreation, access points for water contact recreation, and open space for aesthetic enjoyment. As all of these values can be impacted by development or other disturbances in the floodplain and riparian areas, protection measures are necessary.

Control Measures for Floodplain and Riparian Areas

Regional Board and other state, as well as federal and local, floodplain and riparian protection control actions are described below.

Regional Board Floodplain Control Actions

Regional Board prohibitions regarding floodplains, as well as prohibition exemption criteria, are described in the Waste Discharge Prohibitions section of this Chapter, and in the Lake Tahoe Chapter.

Control Measures for Floodplain and Riparian Areas by other State Agencies

1. California Executive Order 8-39-77 directs that “all agencies responsible for programs which affect land use planning, including state permit programs, shall take flood hazards into account in accordance with recognized floodway and 100-year frequency flood design standards when evaluating plans and shall encourage land use appropriate to the degree of hazard involved.”

2. The California Department of Water Resources (1980) flood management policy includes the following provisions:

- The preferred method of flood damage reduction is to adjust use and occupancy of the floodplain through management or regulation of uses, rather than solely by structural works in the stream;

- Structural flood damage reduction projects should usually be limited to those already developed areas in which flood-proofing or relocation of development is not economically or socially feasible;

- The social values of essentially natural streams will be recognized, and flexibility in degree of protection will be considered where a community so desires since the traditional solution of channelization or elimination of a stream is often seen as a bigger problem by the community;

- The structural integrity of existing flood protection works must be assured through effective management and surveillance programs, accompanied by programs to deal with residual risks;

- Flood management efforts will be carried out in a way that incorporates ground water recharge, wetland, fish and wildlife protection and enhancement, and recreational development as integral parts of the flood management program. This includes recognition of the values of wetland and riparian habitat and native vegetation and maximum efforts to preserve these values and resources.

3. California Department of Forestry and Fire Protection (CDF) Forest Practice Rules (Rules) detail specific best management practices to protect riparian areas during timber harvest operations on non-federal lands throughout California. These Rules require establishment of Watercourse and Lake Protection Zones adjacent to lakes, streams, wetlands, and springs to exclude equipment, roads, and landings, and to retain sufficient canopy cover.

4. Other state agency programs which may regulate floodplain and riparian protection activities include the Department of Fish and Wildlife's stream alteration permit program and endangered species review process (see “Sensitive Species and Biological Communities” discussion later in this section).

Federal Control Measures for Floodplain and Riparian Areas

1. The 1977 Executive Order 11988 (floodplain management) and Executive Order 11990 (wetlands) directed federal agencies to avoid actions that would adversely affect floodplains and wetlands. The floodplain order states that if avoidance is not practical, agencies are to restore and preserve natural floodplain values. The order also provided a basis for coordination among the many federal agencies with floodplain management authority.

2. A U.S. Forest Service policy (Leven 1984) provides that preferential consideration be given to riparian area-dependent resources over other resources and activities when conflicts occur.

3. The U.S. Army Corps of Engineers federal Clean Water Act Section 404 permit program for dredging and filling activities also affects floodplains. For details of the Section 404 permit program, see “Wetlands Protection” discussion above.

Local Control Measures for Floodplain and Riparian Areas

Many counties in the Region provide general protection for floodplains and riparian areas through zoning, land use ordinances and the project review process. Examples include specified buffer zones, building setbacks, grading limits, and building bans within floodplains.

Recommended Future Actions for Floodplain and Riparian Areas

1. For proposed projects with probable floodplain impacts where floodplains have not been mapped by FEMA or the Corps of Engineers, the Regional Board should require appropriate floodplain mapping by the project applicant.

2. The Regional Board should consider adopting floodplain discharge prohibitions for other environmentally sensitive areas of the Region such as Mammoth Lakes.

3. The Regional Board should continue to promote protection of riparian areas on U.S. Forest Service, U.S. Bureau of Land Management, and non-federal grazing operations, allotments, and leases.

Forest Management

Forested lands are found throughout much of the Lahontan Region. Management of these lands can

include commercial timber harvests, vegetation management to address fire risk and forest health, fire suppression, the use of prescribed fire, watershed and ecological restoration, and other activities. The forests of the Lahontan Region have suffered under a century of fire suppression, leaving an unhealthy condition in many locations where an abundance of undergrowth and dense canopy have created increased risk for catastrophic fire. Efforts to reduce these "fuel loads" and to create defensible space for property owners are an ongoing priority. Forest management activities can also include the use of pesticides and various restoration techniques. Restoration techniques and pesticide use are discussed elsewhere in this Chapter. Other activities on forested lands, such as mining, livestock grazing, and recreation, are also discussed separately in this Chapter.

Silviculture/Timber Harvests

Silvicultural activities in the Lahontan Region occur on both federal and non-federal forest land. Tree harvesting methods include commercial thinning, clearcutting, sanitation, and salvaging of dead or dying trees, as well as non-commercial thinning to improve forest health and/or reduce the risk of and severity of wildfire. These harvesting operations are performed on areas of up to several thousand acres per project, and often involve heavy equipment such as tractor skidders, bulldozers, log hauling trucks, chip vans for biomass removal, and road watering trucks. Many project sites have not been harvested for many decades, if at all, and therefore have thick undergrowth, especially near streamcourses or wetlands. Activities such as log felling/yarding and particularly the construction, improvement and use of forest roads, log landings, and watercourse crossings can result in significant impacts. These impacts can include soil erosion and/or compaction, discharge to streams, streamcourse disturbance and diversion, and removal of riparian or wetland vegetation. Such impacts on soils, vegetation and hydrology can in turn affect water quality and beneficial uses.

Control Measures for Silvicultural Activities

Prohibitions on unauthorized waste discharge to surface waters apply throughout the Lahontan Region. Prohibitions on waste discharges to 100-year floodplains apply to forestry activities in the Lake Tahoe and Truckee River watersheds. In the Lake Tahoe Basin, prohibitions on waste discharges to Stream Environment Zones (SEZs) also apply. Exemptions from these prohibitions may be granted for certain types of forest management activities. See Sections 4.1 and 5.2 of this Basin Plan for information on waste discharge prohibitions and exemption criteria.

The Regional Board requires proponents of vegetation or forest management activities with the potential to discharge wastes that could affect the quality of waters of the state to obtain coverage under waste discharge requirements or a waiver of waste discharge requirements. Dischargers must ensure that their activities comply with the applicable provisions of this Basin Plan (including water quality objectives and waste discharge prohibitions or exemption criteria) and are protective of water quality. To the extent that funding and staffing allows, Regional Board staff inspect the project area with the land owner or representative, and recommend water quality protection measures. If Regional Board concerns are not satisfactorily addressed or if violations are observed, the Regional Board may take enforcement actions in accordance with the California Water Code.

The Regional Board regulates timber harvest proposals for both federal and non-federal lands. Special forest management provisions apply to the Lake Tahoe Basin (see Chapter 5).

Federal Lands. The United States Forest Service (USFS) has the authority and responsibility to manage and protect the land which it administers, including protection of water quality. When the USFS plans a timber harvest, it is generally listed quarterly in a notice called the Schedule of Proposed Actions (SOPA). Water Board staff typically review the quarterly SOPA notices and comment on those projects that have the potential to significantly impact water quality within the Lahontan Region. The USFS generally writes a National Environmental Policy Act (NEPA) document and routes it for public review. When the NEPA document is approved, the USFS writes a timber sale contract agreement with the hired logger. This agreement lists the terms of contract and includes protection measures for streamcourses, sensitive vegetation, soil stabilization, and erosion prevention that the logger must follow.

There is a Management Agency Agreement (MAA) between the USFS and State Water Resources Control Board (State Board). The MAA recognizes the mutual desire of each agency to achieve the goals of the Clean Water Act and to assure control of water pollution through implementation of Best Management Practices (BMPs). Each agency mutually agrees to coordinate water quality monitoring, share data, and cooperate in other water quality management planning activities.

During timber harvest activities on NFS lands, the USFS requires use of BMPs to directly or indirectly mitigate adverse effects to water quality and beneficial uses. Once BMPs are applied during a timber operation, their effectiveness is evaluated by the USFS. If BMP implementation did not produce the desired results, the USFS initiates corrective action and the BMPs may be modified as needed.

Timber harvest BMPs that are intended to protect water quality within National Forest System lands include:

- The location and method of streamcrossings, and location of skid trails and roads, must minimize impacts to water quality.
- Maintenance of the natural flow of streams and reduction of sediment and other pollutants that may enter watercourses.
- All project debris must be removed from the streamcourse in the least disturbing manner.
- Timber sale contracts shall specify that timber operators must repair all damage to streamcourses, banks and channels.
- Water bars and other erosion control structures must be located to prevent water and sediment from being channeled into streamcourses and to dissipate concentrated flows.
- Equipment must stay a set minimum distance from streamcourses depending upon slope and high water mark.
- Proper drainage must be maintained during use of log landings.
- Used landings must be ditched or sloped to permit drainage and dispersion of water.
- Appropriate water quality or visual monitoring shall be conducted.

The USFS must obtain waste discharge requirements (permit) or a waiver thereof from the State Water Board or the Regional Board prior to implementing projects that have the potential to discharge wastes that could affect the quality of the waters of the state. The permit or waiver considers the BMPs that have been developed by the USFS and may include additional conditions to protect water quality.

Non-federal lands. The State Board recognizes the water quality authority of the Board of Forestry (BOF) and the California Department of Forestry and Fire Protection (CALFIRE) during timber operations on non-federal lands. The State Water Board has certified a water quality management plan which includes Best Management Practices for these timber operations on non-federal lands.

In cases when a timber owner wishes to conduct commercial timber harvest on private lands, a registered professional forester (RPF) is required to complete and sign a Timber Harvest Plan (THP). The THP includes a topographic map of the area, determination of number of acres, expected time period of operation, locations of roads, large landings and stream crossings, type of harvest, and watercourse and wetland protection measures. This THP is then filed with CALFIRE. A review team meeting is held at the regional CALFIRE office. This meeting may include representatives from CALFIRE, the Regional Board, California Department of Fish and Wildlife (DFW), and California Geologic Survey (CGS). After the meeting, a copy of the THP with any revisions is sent to the Regional Board for its review of potential water quality impacts.

Regional Board staff may elect to meet on-site with CALFIRE staff and the RPF who completed the THP. The land or timber owner and other review team agency representatives may also be present. The timber harvest operation is inspected to ensure compliance with State Forest Practice Rules (FPRs) and the Regional Board's Basin Plan and permit or waiver. These FPRs include the following provisions:

- Timber operations shall prevent unreasonable damage to riparian vegetation, and site productivity must be maintained by minimizing soil loss.
- Appropriate levels of protection are assigned to different types of watercourses, including minimum distances logging machinery must be kept away from streamcourses and wet areas (buffer zones). The widths of the buffer zones depend on side slope and beneficial uses of the water.
- Depending on the watercourse classification there are retention standards for understory and overstory vegetation.
- Watercourse crossings must be kept to a minimum.
- If fish are present, the crossing must allow unrestricted passage of fish and water.

- Roads must be located and constructed to minimize impacts to water quality.
- Roads and landings should have adequate drainage.
- Heavy equipment is not to be operated on unstable soils or slide areas.
- Waterbreaks must be installed before the winter period. Standards are to be followed for distances between water breaks on slopes. These water breaks should allow water to discharge into vegetative cover, duff, slash, rock or less erodible material to minimize erosion and should be maintained during timber operations.
- Timber operations during the winter period must not be performed under saturated soil conditions.
- Material from logging operations shall not be discharged into waters of the State in quantities deleterious to beneficial uses of water.
- Timber operators shall not use watercourses, marshes or wet meadows as log landings, roads or skid trails.
- Trees cut within watercourse and lake protection zones shall be felled away from the watercourse by endlining to protect vegetation from heavy equipment operations.

Lake Tahoe Basin. Special control actions for forest management activities within the Lake Tahoe Basin are included in Chapter 5 of this Plan.

Recommended Future Actions for Silvicultural Activities

Regional Board staff should continue to actively review both federal and non-federal timber harvest proposals and to conduct on-site inspections as necessary. Since 2003, the Regional Board has had conditional waivers of waste discharge requirements for vegetation management activities on both public and private lands in California (Timber Waivers). These timber waivers address both commercial and non-commercial timber harvest and vegetation management activities. Non-commercial activities may be conducted for fuel reduction and forest health purposes. Timber Waivers must be renewed every 5 years and may be terminated at any time by the Regional Board. The timber waiver renewal must occur in a public hearing with prior public noticing. Significant research and equipment innovation is being conducted to address the shift in forest management associated with fuel reduction activities. The timber waiver acknowledges that new approaches are being developed to address forest and watershed health. The waiver allows for project specific analysis of implementation approaches and an avenue to regulate practices as new technologies are developed. The timber waiver and the Basin Plan need to have flexibility in allowing for increased future utilization of biomass created during fuel reduction activities. Future Regional Board efforts should focus on adaptive management, the use of innovative technology, and design features and BMPs that reduce water quality impacts of forest management activities.

Fire Control and Prescribed Burns

Wildfires are part of the natural process of the forest ecosystem. Some species of trees and other plants are dependent upon wildfires for seed germination and/or seedling establishment. However, these fires, both natural and human caused, can have major impacts on vegetation conditions with subsequent effects on soils and water quality. In many forests, fire suppression techniques are commonly used, adding an abundance of available “fuel” to the forest. This “fuel” can contribute to a high intensity wildfire which magnifies impacts on vegetation, soils, and water quality.

Fires initiate a process of soil movement that continues through subsequent rainstorms. The process begins as fires consume vegetation. With the vegetation removed, effective ground cover to hold soils in place is also removed. The vegetation is no longer removing and using soil nutrients like nitrogen and phosphorus. Many nutrients are left in the ashes which can easily be transported to surface waters by stormwater runoff or ground water flow. If the fire destroys the duff layer (a biologically rich protective layer of decaying needles and branches), only easily erodible ashes are left to cover the bare mineral soils. The duff layer normally functions like a sponge, soaking up precipitation, including snow melt. Without the duff layer, the water which would normally infiltrate to ground

water becomes erosive runoff. In areas of sandy soils, intense burning of the duff layer can chemically alter the soils, creating a water repellant or "hydrophobic" layer which can further increase runoff. Runoff can rapidly erode bare mineral soil and flush nutrient-rich ashes into rills and gullies. Over time, these gullies can increase in size, eventually draining to surface waters, eroding upland areas, scouring some natural stream channels while adding sediments to some channels and lakes. This increased sedimentation can impact fish spawning gravels and fill pools and riffles which are important aquatic habitat components. Sediments also contribute large amounts of nutrients to streams and lakes. Fires can further impact water quality by increasing the magnitude of floods associated with moderate and extreme storms. Fires can also impact water temperature by reducing stream shading.

Burning under prescribed conditions to control undesirable vegetation, control insects or pathogens, or to maintain ecological succession, can have similar water quality impacts to those of wildfires, but usually on a lesser scale.

Thus, from a water quality perspective, controlling fires is important. However, fire fighting can also leave its mark on watersheds. The activities of firefighters and heavy equipment can result in soil disturbance, vegetation removal, and stream sedimentation. Chemical fire retardants also have the potential to impact water quality. Many of these fire retardants are ammonium-based and decompose to such products as ammonia, sodium cyanide and sulfuric and phosphoric acids. Some retardants are mixes of foaming and wetting agents. Aquatic toxicity testing of these fire retardants has shown aquatic organism sensitivity to many retardants. In the case of foaming agents, the water surface tension is reduced which interferes with the ability of fish and other organisms to obtain oxygen from the water. Surface waters in many of the forested watersheds of the Lahontan Region are naturally oligotrophic, and loading of nitrogen and phosphorus from fire retardants to surface waters may contribute to eutrophication.

Control Measures for Fire Control and Prescribed Burn Operations

The Regional Board shall rely on the water quality expertise of the USFS and CALFIRE to promptly take measures after fires to reduce the adverse effects on water quality and beneficial uses. The Regional Board shall further rely on the USFS and CALFIRE in the design and use of fire control activities and prescribed burn activities which avoid or minimize adverse impacts on water and soil resources. The Regional Board encourages the USFS and CALFIRE to consider the following measures to protect water quality and beneficial uses.

- Burning under prescribed conditions should generally be located away from stream channels or standing water. Some types of burns may be closer to standing water. The Regional Board should be notified of any proposal to conduct burning activities near watercourses. Prescribed burning activities may be covered by the Regional Board's waiver of waste discharge requirements or other regulatory mechanism. Efforts shall be made to limit fire intensities, prevent transport of ash and soil to waters, increase recovery of vegetation and/or implement BMPs to quickly stabilize soils following burning.

- When the residual fuel load will be acceptable, non-burning techniques such as scattering or hauling away slash are acceptable, especially where the slash, chipped or masticated material will provide soil protection. (Timber harvests and herbicide use, both possible means of reducing fuel loads, are discussed elsewhere in this Chapter.)

- When selecting and stocking fire retardants, fire protection agencies should consider the relative potentials of different compounds for toxicity to aquatic life (particularly to threatened/endangered species), and for eutrophication of naturally oligotrophic waters. When fighting fires, direct drops of fire retardants into streams, lakes, wetland areas, or riparian areas should be avoided.

Recommended Future Actions for Fire Control and Prescribed Burn Operations

The Regional Board may request each state and federal land management agency within the Region to submit information on any fire retardant proposed for use in fire fighting. This information should include chemical composition, chemical decomposition products, results of any aquatic organism toxicity or other toxicity testing and mode of action (foaming, wetting, etc.). Following any fire fighting activities, information on amounts used and locations of use should be submitted to the Regional Board.

Range Management

Rangeland is the most extensive landtype in California, accounting for more than 40 million acres

of the State's 101 million acres. As most of the rangelands are located between forested areas and major river systems, nearly all surface waters in theState flow through rangelands. Thus, rangeland activities can greatly impact water quality. In this section, grazing activities are discussed. Other rangeland management activities, such as riparian restoration and erosion control, are discussed elsewhere in this Chapter.

Livestock Grazing

Grazing activities (particularly overgrazing), by contributing excessive sediment, nutrients and pathogens, can adversely impact water quality and impair beneficial uses. Soil erosion and sedimentation are the primary causes of lowered water quality from rangelands. When grazing removes most of the vegetative cover from pastures and rangelands, the soil surface is exposed to erosion from wind and water. With runoff, eroded soil becomes sediment which can impair stream uses and alter stream channel morphology. With steep slopes, highly erodible soils and intense storm events, the sediment delivery ratio (a measure of the amount of eroded soil delivery to a waterbody) on rangeland can be very high. Streambank erosion and lakeshore erosion are other sources of sediment on rangelands. Lakeshores, streambanks and associated riparian zones are often subjected to heavy livestock use. Trampling and grazing of vegetation contribute to lakeshore and streamside instability as well as accelerated erosion.

Sediments can contribute large amounts of nutrients to surface water. Nutrients, mainly nitrogen and phosphorous, from manure and decaying vegetation also enter surface waters, particularly during runoff periods. Very critical nutrient problems can develop where livestock congregate for water, feed, salt and shade. Pasture fertilization can also be a source of nutrients to surface waters, as well as a source of pesticides, particularly if flood irrigation techniques are used on rangelands. (Irrigation return flows are discussed in the “Agriculture” section of this Chapter).

Stream zone and lakeshore areas are important for water quality protection in that they can “buffer” (intercept and store nutrients which have entered surface and ground waters from upgradient areas). These “buffer zones” are more sensitive to processes which can increase nutrient discharges such as soil compaction, soil erosion, and vegetation damage than other areas of the rangeland.

Localized contamination by pathogens in surface water, ground water and soils can result from livestock in pastures and rangelands. Rangeland streams can show increased coliform bacterial levels with fecal coliform levels tending to increase as intensity of livestock use increases. Fecal coliform serve as indicators that pathogens could exist and flourish. The extent of the pathogens is usually determined by livestock density, timing and frequency of grazing, and access to the surface waters.

Control Measures for Grazing

Grazing activities occur on both public and private lands in the Lahontan Region. Regulation of grazing on federal lands differs from that on private lands.

Federal lands. Grazing activities on federal lands are regulated by the responsible land management agency, such as the U.S. Bureau of Land Management (BLM) or the U.S. Forest Service (USFS). Through MOUs and MAAs, the Regional Board recognizes the water quality authority of the USFS and BLM in range management activities on federal lands. Both the USFS and BLM require allotment management plans (AMPs) to be prepared for a specific area and for an individual permittee. The Regional Board relies on the water quality expertise of the USFS or BLM to include appropriate water quality measures in the AMPs. Most AMPs include specific Best Management Practices (BMPs) to protect water quality and existing and potential beneficial uses.

Non-federal (private) lands. The Range Management Advisory Committee (RMAC) is a statutory committee which advises the California Board of Forestry on rangeland resources. The RMAC has identified water quality protection as a major rangeland issue and it assumed a lead role in developing a water quality management plan for private rangelands in California. The California Rangeland Water Quality Management Plan (Rangeland Plan) was accepted by the State Water Resources Control Board (SWRCB) in 1995. The Rangeland Plan summarizes authorities and mandates for water quality and watershed protection, and specifies a framework for the voluntary and cooperative development of ranch management strategies for water quality protection under Tier I of the SWRCB’s Nonpoint Source Management Plan. (See the Introduction to Chapter 4 of this Basin Plan for an explanation of the Nonpoint Source Plan.) The Rangeland Plan provides that where water quality or the beneficial uses of water are impaired or threatened, ranch owners shall develop an individual Rangeland Water Quality Management Plan (RWQMP) or participate in one of the several other recognized individual or coordinated rangeland

planning processes. The Rangeland Plan also describes sources of technical and financial assistance available to ranch owners.

On private lands whose owners request assistance, the U.S. Natural Resources Conservation Service (NRCS), in cooperation with the local Resource Conservation Districts (RCDs), can provide technical and financial assistance for range and water quality improvement projects. An MOU is in place between the NRCS and the State Board for planning and technical assistance related to water quality actions and activities undertaken to resolve nonpoint source problems on private lands.

On both public and private lands, the Regional Board encourages grazing strategies that maintain adequate vegetative cover to reduce erosion and sedimentation. The Regional Board promotes dispersal of livestock away from surface waters as an effective means of reducing nutrient and pathogen loading. The Regional Board encourages use of BMPs to improve water quality, protect beneficial uses, protect streamzone and lakeshore areas, and improve range and watershed conditions. These BMPs include:

- Implementing rest-rotation grazing strategies
- Changing the season of use (on/off dates)
- Limiting the number of animals
- Increasing the use of range riders to improve animal distribution and use of forage
- Fencing to exclude grazing in sensitive areas
- Developing non-lakeshore and non-stream zone watering sites
- Constructing physical improvement projects such as check dams
- Restoring riparian habitat

These same BMPs may result in improved range and increased forage production, resulting in increased economic benefit to the rancher and land owner. The Regional Board also encourages land owners to develop appropriate site-specific BMPs using technical guidance documents from the Natural Resources Conservation Service and the U.S. Environmental Protection Agency (USEPA 1993).

Regional Board Control Actions for Livestock Grazing

In addition to relying on the grazing management expertise of agencies such as the USFS, BLM or RMAC, the Regional Board can directly regulate grazing activities where voluntary implementation of BMPs is deemed by the Regional Board or its Executive Officer to be inadequate to ensure protection of water quality and beneficial uses of water. Actions available to the Regional Board include:

1. Require that a Report of Waste Discharge be filed, that an AMP be prepared, or that an Individual Rangeland Water Quality Management Plan (RWQMP) or Coordinated Resource Management Plan (CRMP) be adopted within one year of documentation of erosion problems, destruction or major impairment of vegetation, or significant addition of nutrients, pathogens and/or sediments to surface waters or ground waters resulting from grazing or grazing management activities. Such problems indicate impairment of beneficial uses or violation or threatened violation of water quality objectives.

2. Require that all AMPs, RWQMPs and CRMPs contain BMPs necessary to correct existing water quality problems or to protect water quality so as to meet all applicable beneficial uses and water quality objectives contained in Chapters 2 and 3 of this Basin Plan. Corrective measures would have to be implemented within one year of submittal of the AMP, RWQMP or CRMP, except where staged BMPs are appropriate. Implementation of a staged BMP must commence within one year of submittal of the AMP, RWQMP or CRMP.

3. Require that each AMP, RWQMP or CRMP include specific objectives, actions, and monitoring and evaluation procedures. The discussion of actions must establish the seasons of use, number of livestock permitted, grazing system(s) to be used, a schedule for rehabilitation of ranges in unsatisfactory condition, a schedule for initiating range improvements, and a schedule for maintenance of improvements. The schedule for initiating and maintaining range improvements must include priorities and planned completion dates. The discussion of monitoring and evaluation must propose a method and timetable for reporting of livestock forage conditions, watershed condition, and surface and ground water quality.

4. Require that all AMPs and CRMPs be circulated to interested parties, organizations, and public agencies.

5. Consider adoption of waste discharge requirements if an AMP, RWQMP or CRMP is not prepared or if the Executive Officer and the landowner do not agree on BMPs proposed in an AMP, RWQMP or CRMP.

6. Decide that AMPs, RWQMPs and CRMPs prepared to address a documented watershed or water quality problem may be accepted by the Regional Board's Executive Officer in lieu of adoption of Waste Discharge Requirements.

7. Oversee monitoring of water quality variables and beneficial uses. Provide data interpretation.

Eagle Lake. The following control measures apply to the Eagle Drainage Hydrologic Area (see map in Section 4.1):

- A Report of Waste Discharge must be filed, or an AMP, RWQMP or CRMP prepared for specific areas within one year of documented proof of (1) erosion problems that threaten water quality or beneficial uses of water, (2) destruction, or major impairment of vegetation, or (3) significant addition of nutrients to surface waters or ground waters resulting from grazing or grazing management activities.

- All AMPs, RWQMPs or CRMPs must contain Best Management Practices (BMPs) necessary to correct existing water quality problems or to protect water quality. Corrective measures must be implemented within one year of submittal of the plan, except where staged BMPs are appropriate. Implementation of a staged BMP must commence within one year of submittal of the plan. The BMPs required because of documented watershed or water quality problems may be accepted by the Regional Board's Executive Officer in lieu of adoption of Waste Discharge Requirements.

- AMPs and CRMPs must be circulated to interested parties, organizations, and public agencies. Each AMP, RWQMP and CRMP must address objectives, actions, and monitoring and evaluation. The discussions of actions must establish the seasons of use, number of livestock permitted, grazing system to be used, a schedule for rehabilitation of ranges in unsatisfactory condition, a schedule for initiating range and watershed improvements, and a schedule for maintenance of range and watershed improvements. The schedule for installing and maintaining range and watershed improvements must include priorities and planned completion dates. The discussion of monitoring and evaluation must propose a method and timetable for reporting of livestock forage conditions, watershed condition, and surface and ground water quality. Each plan should describe all BMPs in enough detail to show that all water quality standards of this Basin Plan will be protected or restored.

Recommended Future Actions for Grazing Management

1. Provide information to private landowners, local RCDs and other agencies regarding grant monies available through the SWRCB and other sources for water quality planning and BMP implementation on rangelands. When requested, Regional Board staff should participate in the voluntary implementation of BMPs on rangelands by providing information and technical assistance to facilitate grant applications.

2. Encourage private landowners to request technical and financial assistance from the Natural Resources Conservation Service and the University of California Cooperative Extension, in cooperation with the local Resource Conservation Districts, in the preparation of AMPs, RWQMPs and CRMPs, and the implementation or construction of grazing and water quality improvements.

Fisheries Protection and Management

Fisheries protection, including the preservation and enhancement of aquatic habitat, is a necessary consideration during project review, when potential impacts may occur as a result of a project. Recommended control actions for protecting fishery-related beneficial uses are described below.

Fisheries management activities in the Lahontan Region include operation of public hatcheries to rear fish, restoration of habitat, and use of fish toxicants (i.e., rotenone) to eliminate undesirable fish populations. Regulation of activities related to public hatcheries and fish toxicants are discussed in this section. Habitat restoration is discussed elsewhere in this Chapter.

Control Actions for Fisheries Protection

1. The Regional Board will coordinate with the California Department of Fish and Wildlife (DFW) and the U.S. Fish and Wildlife Service (USFWS) to decide on the appropriate and necessary protection measures to protect a specific fish population and its habitat. Fisheries protection requirements should be considered during review of any proposed project that may impact any fishery or its habitat.

2. Chapter 2 of this Plan designates beneficial uses of the Region's surface waters. The general uses related to fish habitat are: “Cold Freshwater Habitat” (COLD), “Warm Freshwater Habitat” (WARM), “Inland Saline Water Habitat” (SAL). Some surface waters have also been further designated for “Migration of Aquatic Organisms” (MIGR) and “Spawning, Reproduction, and Development” (SPWN). Where migration and/or spawning occur, the special measures listed below are required to protect spawning areas and migration corridors:

   - Prior to activities which may impact spawning habitat, an assessment of the gravel bed condition will be made by the discharger with assistance from DFW. Waste discharge activities with detrimental impacts to the gravel bed will not be allowed.

   - During construction, maintenance or operation of any project, minimum stream flows are to be maintained for fish survival and/or passage.

   - During construction, maintenance or operation of any project, fish passage shall be provided.

   - When designing facilities to be placed in a streambed, such as a culvert, stream velocities shall be maintained at a reasonable level which will not result in obstruction of fish passage.

Fish Hatcheries

Discharges produced by fish hatcheries include suspended solids and nutrients from fish wastes and unconsumed fish food, as well as potential discharges of pesticides or other substances used to control fish diseases. Potential water quality impacts downstream from these discharges include increased productivity and algal growth, increased biological oxygen demand, and impaired aquatic habitat. However, in one instance, discharges from a hatchery (Hot Creek Hatchery) promoted the growth of vegetation fed upon by the endangered Owens tui chub. Because the routine removal of the vegetation was threatening the endangered fish, hatchery personnel stopped removing the vegetation.

Hatchery operations are themselves sensitive to water conditions. For example, optimum propagation of fish is restricted to a narrow range of temperatures; alteration of ambient water temperature can have a severe effect on hatchery fish production. In one instance, geothermal development in the vicinity of a fish hatchery could alter the temperature of geothermal springs that are used as water supplies for hatchery operations. The potential loss in productivity due to altered temperature of the hatchery water supplies could potentially result in several million dollars in monetary damages. (Geothermal development is discussed in the “Mining, Industry and Energy Development” section of this Chapter.)

Control Actions for Hatcheries

All hatchery operations which include point source discharges to surface waters are regulated under National Pollutant Discharge Elimination System (NPDES) permits. Effluent discharge parameters limited in the NPDES permits include suspended solids and settleable matter. Receiving water limitations in the NPDES permits for hatcheries include color, taste, odor, foaming agents, toxic substances, dissolved oxygen, turbidity and aquatic growth.

Rotenone Use in Fisheries Management

The California Department of Fish and Wildlife (DFW) and the United States Fish and Wildlife Service (USFWS) occasionally have cause to eliminate competitors, predators, and otherwise undesirable fish populations as part of their fishery management programs. Such management programs may include the restoration or protection of threatened or endangered species, control of fish diseases, elimination of restricted species, actions to increase the abundance of desirable sport fish species, and actions to establish and maintain wild trout stocks.

In carrying out their management programs, the DFW or the USFWS occasionally find it necessary to completely eliminate existing fish populations in designated areas; this practice provides conditions for propagation of healthy, desirable fish. The DFW has determined that in certain situations the use of rotenone, a fish toxicant, is the only effective, practical method of achieving this objective.

The discharge of rotenone formulations and the detoxifying agent, potassium permanganate, can

violate water quality objectives and adversely affect beneficial uses of water. Impacts may occur both within project boundaries and outside of those boundaries. (Project boundaries are defined as encompassing the treatment area, the detoxification area, and the area downstream of the detoxification station up to a thirty-minute travel time.)

Rotenone treatment is typically followed by the addition of potassium permanganate, which is a strong oxidant used to detoxify the active ingredient(s). (Potassium permanganate may cause a characteristic purple or brown color to waters being detoxified and downstream receiving waters). Unexpected fish kills have also occurred downstream of project boundaries due, at least in part, to permanganate toxicity. However, potassium permanganate decomposes quickly in water and does not persist for more than a day following the end of detoxification. At these levels, potassium permanganate is not considered a health threat to humans.

In addition to the active ingredient, liquid rotenone formulations also contain “inert” ingredients (e.g., carriers, solvents, dispersants, emulsifiers), and may also contain, in trace amounts, organic contaminants. Such “inert” ingredients and contaminants may include naphthalene, methylnaphthalene, xylene, acetone, trichloroethylene (TCE), benzene, and ethylbenzene.

The use of rotenone and detoxifying agents has both short-term and long-term impacts. Short-term impacts(such as toxicity, discoloration, and odors) last only as long as chemical residues from the rotenone treatment persist. Chemicals are introduced to the water during the treatment and detoxification process, but tend to decompose or volatilize in a matter of hours or days, depending on site conditions. Some chemical residues may be detectable for longer periods, particularly where standing water (i.e. lakes) is treated. In addition to effects on aquatic life, short-term impacts can adversely affect aesthetics, recreation, and water supplies. Short-term impacts are generally limited to the area within project boundaries.

Long-term impacts of rotenone use are those that persist after the chemical residues have dissipated. Because rotenone is toxic to all gill-breathing animals, non-target aquatic invertebrates and amphibians are also killed. This may adversely affect non-target endemic species, including undiscovered species or threatened or endangered species, as well as instream assemblages of more common species. The time period for full recovery of instream invertebrate assemblages is unknown, and it is possible that endemic species with limited ranges could be lost entirely. Long-term impacts also result where treatments are repeated at a given project site for multiple years. During this time, most or all fish are eliminated from the project site causing a loss of fishing opportunities until fish are re-stocked after a multi-year project is completed.

As described above, the application of rotenone to surface waters by the DFW or the USFWS will result in a temporary lowering of water quality. The State Board's “Statement of Policy with Respect to Maintaining High Quality of Waters in California” (Resolution No. 68-16) directs that whenever the existing quality of waters is better than standards established in water quality objectives, the existing level of quality shall be maintained. Water quality degradation is permissible only if the Regional Board finds that such a change will be consistent with maximum benefit to the people of the State. Similarly, the Federal Antidegradation Policy (40 CFR § 131.12) dictates that water quality shall be preserved unless degradation is necessary to accommodate important economic or social development.

The temporary degradation of water quality due to the use of rotenone by the DFW or the USFWS may be justifiable in certain situations. The Regional Board recognizes that the State and federal Endangered Species Acts require the restoration and preservation of threatened and endangered species. The Regional Board also recognizes that situations may arise where outbreaks of fish disease or the threat presented by prohibited or exotic species may require immediate action to prevent serious damage to valuable fisheries resources and aquatic habitat. These resources are of important economic and social value to the people of the State, and the transitory degradation of water quality and impairment of beneficial uses that would result from rotenone application may be justified, provided suitable measures are taken to protect water quality within and downstream of the project area.

Control Measures for Rotenone Use and Other Fish Toxicants

The Regional Board may grant the conditional use of rotenone by the DFW or the USFWS, provided the rotenone application is proposed for the purposes of (1) the restoration and protection of threatened or endangered species (2) the control of fish diseases where the failure to treat could result in significant damage to fisheries resources and aquatic habitat or (3) the elimination of species (as defined in CA Fish

and Game Code § 2118), where competition or predation from such species threatens the native fish populations, or populations of other organisms (includes rare, unique, sensitive, or candidates for listing as endangered or threatened species.

The Regional Board may, on a project-by-project basis, grant exemptions for the use of fish toxicants in other kinds of fisheries management activities, when the DFW or the USFWS can provide the necessary justification for allowing a temporary lowering of water quality (i.e. degradation) according to the provisions of the federal Antidegradation Policy (contained in 40 CFR § 131.12) and State Board Resolution No. 68-16.

Before the Regional Board considers an exemption to the prohibition against discharges of pesticides to surface waters, the project proponent must submit a project proposal that satisfies the below criteria. A prohibition exemption will not be granted for any project that fails to meet these criteria.

1. Chemical residues resulting from rotenone treatment must not exceed the narrative or numerical limitations established in Chapter 3 of this Basin Plan, under the section entitled "Water Quality Objectives For Fisheries Management Activities Using the Fish Toxicant Rotenone."

2. The planned treatment protocol will result in the minimum discharge of chemical substances that can reasonably be expected for an effective treatment.

3. Chemical transport, spill contingency plans, and application methods will adequately provide for protection of water quality.

4. A public notification plan accepted by the Executive Officer.

5. Suitable measures will be taken to identify potentially affected sources of potable surface water intakes and ground water wells, and to provide potable drinking water where necessary.

6. The chemical composition of the rotenone formulation has not changed significantly (based on analytical chemical scans to be performed by the DFW or USFWS on each formulation lot to be used) in such a way that potential hazards may be present which have not been addressed.

7. Plans for disposal of dead fish are adequate to protect water quality.

8. To promote decomposition and minimize persistence of active ingredients and detoxifying agents, rotenone shall not be applied to waters when the water temperature is below five (5) degrees Celsius.

9. Pre-project monitoring and mitigation plan to determine the presence of and to protect threatened or endangered species. Where threatened or endangered species are present, appropriate mitigation measures (e.g., temporary or permanent relocation) shall be implemented to lessen adverse effects.

10. A monitoring and reporting program and a mitigation program[1], accepted by the Regional Board, will be followed to assess the effects of treatment on surface and ground waters, and on bottom sediments if specified by the Regional Board. The monitoring plan shall specify, but not limited to: chemical monitoring methods (for active ingredients, detoxifying agents, and any pesticide "inert" ingredients of concern), biological monitoring methods (pre-project and post-project bioassessment surveys at appropriate test and control sites, sufficient to characterize project impacts and recovery considering spatial and temporal variability), sampling locations, index period(s), frequencies, schedule, and QA/QC procedures.

    Both the pre-project monitoring and mitigation plan for T&E species, and the monitoring, reporting, and mitigation program for non-target communities shall be peer-reviewed by independent experts. The peer reviewers shall be proposed by the DFW and/or USFWS and shall be mutually agreeable to both the project proponent(s) and the Regional Board.[2]

    The biological monitoring plan must be based on an appropriate study design, metrics, and

[1] The mitigation program must examine potential measures to facilitate the restoration of non-target to pre-project abundance and diversity. The mitigation program must include a discussion of mitigation measures included and those that were considered but rejected. The project proponent must justify why these measures were rejected as feasible mitigation measures. The requirement to implement mitigation measures may be waived during post-project recovery at the discretion of the Regional Board.

[2] The Regional Board can exempt DFW or the USFWS from the requirement of the monitoring and reporting program and mitigation program being externally peer-reviewed.

performance criteria to evaluate restoration of aquatic life. The indices used in the assessment must be commonly accepted by the scientific community and accepted by the Regional Board. Biological monitoring shall be designed, and conducted as long as needed, to effectively demonstrate that non-target macrovertebrate populations have been fully restored. Fully restored means that the structure and function of non-target macrovertebrate communities have returned to conditions that reflect pre-project conditions. Function will be judged by metrics and indices related to trophic levels (e.g., functional feeding groups) and productivity (e.g., abundance/biomass). Structure will be judged based on metrics and indices related to richness and diversity (e.g., taxa richness, multivariate O/E (observed/expected) model predictions, multivariate ordinations) and presence of sensitive and rare taxa. This definition of "fully restored" shall be provided to the peer reviewers prior to peer review of the monitoring and reporting plan, with instructions to determine whether the monitoring design is capable of determining whether full restoration has been achieved.

Within two years of the last treatment of a specified project, a qualified biologist(s) from the DFW or USFWS must assess the restoration of non-target aquatic life and benthic communities within treated waters, and if, based on the monitoring data, the evidence demonstrates, certify in writing that all affected non-target biological communities have been fully restored. The certification shall be accompanied by a report detailing the pre-project and post-project monitoring, including detailed explanation of the assessment methods used and the rationale for the certification. Macroinvertebrates shall be identified and classified, and data provided in electronic formats using conventions acceptable to the Regional Board. A project will be considered complete only upon written acceptance by the Regional Board of such report and certification.

If non-target biological communities are not fully restored after two years, the project proponent must conduct continued annual monitoring and implement the proposed mitigation measures until the Regional Board accepts the certification.

The Regional Board acknowledges that projects may occur where the non-target communities do not fully recover to pre-project levels. After five years of annual post-project monitoring, the project proponent may petition the Regional Board to release it from annual monitoring and reporting and mitigation obligations. Such petitions must include: (1) results of mitigation efforts, (2) monitoring trends demonstrating maturity of an asymptotic recovery, and (3) evidence that the ability to attain full recovery has been significantly affected by natural environmental factors (e.g., fires, floods, drought) or catastrophic events (e.g., chemical spills) during the years of monitoring. Annual reporting shall continue unless and until the Regional Board rescinds the monitoring requirements.

Recommended Future Actions for Rotenone Use

1. In cooperation with the DFW or the USFWS, monitor projects involving the discharge of fish toxicants to determine impacts on water quality and beneficial uses.

2. In cooperation with the DFW or USFWS, modify rotenone application, detoxification, and monitoring procedures, whenever measures are identified that will provide greater protection for water quality and beneficial uses.

3. In cooperation with other state and federal agencies, and private entities, encourage the development of rotenone formulations which pose the lowest possible environmental hazards while still achieving project goals.

4. In cooperation with other state and federal agencies, and private entities, encourage research to determine whether rotenone persists in stream sediment and, if so, what impact, if any, does it have on hyporheic invertebrates.

Sensitive Species and Biological Communities

Because of its great topographic, geologic and climatic diversity, and because of environmental changes over time which have created ecological islands which facilitate evolutionary change, the Lahontan Region supports a wide variety of plant and animal species and many biological community types. Numerous plant and animal species in the Region are listed as threatened or endangered under the federal Endangered Species Act and/or the California Endangered Species Act (CESA), or are candidates for such listing. Examples include the Lahontan and Paiute cutthroat trout, several kinds of desert pupfish, the Lake Tahoe shorezone plant Tahoe yellowcress, and springsnails which are restricted to a few springs in the Owens River

watershed. These and many other sensitive species depend directly on aquatic or wetland habitats for survival. The Lahontan Region also includes water bodies which support rare or unique combinations of species (biological communities). Examples include the Grass Lake sphagnum bog in the Lake Tahoe Basin, the Mono Lake ecosystem, and the springs and wetlands in the Amargosa River watershed. In some cases, these communities have been given special recognition and protection, as U.S. Forest Service Research Natural Areas or Special Interest Areas, U.S. Bureau of Land Management Areas of Critical Environmental Concern, etc. Detailed information on sensitive species and communities in the Lahontan Region can be found in the Department of Fish and Wildlife's (DFW's) Natural Diversity Database, which is updated on an ongoing basis. The Regional Board's Geospatial Waterbody System (GeoWBS) database can also provide information on the presence of sensitive species and communities in association with specific water bodies.

Aquatic and wetland habitats for many sensitive species have been degraded, impaired, or threatened by water diversions and/or the nonpoint source problems (mining, silviculture, livestock grazing, etc.) discussed elsewhere in this Chapter. The human introduction of nonnative predator and competitor species or species capable of hybridizing with sensitive plants and animals is also a problem. Because little chemical or biological monitoring has been done for most water bodies in the Lahontan Region, the habitat requirements of many sensitive species are not well known.

Control Measures for Sensitive Species and Biological Communities

1. The U.S. Fish and Wildlife Service and the California Department of Fish and Wildlife (through the Fish and Game Commission) are responsible for “listing” threatened and endangered species, defining critical habitats, and preparing and implementing recovery plans. These agencies review proposed projects which could affect sensitive species or critical habitats. Under the CESA, state agencies which are lead agencies under the California Environmental Quality Act must consult with the California Department of Fish and Wildlife (DFW) before approving projects with potential impacts on state-listed species. If the DFW issues a determination of “jeopardy,” the lead agency must provide for DFW-approved mitigation in order to approve the project. The Regional Board consults with DFW under CESA regarding potential impacts of its Basin Plan amendments, policy changes, and the development projects for which it occasionally takes lead agency responsibility.

2. The Regional Board has recognized existing or potential habitats for sensitive species and biological communities through the “RARE” and “BIOL” beneficial use designations in Chapter 2 of this Plan. Additional water bodies will be so designated as new species are listed or new information about species distribution becomes available. The Regional Board may allow the use of rotenone and piscicides in treatment of water bodies prior to the reintroduction of threatened or endangered fish species provided these projects (i.e. fish toxic treatments) comply with the criteria described in Chapter 4 under the section entitled “Exemption Criteria for Aquatic Pesticide Use” under the sub-section titled “Exemption Criteria for Fisheries Management.”

Recommended Future Actions for Sensitive Species and Biological Communities

1. The State Water Resources Control Board and/or the Department of Fish and Wildlife should provide the necessary funds for the biological and chemical monitoring in the Lahontan Region to support Regional Board determinations on the adequacy of statewide objectives to protect threatened/endangered species, and to support the development of site-specific objectives if necessary.

2. Local governments should recognize and provide protection for sensitive aquatic/wetland species and communities in their land use planning, zoning and project review activities.

Watershed Restoration

As water flows through a watershed, its quality is determined by many factors within that watershed including climate, geology and topography. Natural events within the watershed, such as fire and flooding, can affect the quality of the ground waters, lakes, streams and wetlands within the watershed. The quality of these ground waters, lakes, streams and wetlands can also be impacted by human land use activities within the watershed, including the precipitation and dry deposition of atmospheric contaminants.

"To restore and maintain the chemical, physical and biological integrity of the Nation's waters" is a proclaimed goal of the federal Clean Water Act (33 U.S.C. 466 et seq.). Part of this goal, maintaining or protecting water quality, is addressed in many parts of this Plan, including nondegradation policy statements (Chapters 3 and 6), designation of water quality standards (Chapters 2 and 3) and identification of special designations to protect water quality (Chapter 4). The second part of this goal is to "restore." As described above, water quality is so closely related by drainage basin or watershed conditions that water quality restoration relies to a great extent on watershed restoration.

In this section, the term *restoration* means the reestablishment of pre-disturbance functions and related physical, chemical and biological characteristics of aquatic ecosystems (National Research Council 1992). The goal of restoration is to return an ecosystem to a former natural condition—to emulate a natural system which is ecologically integrated with its surrounding area.

This section is divided into three parts: lake, river/stream and wetland restoration. However, the Regional Board supports an integrated approach to restoration—an approach which tries to consider ecological interactions within a watershed. As all watershed components (lakes, streams, rivers, ponds, ground water, wetlands) are interconnected, successful restoration of one component must consider all other components, including cumulative impacts to the watershed.

In each part of this section, impacts and stresses to the water body type which could create the need for restoration are described, followed by a discussion of restoration techniques, water quality control measures and recommended actions for the restoration techniques. Potential sources of funding for restoration are also included.

Lake and Reservoir Restoration

Main causes of degradation of lake quality include eutrophication (increased biological productivity due to excessive loading of nutrients and organic matter), hydrologic changes (e.g., artificially stabilizing lake level), siltation from erosion, acidification (from atmospheric sources or acid mine drainage) and toxic contamination (National Research Council 1992).

Eutrophication is a natural process. However, excessive addition of inorganic nutrients, organic matter and/or silt to lakes and reservoirs can accelerate the process, leading to increased biological production (such as increased populations of algae and rooted plants) and a decrease in lake or reservoir volume. Sediment and associated nutrients from nonpoint sources (such as land development, agriculture, livestock grazing, forest practices, and recreational activities) are often the cause of accelerated eutrophication. Signs of accelerated eutrophic conditions include algal blooms, surface scum, rapid loss of volume in lakes and reservoirs, noxious odors, tainted fish flesh, tainted domestic water supplies, depleted dissolved oxygen, fish kills and development of nuisance plant or animal populations such as common carp. Thus, eutrophic conditions affect water quality and impair the aesthetic, recreational, fish and wildlife, industrial, domestic and other beneficial uses of lakes and reservoirs. Eutrophication can result in decreased property values and the need for expensive water treatment or the development of new water supplies, including construction of new reservoirs.

In the Lahontan Region, accelerated eutrophication is a concern in many lakes and reservoirs. As early as 1946, possible impacts on the water quality of Lake Tahoe from land use activities were noted. Land uses such as waste treatment from septic systems in the Eagle Lake basin of Lassen County are contributing to the eutrophication of Eagle Lake. The prolific growth of aquatic weeds in Twin Lakes of the Mammoth Lakes Basin is considered a nuisance by many Basin residents.

Hydrologic changes to a lake include diversions of tributary stream flows which can result in long-term lowering of the lake level and ecological impacts to both the tributaries and the lake. Diversion of tributaries into Mono Lake resulted in a lowered water supply, increased the lake's salinity and caused ecological damage to the tributaries and to

the lake itself. Stabilizing lake levels through use of a control structure such as a dam can lead to damage to near-shore ephemeral wetlands, loss of fish spawning areas, and degraded water quality from accumulation of littoral sediments (oxidizing organic sediments) (National Research Council 1992).

Acidification of poorly buffered lakes by acidic deposition can affect the entire ecosystem. Acid deposition is discussed in detail later in this section (see “Atmospheric Deposition” later in this Section).

Lake restoration technology can be divided into two main categories (National Research Council 1992). The first category includes steps to divert, prevent or treat excessive nutrient, silt and organic loads. This first category of technology may be insufficient to produce immediate and long-lasting effects due to internal nutrient recycling and associated algal/macrophyte production. Thus, a second category of technologies may be necessary which changes or controls internal physical, chemical or biological processes of the lake or reservoir. In the first category, several restoration techniques have been documented to achieve the physical and chemical control of nutrients (diversion, advanced waste treatment, dilution, flushing, sediment removal and hypolimnetic flushing or aeration). Likewise, several techniques in the second category such as plant biomass control measures (harvesting, biological controls, herbicide use) have also been documented.

Examples of both of these categories of restoration are found in the Lahontan Region. To prevent pollutant loading into Lake Tahoe, waste discharge prohibitions have been implemented and many millions of dollars have been spent on slope stabilization, revegetation and other remedial erosion control measures (see “Stormwater Runoff, Erosion, and Sedimentation” section in this Chapter). The clarity, nutrient levels and both phytoplankton and periphyton productivity in Lake Tahoe are carefully monitored. Transport of fine sediment particles to the lake, identified by the Lake Tahoe TMDL as a primary cause of deep water transparency decline, has been monitored since 2005 and will continue to be assessed. To prevent nutrient loading into Eagle Lake (Lassen County), waste discharge prohibitions are also implemented. The prolific growth of aquatic weeds in Twin Lakes of the Mammoth Lakes Basin often results in a weed harvest.

Generally, the Lahontan Regional Board encourages the restoration of water quality and beneficial uses through lake and reservoir restoration measures, particularly those techniques which prevent pollutant loading into lakes or reservoirs. However, to prevent possible detrimental impacts to water quality or beneficial uses from certain restoration techniques, the following control measures are necessary.

Control Measures for Lake/Reservoir Restoration

1. Erosion control and other nonpoint source control measures designed to prevent pollution loading into lakes and reservoirs must comply with proven, standard Best Management Practices (see BMP discussion in the Introduction to this Chapter). Proposed alternative BMPs may be considered on a case-by-case basis.

2. The Regional Board will review, and regulate as necessary, grazing practices and other land use practices to minimize damage to lake ecosystems and to restore damaged lakes. Where appropriate, the Regional Board may require a protection or buffer zone for the restoration project.

3. Herbicidal and algicidal chemicals have been associated with major adverse impacts on lake systems, none of which are considered restorative. These impacts include nutrient releases to the water after plant death, dissolved oxygen depletion following plant decay, toxic effects on nontarget organisms at recommended doses, rapid regrowth of plants following treatment, as well as conflicting and unresolved issues regarding the mutagenic and carcinogenic effects of some of the chemicals. Thus, the use of herbicides and algicides for lake/reservoir restoration purposes is strongly discouraged. The Regional Board’s regionwide prohibition for pesticides and control measures for pesticides, discussed in Chapter 4, is applicable to the use of herbicides and algicides for lake/reservoir restoration. The Regional Board may grant prohibition exemptions to allow the use of aquatic pesticides for lake/reservoir restoration projects only if the pesticide application project is proposed for the circumstances described in Chapter 4 under the section entitled “Circumstances Eligible for Prohibition Exemption” and according to the criteria under the section entitled, “Exemption Criteria for Aquatic Pesticide Use.”

4. Restoration projects which propose the use of biological controls will be carefully reviewed and regulated by the Regional Board if necessary to ensure the protection of beneficial uses of the lake/reservoir. To avoid the unintentional development of pest populations, review of

biological control proposals will be coordinated with the California Department of Fish Game.

5. Restoration techniques which could or will result in a waste discharge, such as sediment removal (see discussion on "Dredging" in the "Recreation" section of this Chapter), flushing, nutrient precipitation/removal, bank sloping, placement of woody debris, and/or placement of spawning gravel will be regulated as necessary by the Regional Board to ensure compliance with all provisions of this Basin Plan including waste discharge prohibitions. The prohibitions and exemption criteria for restoration work are discussed in the "Waste Discharge Prohibitions" section of this Chapter.

6. Any proposal to reduce the effect of lake/reservoir acidification (e.g., liming or calcite treatments, dilution) will be reviewed by the Regional Board on a case-by-case basis and will be regulated as necessary.

7. Eroding shorelines should be stabilized. Vegetative methods are strongly preferred unless structural methods are more cost-effective, considering the severity of wind and wave erosion, offshore bathymetry, and the potential adverse impacts on other shorelines and offshore areas.

   The USEPA (1993) summarizes information on a variety of shoreline protection practices. General considerations include design of all shorezone structures so that they do not transfer erosion energy or otherwise cause visible loss of surrounding shorezones; establishment and enforcement of no wake zones to reduce erosion potential from boat wakes, establishment of setbacks for upland development and land disturbance, and direction of upland drainage away from bluffs and banks so as to avoid accelerating slope erosion.

8. The Regional Board will recommend that all proposals for lake/reservoir restoration include adequate monitoring to evaluate the success of the project. The monitoring may include the establishment of baseline water quality, habitat assessment and biotic community data as a reference from which to evaluate project success, as well as monitoring after implementation of the restoration project. Where appropriate, the monitoring may be required by the Regional Board.

Recommended Future Actions for Lake/Reservoir Restoration

1. The Regional Board should encourage evaluation of past lake restoration efforts to guide future efforts.

2. The Regional Board should encourage lake restoration methods which promote a stable, self-sustaining system.

3. The Regional Board should support lake restoration projects which develop improved techniques for aquatic plant (macrophyte) and littoral zone management.

4. The Regional Board should support projects which result in the ability to predict a lake's trophic state from nutrient loading.

5. The Regional Board should support demonstration watershed-scale restorations which integrate lake components with river/stream and wetland components. Whenever possible, demonstration projects should be conducted outside of sensitive areas such as the Lake Tahoe Basin.

Potential Sources of Funds for Lake and Reservoir Restoration

A potential source of funds for lake restoration projects is the federal Clean Lakes Program. The Clean Lakes Program is administered by the U.S. Environmental Protection Agency (USEPA). The Program includes funding for both diagnostic and feasibility studies, and for implementation projects. The Regional Board coordinates with the State Board and the USEPA to solicit and evaluate lake restoration proposals, and also participates in the grant award process. State Board Nonpoint Source (§ 319), Water Quality Management (§ 205[j]) and Special Investigations Programs also are potential sources of funds for lake restoration projects.

River and Stream Restoration

Healthy, vegetated riparian habitat is essential to the natural ecological functioning of associated rivers and streams (National Research Council 1992). The removal of riparian vegetation by livestock, farming, logging, mining and urban development can result in wider, shallower and warmer streams and rivers, as well as introduction of excessive sediment loads and toxics from runoffinto the water. Flood control practices, such as straightening stream channels, can cause water to gouge wide, shallow channels, resulting in altered riparian vegetation.

Diversions have totally or almost totally dewatered some streams in the Lahontan Region, impairing or precluding the attainment of aquatic beneficial uses (e.g., the Owens Gorge, Mono Lake tributaries). Recent court decisions have required the rewatering of the Owens River Gorge and some Mono Lake tributaries. Where diversion is not total, lower flows, or changes in the timing of flows, can stress aquatic ecosystems through higher summer temperatures, greater winter ice formation, increases in the concentrations of pollutants, and other factors. Temperature and flow variations can affect critical life stages of aquatic organisms, and can change the nature and rate of nutrient and mineral cycles.

Environmental stresses to streams and rivers, such as those described above, can impact water quality parameters including temperature, turbidity, dissolved oxygen, nutrients and pH. The stresses can also impact aquatic habitat quality by affecting substrate type, water depth and velocity, spawning and nursery areas, and habitat diversity (pools, riffles, woody debris).

The goal of river and stream restoration is to restore the natural sediment and flow regimes, a natural channel morphology, the natural riparian plant community, and the native aquatic plants and animals (National Research Council 1992). River and stream restoration technology can be divided into the two categories of nonstructural and structural techniques. Both nonstructural and structural techniques can be used in species-centered restoration, such as restoring stream habitat to improve trout productivity, or in general restoration.

Nonstructural techniques include policies and procedures that limit or regulate activities such as withdrawal of water from a stream or land use practices such as grazing. Other examples of nonstructural techniques are the preservation or restoration of floodplains (see “Floodplain” discussion above), the establishment of riparian protection zones (buffer zones) and exclusion of riparian areas from heavy human and livestock use.

Structural techniques include installation or removal of instream structures, or modifications such as installation of fish ladders or selective water withdrawal structures to maintain downstream temperatures. Structural instream techniques also include placement of logs, root wads or artificial structures for habitat improvement and channel modifications. Structural bank modifications include use of vegetation for stabilization, bank sloping, sheet piling and riprap. These structural techniques can be divided into three types: biotechnical engineering (e.g., channel modification which uses vegetation); natural or “soft” engineering (e.g., restoration which uses local natural materials such as woody debris and alluvium), and “hard” hydraulic engineering (e.g., use of concrete, sheet piling, riprap).

Generally, the Lahontan Regional Board encourages the restoration of water quality and beneficial uses through stream and river restoration measures, particularly erosion control or other measures which prevent pollutant loading into streams and rivers. However, to prevent possible detrimental impacts to water quality or beneficial uses from certain restoration techniques, the following control measures are necessary.

Control Measures for River and Stream Restoration

1. Erosion control and other measures to prevent pollution loading must comply with proven, standard Best Management Practices (see BMP discussion in the Introduction to this Chapter). Proposed alternative BMPs may be considered on a case-by-case basis. The Regional Board will encourage erosion control by biotechnical or “soft” engineering approaches for bank stabilization and repair, where appropriate, in preference to dams, levees, channelization, riprap or other “hard” engineering approaches.

2. The Regional Board will review, and regulate as necessary, grazing practices and other land use practices to minimize damage to riparian ecosystems and to restore damaged streams and rivers. Where appropriate, the Regional Board may require a protection or buffer zone for the restoration project.

3. Restoration techniques which could or will result in a waste discharge such as bank sloping, placement of woody debris, and/or placement of spawning gravel or sediment removal, will be regulated as necessary by the Regional Board to ensure compliance with all provisions of this Basin Plan, including waste discharge prohibitions. The prohibitions and exemption criteria for restoration work are discussed in the “Waste Discharge Prohibitions” section of this Chapter.

4. The Regional Board will recommend that all proposals for river and stream restoration include adequate monitoring to evaluate the success of the project. The monitoring may include the establishment of baseline water quality, habitat assessment and biotic community data as a

reference from which to evaluate project success, as well as monitoring after implementation of the restoration project. Where appropriate, the monitoring may be required by the Regional Board.

Recommended Future Actions for River/Stream Restoration

1. The Regional Board should encourage evaluation of past river/stream restoration efforts to guide future efforts.

2. The Regional Board should encourage river/stream restoration methods which promote a stable, self-sustaining system. This could include designation of floodplain/riparian protection zones or removal of dikes/levees to reestablish connections between rivers, streams, riparian wetland areas and floodplains.

3. During the issuing or renewal of water rights permits (e.g., renewal of hydroelectric licenses, dam operating permits), the Regional Board should support opportunities to allocate waters to instream uses. Similarly, the Regional Board should support opportunities to allocate waters to instream uses when water conservation efforts result in surplus water.

4. The Regional Board should support demonstration watershed-scale restorations which integrate river/stream components with lake and wetland components. Whenever possible, demonstration projects should be conducted outside of sensitive areas such as the Lake Tahoe Basin.

Potential Sources of Funds for Stream/River Restoration

Federal Clean Lakes Program funds are also available for projects affecting tributaries into lakes (see program description above). River and stream restoration funds are available from the State Board Nonpoint Source (§ 319), Water Quality Management Programs (§ 205[j]) and Special Investigations Programs. Funds for urban stream restoration are available from the California Department of Water Resources. Urban stream restoration funds are awarded to reduce damage from flooding and from bank erosion while restoring the aesthetic value of the stream.

Wetland Restoration

(Creation of artificial wetlands for mitigation purposes is discussed in the “Wetlands Protection” section above; SEZ restoration is discussed in the Lake Tahoe Chapter.)

Unlike lakes and rivers, wetlands have not always been considered as valuable natural resources. Thus, in California, an estimated 91 percent of wetlands have been lost due to alterations in their biological, chemical and physical properties (National Research Council 1992). Biological alterations include damage to or removal of natural biota, including impacts from the introduction of non-native plants and animals. Many riparian wetland areas of the Owens River have been impacted by grazing which causes soil compaction and destruction of the natural wetland vegetation. Physical alterations include changes in the hydrology and topography which support the wetland. Mono Basin wetlands have been impacted by water diversions, as have wetlands in the Owens River basin. Draining wetlands for agriculture, dredging and filling in rivers and lakes and construction of dams all can physically damage wetlands. Construction of the Tahoe Keys subdivision at the delta of the Upper Truckee River into Lake Tahoe resulted in dredge and fill of over 300 acres of wetlands. Point and nonpoint source runoff can chemically alter wetlands by discharging nutrients, toxic, hazardous or other chemical wastes into the wetland.

Wetland restoration techniques include reestablishing flow (restoring river flows, restoring flood regimes, controlling drainage) reestablishing topography (removing fill, replacing dredged materials), controlling pollutant loading and reestablishing wetland biota.

Generally, the Lahontan Regional Board encourages the restoration of water quality and beneficial uses through wetland restoration measures, particularly erosion control or other measures which prevent pollutant loading into the wetlands. However, to prevent possible detrimental impacts to water quality or beneficial uses from certain restoration techniques, the following control measures are necessary.

Control Measures for Wetland Restoration

1. Erosion control and other measures to prevent pollution loading into the wetland restoration site must comply with proven, standard Best Management Practices (see BMP discussion in the Introduction to this Chapter). Alternative management practices may be considered on a case-by-case basis.

2. The Regional Board will review, and regulate as necessary, grazing practices and other land use practices to minimize damage to wetland ecosystems and to restore damaged wetlands.

Where appropriate, the Regional Board may require a protection or buffer zone for the restoration project.

3. Restoration techniques which could or will result in a waste discharge, such as removal of fill or replacement of dredged materials, will be regulated as necessary by the Regional Board to ensure compliance with all provisions of this Basin Plan, including waste discharge prohibitions. The prohibitions and exemption criteria for restoration work are discussed in the "Waste Discharge Prohibitions" section of this Chapter.

4. The Regional Board will recommend that all proposals for wetland restoration include adequate monitoring to evaluate the success of the project. The monitoring may include the establishment of baseline water quality, habitat assessment and biotic community data as a reference from which to evaluate project success, as well as monitoring after implementation of the restoration project. The monitoring may include sampling off the project site wherever affected by the restoration. Where appropriate, the monitoring may be required by the Regional Board.

5. In instances where natural wetlands are to be restored for the main purpose of wastewater treatment (including stormwater treatment), the Regional Board will determine the applicability of water quality standards to the wetland on a case-by-case basis, and may elect to develop site-specific objectives. In its determination, the Regional Board will consider factors such as size, type of waste to be treated, location, degree of isolation of the created wetlands, and other appropriate factors.

Recommended Future Actions for Wetland Restoration

1. The Regional Board should encourage evaluation of past wetland restoration efforts to guide future efforts.

2. The Regional Board should encourage wetland restoration methods which promote a stable, self-sustaining system.

3. The Regional Board should encourage wetland restoration assessment to evaluate both structural (hydrology, flora, fauna) and functional (sediment retention, nutrient cycling) parameters.

4. The Regional Board should promote projects which will result in more natural wetland restoration (e.g., native wetland plant propagation, baseline studies of natural wetland ecosystems).

5. When practical, where wetland restoration is required as mitigation, the Regional Board should require that the mitigation is completed **before** allowing wetland damage to occur.

6. The Regional Board should support demonstration watershed-scale restorations which integrate wetland components with lake and river/stream components. Whenever possible, demonstration projects should be conducted outside of sensitive areas such as the Lake Tahoe Basin.

Potential Sources of Funds for Wetland Restoration

The State and Regional Board coordinate in submittal and administration of federal wetland grants issued under Clean Water Act § 104(b)(3). The focus of these grants is wetland protection but wetland restoration can be included when it is part of an overall wetland protection program. Other grant programs (e.g., § 314, § 319, § 205[j]) administered by the State Board may also provide funds for wetland restoration.

Atmospheric Deposition ("Acid Rain" and Dry Deposition of Pollutants)

Public concern over the impacts of air pollutants on water quality has increased in recent years. Acidic rain, snow, and fog have been measured in California. Dry deposition of pollutants can also occur directly onto surface waters. Nitric acid from vehicle emissions tends to be the most important acidic pollutant, in contrast to the eastern United States where sulfuric acid from the burning of coal is more abundant. Organic acids are also present in acid rain. The California Air Resources Board (CARB) has documented long distance transport of pollutants from urban coastal areas to the Sierra Nevada and the Mojave Desert. The CARB is sponsoring long-term research on the impacts of wet and dry deposition of air pollutants on Sierra Nevada ecosystems. Although much of this research is centered on the west slope of the Sierra, the results are applicable to comparable soils and waters of the Lahontan Region.

Atmospheric deposition is of concern because of the direct and indirect impacts of acidification on beneficial uses of water, and because of the potential for increased eutrophication due to the deposition of nitrogen, which is known or presumed to be the limiting nutrient for many Sierra waters. Many of the high elevation lakes and streams of the Lahontan Region naturally have very low alkalinity, and their granitic watersheds provide very little buffering capacity for incoming acidity. Short-term drops in the pH of streams in the Lake Tahoe Basin have been documented during the snowmelt season (U.S. Forest Service, Lake Tahoe Basin Management Unit 1990) but the long-term acidification of surface waters in the Lahontan Region has not been conclusively documented. Limited sampling by the U.S. Environmental Protection Agency (1987) and the Department of Fish and Wildlife (McClenaghan et al. 1987) demonstrated that some Lahontan Region lakes have pH values below the 6.5 unit objective in Chapter 3 of this Plan. However, in the absence of long-term baseline monitoring data for most of these lakes, it is difficult to ascertain whether these low pH values are natural or the result of acidification.

Changes in pH may stress or kill aquatic organisms directly. Spring flushes of acidity accumulated in winter snowpacks may be directly damaging. Experiments have shown that acidity increases the tendency of benthic invertebrates to leave their stream substrates and “drift” downstream. This obviously affects local nutrient and energy cycling and the availability of food for fish. Acidity also affects aquatic biota by changing the mobility of nutrients and toxic trace elements in soils, and their availability in waters. In the eastern United States, the increased availability of aluminum as a result of acidification is a major factor in the decline of fish populations. There are naturally high levels of metals in many Lahontan Region watersheds, as shown by the large number of inactive mines and the results of the Toxic Substances Monitoring Program (see Chapter 7). Increased mobilization of these metals due to atmospheric deposition would be of great concern. Through one or more of these mechanisms, atmospheric acidity may be involved in the documented declines of amphibian populations in the Sierra Nevada in the 1980s.

Although the magnitude of the impacts is still controversial, acid deposition has been linked to “forest decline” in the northeastern U.S. and in Europe. The CARB has documented stress to forest trees in the San Bernardino Mountains from air pollutants from the South Coast air basin. The death of terrestrial vegetation may affect nutrient loading to surface waters by increasing rates of erosion and reducing nutrient uptake. Studies in and near the Lake Tahoe Basin have shown that undisturbed meadow soils and vegetation are capable of removing at least 98% of the nitrogen in incoming precipitation.

The impacts of direct wet and dry nutrient deposition on eutrophication of surface waters have not been studied for most surface waters of the Lahontan Region. Logically, one would expect such eutrophication to occur in small, shallow lakes near the Sierra crest which receive more precipitation than waters further east. Such eutrophication has not been documented.

Atmospheric deposition is considered a significant part of the nitrogen budget of Lake Tahoe. Precipitation chemistry in the Lake Tahoe Basin has been monitored on an ongoing basis since the early 1980s. Direct deposition on the Lake has also been studied by the University of California Tahoe Environmental Research Center and the California Air Resources Board (CARB). Studies by these groups, as reported in the Lake Tahoe TMDL Technical Report, indicate that 69 percent of nitrogen deposition on Lake Tahoe originates locally, with the remaining 31 percent coming from regional sources. Combined, these sources annually contribute an estimated 218 metric tons of total nitrogen to Lake Tahoe..

Atmospheric deposition is also a key source of fine sediment particle deposition to the lake. The Lake Tahoe TMDL estimates that approximately 16 percent of Lake Tahoe’s total fine sediment particle load is from atmospheric deposition. Over 70 percent of this atmospheric particulate load is from in-basin sources. The primary in-basin source of fine sediment particles is dust from paved and unpaved roads and construction sites, and other disturbed land. Atmospheric nutrients are important considerations for Lake Tahoe because of the lake's large surface area in relation to the size of its watershed, and the long residence time of lake waters (about 700 years).

Recommended Control Measures for Acid Deposition

1. The control of air pollution is outside of the authority of the State and Regional Boards. However, these agencies should work with state and regional air pollution control, transportation, and land use planning authorities to ensure that atmospheric deposition continues to be monitored, and that pollution emissions are minimized to the greatest extent feasible.

2. The CARB expects to continue studying the impacts of acid deposition on aquatic ecosystems, and has been directed to consider the feasibility of air quality standards for areal loading of pollutants (e.g., kilograms of nitrogen per hectare per year). Regional Board staff should continue to review CARB reports related to water quality issues and should comment on the loading standards if and when they are proposed.

3. The State and Regional Boards should work with the Department of Fish and Wildlife, the Department of Water Resources, and university researchers to ensure that adequate biological and chemical monitoring of Lahontan Region waters is done so that trends toward acidification and/or eutrophication as a result of atmospheric deposition can be detected before such problems become significant and perhaps irreversible.

4. Restoration techniques for acidified waters (e.g., liming) are being developed, largely in the eastern United States. However, these methods are expensive, require long-term maintenance, and are probably not feasible for the remote lakes in federal wilderness areas which are the most vulnerable to acidification.

5. Regional Board staff should consider atmospheric nutrient loading when constructing nutrient budgets for specific watersheds, for use in wasteload allocations and effluent limitations, and for revisions to receiving water objectives. Atmospheric deposition may be an important consideration in stormwater NPDES permits (see the “Stormwater Runoff” section of this Chapter). Staff should evaluate whether existing objectives for nutrients, pH, and biological communities are adequate to protect beneficial uses threatened by acidification. Additional site specific objectives may be necessary.

6. The Tahoe Regional Planning Agency has adopted a regional “environmental threshold carrying capacity” standard to reduce annual “vehicle miles travelled” (VMT) within the Lake Tahoe Basin by 10% from the 1981 level in order to reduce nitrogen oxide emissions and consequent atmospheric deposition to the Lake. The 208 Plan (TRPA 1988), outlines control measures to be implemented by TRPA and local governments to reduce atmospheric nutrient deposition. These include increased and improved mass transit; redevelopment, consolidation, and redirection of land uses to make transportation systems more efficient; controls on combustion heaters and other stationary sources of air pollution; protection of vegetation, soils, and the duff layer; and controls on offroad vehicles to control suspension of nutrient-laden dust.

Table 4.9-1
List of rivers in Lahontan Region determined eligible for National Wild & Scenic River designation by federal land management agencies

Hydrologic Unit Number	Name of river/creek followed by managing agency	NF = National Forest; RA =USBLM Resource Area
601	Lee Vining Creek	Inyo NF
601	Mill Creek	Inyo NF
601	South Fork Mill Creek	Inyo NF
601	Upper Parker Creek	Inyo NF
603	Walker Creek	Inyo NF
603	Convict Creek	Inyo NF
603	Cottonwood Creek (Sierra Nevada)	Inyo NF
603	Fish Slough	Bishop RA
603	George Creek	Bishop RA
603	Glass Creek	Inyo NF
603	Hot Creek	Inyo NF & Bishop RA
603	Independence Creek	Bishop RA
603	Laurel Creek	Inyo NF
603	Lone Pine Creek	Inyo NF
603	McGee Creek	Inyo NF
603	Rock Creek	Inyo NF & Bishop RA
603	South Fork Bishop Creek	Inyo NF
603	Upper Owens River	Inyo NF
628	Mojave River (Afton Canyon)	Barstow RA
630	Atastra Creek	Bishop RA
630	Dog Creek	Bishop RA
630	East Walker River	Toiyabe NF
630	Green Creek	Bishop RA
630	Rough Creek	Bishop RA
630	Virginia Creek	Bishop RA
631	West Walker River	Toiyabe NF
632	East Fork Carson River	Toiyabe NF
634	Cold Creek	Tahoe NF
634	Martis Creek	Tahoe NF
634	Upper Truckee River	LTBMU
635	Alder Creek	Tahoe NF
635	Lower Truckee River	Tahoe NF
636	Independence Creek	Tahoe NF
636	Little Truckee River	Tahoe NF
636	Perazzo Canyon	Tahoe NF
636	Sagehen Creek	Tahoe NF

Table 4.9-2
SUGGESTED METHODS FOR EVALUATING
WETLAND FUNCTIONS AND VALUES

Function/Value	Suggested Methods of Evaluation
HYDROLOGY	
Surface Water Inflow/Outflow	Monitor flow rates; hydrological model of watershed dynamics (usually a simple model of extent of wetland, timing and volume of inputs, depth and duration of flooding, discharge from wetland); install and monitor staff gages.
Ground Water Discharge/Recharge	Monitor water levels in appropriate wells; Install and monitor piezometers; Model of watershed dynamics (see above).
Nutrient Supply and their limiting factors	Analyze soil texture and organic matter content; Determine soil and pore water nutrient concentrations; Sample inflowing and outflowing waters for nutrient concentrations (use to estimate nutrient removal); Survey for toxic substances; Conduct bioassays for limiting factors.
Flood Storage	Monitor water levels in relation to flow velocity; Model of watershed dynamics (see above).
Erosion/Accretion/Sedimentation	Measure in channels and in wetlands
Shoreline Stabilization	Map shoreline from aerial photographs; Install and monitor markers.
PRODUCTIVITY	Assess cover of floating or epibenthic algae by calculating change in biomass through time; also see "Plant Growth" below.
VEGETATION	
Plant Cover	Use aerial photographs to determine cover of dominant species; Verify aerial photograph determinations by using methods such as belt transect (forested wetlands), replicate transect (herbaceous wetlands), multiple quadrants (shrub dominated wetlands); Establish and use fixed point panoramic photograph locations.

(from National Research Council, 1992; Kusler and Kentula, 1990)

Table 4.9-2 (continued)
SUGGESTED METHODS FOR EVALUATING WETLAND FUNCTIONS AND VALUES

Function/Value	Suggested Methods of Evaluation
VEGETATION (CONTINUED)	
Plant Growth and its Limiting Factors	Measure end-of-season live standing crop (EOSL); use linestrip/elongated quadrant (to monitor survival and growth of weedy species); Assess/monitor organic matter composition; Measure soil redox potential; Measure nutrient content of inflowing waters; Establish and use fixed point panoramic photograph locations.
Sensitive Plant Species/Communities	Quantitatively survey populations of sensitive plant species; Determine life history characteristics to predict ability to survive in restored wetland (e. g., numbers, seed production and germination, seedling establishment, recruitment).
WILDLIFE / FISHERY HABITATS	Survey/censuses; Sample community composition, seasonally if necessary, including macroinvertebrate sampling (artificial substrate samplers); reliable observations (record habitat use and movements between habitats, identify areas for feeding, nesting, refuge, spawning, nursery.
Sensitive Species/Communities	Quantitatively survey populations; Determine life history characteristics to predict ability to survive.
RESILIENCE	Follow recovery of species impacted by environmental extremes; Establish and use fixed point panoramic photograph locations.
RESISTANCE TO INVASIVE EXOTICS	Map occurrence of weedy plants, and rank species abundance; census exotic animals and evaluate population (stable, declining, increasing).
RECREATION (Contact and non-water contact)	Survey recreational uses.
ECOLOGICAL WATERSHED CONTEXT	Use analytical models to evaluate the relationships between wetland, upland, and transitional areas in terms of factors such as flood control, habitat, and food chain support.

(from National Research Council, 1992; Kusler and Kentula, 1990)

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