Chapter 5
WATER QUALITY STANDARDS AND CONTROL MEASURES FOR THE LAKE TAHOE BASIN

Introduction

Lake Tahoe is a designated Outstanding National Resource Water1 (ONRW) that is renowned for its extraordinary clarity and purity, and deep blue color. Since the 1960s, Lake Tahoe has become impaired by declining deep water transparency and increasing phytoplankton productivity due to increased fine sediment particles and nutrient loading attributable to human activities (Figures 5-1 and 5-2). Fine sediment particles are defined as sediment particles less than 16 microns in diameter. Further increases in algal growth could change the clear blue color of the Lake. Algal growth is fed by nitrogen and phosphorus. Phosphorus sorbed to fine sediment particles is responsible for the majority of Lake Tahoe's phosphorus load. Degradation of Lake Tahoe is controlled by federal and state antidegradation regulations and guidelines. Attainment of deep water transparency and productivity standards requires control of nutrient and fine sediment particle loading, which in turn requires (1) export of domestic wastewater and solid waste from the Lake Tahoe watershed, (2) restrictions on new development and land disturbance, and (3) remediation of a variety of point and nonpoint source problems related to past human activities in the Tahoe Basin. This Chapter summarizes a variety of control measures for the protection and enhancement of Lake Tahoe that in many cases are more stringent than those applicable elsewhere in the Lahontan Region.

For the reader's convenience, this Chapter contains copies of some information on water quality objectives, beneficial use designations, and waste discharge prohibitions for waters of the Lake Tahoe Basin that is also included in Chapters 2, 3, and 4 of this Basin Plan.

Water Quality Problems and Control Needs

Steep slopes, erodible soils, and a short growing season make the Lake Tahoe Basin acutely sensitive to human activities. Development practices and ongoing soil disturbing land uses that may have little impact elsewhere can cause severe erosion in the Tahoe Basin, increasing fine sediment particle, nitrogen and phosphorus loads to Lake Tahoe. The level of algal growth in the lake is limited by the availability of nutrients; the concentration of nutrients in the lake at present is extremely low. The primary source of additional phosphorus is erosion resulting from land development and ongoing soil disturbance associated with land management practices. Lake Tahoe has historically been considered nitrogen limited; recent bioassays indicate that phosphorus is also becoming limiting. It is important to control **all** controllable sources of both nitrogen and phosphorus. Development disturbs vegetation and soils, and creates impervious surface coverage that interferes with natural nutrient and fine sediment particle removal mechanisms. Other sources of nutrients include fertilizers, sewer exfiltration and sewage spills, and leachate from abandoned septic systems, and atmospheric deposition.

Fine sediment particles are independently responsible for approximately two thirds of the lake's deep water transparency loss. The mechanism for transparency loss from fine sediment particles is the scattering of light in the water column. This contrasts with deep water transparency loss due to light absorption caused by enhanced phytoplankton productivity. Runoff from roadways and other urbanized landscapes are the primary sources of fine sediment particles reaching the lake.

Phytoplankton productivity in Lake Tahoe increased more than 420 percent, and deep water transparency decreased by 31 percent, between 1968 and 2007. (Water quality standards for clarity and phytoplankton productivity are based on 1968-1971 levels.) Increased growth of attached algae in nearshore waters may be linked to the level of onshore development. The Regional Board is addressing Lake Tahoe's nearshore water quality through collaborative investigation and regulatory actions. Pollutant load reduction actions taken to implement the Lake Tahoe TMDL are anticipated to improve the nearshore environment by decreasing pollutant loads entering the lake. Additional analysis, however, is needed to determine whether different resource management actions are needed to address the nearshore condition. While targeted load reduction actions may or may not immediately address

1 **Note:** ONRWs are described in Chapter 4. See the subsection entitled "Special Designations to Protect Water Resources" within Section 4.9, "Resources Management and Restoration."

localized pollutant discharges to the nearshore, long term, basin-wide pollutant load reduction efforts are expected to improve the nearshore condition. The Regional Board will evaluate results of ongoing research related to nearshore conditions and take appropriate actions if necessary to improve nearshore conditions.

Although the primary purpose of the implementation program in this Chapter is to protect and enhance the water quality and beneficial uses of Lake Tahoe, it will also protect tributary waters. There are 170 other lakes, 63 tributary streams, and numerous wetlands in the Lake Tahoe Basin; most of the lakes and about half of the streams are in California. There are also two named ground water basins in the California portion of the watershed. Most of these waters have naturally high quality, and state and federal antidegradation regulations apply. The Upper Truckee River and the lower Truckee River downstream of the Lake Tahoe dam are under study for inclusion in the National Wild and Scenic Rivers System. Although many of the lakes are within wilderness areas, they are threatened by heavy recreational use and atmospheric deposition. Other tributary waters have been adversely affected by erosion, stormwater, diversion, channelization, or filling. In particular, wetlands have been drastically disturbed by human activities; see the section on Stream Environment Zones (SEZs) below.

The water quality control program for the Lake Tahoe Basin treats erosion and surface runoff (stormwater) as different facets of the same problem. Reducing nutrient and fine sediment particle loads will require remedial measures to correct existing erosion/runoff problems. The principal control measures are:

- Large-scale erosion remediation, stormwater treatment, and drainage control and SEZ restoration projects.

- Installation and maintenance of onsite erosion and surface runoff (stormwater) control measures in connection with all new and existing development.

- Controls on discharges related to other activities including timber harvest, livestock confinement and grazing, and recreational facilities (including golf courses, dredging, and shorezone construction to support water-related recreational activities).

In addition to the control measures for sediment and nutrients, regionwide control measures for toxic pollutants, needed for attainment of the water quality objectives in the USEPA's National Toxics Rule, section 131.36 of 40 CFR (12/22/92), and California Toxics Rule, section 131.38 of 40 CFR (5/18/00), which are incorporated by reference, apply to the Lake Tahoe Basin. Because the Lake Tahoe program emphasizes the use of wetlands (SEZs) for stormwater treatment, the attainment of objectives for toxic metals and whole effluent toxicity in waters affected by stormwater discharges must be given special consideration. Control measures to ensure attainment of the objective for nondegradation of biological communities and populations are also of concern in relation to stormwater discharges.

Implementation Authority

Implementation of the water quality control programs discussed in this Chapter is a bistate, interagency effort. Many of the control measures can best be implemented by local governments or the Tahoe Regional Planning Agency (TRPA), but the Lahontan Regional Board and State Water Resources Control Board are ultimately responsible for implementation of those controls within their authority. To the extent that other agencies do not make and fulfill implementation commitments, the Regional Board may require implementation of these control measures. Similar control measures are being implemented by TRPA and the Nevada Division of Environmental Protection in Nevada.

The Lahontan Regional Board's authority for planning, regulation, and enforcement is discussed in greater detail in Chapters 1 and 4 of this Basin Plan. The Regional Board implements the federal Clean Water Act, portions of the California Water Code (including the Porter-Cologne Act) and a variety of laws related to control of solid waste and toxic and hazardous wastes. The Regional Board has authority to set and revise water quality standards and discharge prohibitions. It may issue permits, including federal NPDES permits and Section 401 water quality certifications, and State waste discharge requirements or waivers of waste discharge requirements. Its planning and permitting actions require compliance with the California Environmental Quality Act (CEQA). The Regional Board has broad enforcement authority; actions may range from staff enforcement letters, through cleanup and abatement or cease and desist orders, to civil penalties or referral to the California Attorney General.

The State Board has authority to review Regional Board planning, permitting and formal enforcement actions. It sets statewide water quality policy. It may also adopt water quality standards and control measures on its own initiative. Other State Board functions that may affect the Lake Tahoe Basin include loan and grant funding for wastewater

treatment facilities and nonpoint source control projects, and water rights permitting authority.

The TRPA's authority comes from P.L. 96-551 and from the water quality planning functions delegated by California, Nevada, and the USEPA under Section 208 of the Clean Water Act. TRPA has a bistate Governing Body with appointed members, an Advisory Planning Commission that includes a Lahontan Regional Board representative, and a technical staff under an Executive Director. It may set regional environmental standards, issue land use permits including conditions to protect water quality, and take enforcement actions. TRPA is directed to ensure attainment of the most stringent state or federal standards for a variety of environmental parameters in addition to water quality; for example, it is a designated air quality and transportation planning agency in California. TRPA has delegated authority to review certain types of new development to local governments under Memoranda of Understanding (MOUs). P.L. 96-551 establishes a TRPA environmental review process that is legally separate from CEQA and from the National Environmental Policy Act (NEPA). TRPA's Code of Ordinances and its MOUs with federal, state and local governments identify categories of projects and activities that are exempt from TRPA's review.

The U.S. Forest Service (USFS), Lake Tahoe Basin Management Unit (LTBMU), controls over 70 percent of the land in the Lake Tahoe Basin. It implements a land and resource management plan (USFS 1988, amended 2004 and 2007) and the statewide USFS 208 Plan (USFS 1979). In contrast to some National Forest plans that emphasize resource extraction activities such as timber harvest, the major emphasis of the LTBMU plan is water quality protection. The LTBMU has an ongoing watershed restoration program, and implements a land acquisition program to prevent development of sensitive private lands. It has permitting and enforcement authority over activities by other parties on National Forest lands. USFS activities and permits are subject to environmental review under NEPA. The Lahontan Regional Board may issue waste discharge requirements or a waiver of waste discharge requirements for timber harvest activities by the LTBMU in the Tahoe Basin. It may also issue permits for other activities on National Forest land (e.g., ski area expansion).

Local governments in the Lake Tahoe Basin have been delegated authority by TRPA to implement its plans for certain types of development projects. They also have major responsibility for implementing the remedial projects for water quality problems that are discussed later in this Chapter.

Other agencies involved in implementation of water quality control measures in the California portion of the Tahoe Basin include the U.S. Army Corps of Engineers, the U.S. Natural Resources Conservation Service, the California Department of Transportation (Caltrans), the California Tahoe Conservancy, the California State Lands Commission, the California Department of Parks and Recreation, the California Department of Fish and Wildlife, the California Department of Forestry and Fire Protection, and the Tahoe Resource Conservation District. Monitoring carried out by the LTBMU, the U.S. Geological Survey, the University of California Tahoe Environmental Research Center, the California Department of Water Resources, and other agencies continues to be important in assessing progress on implementation.

Jurisdictional Boundaries

The California water quality standards and discharge prohibitions, and most of the control measures discussed later in this Chapter apply to the “Lake Tahoe Basin” or “Lake Tahoe Hydrologic Unit (HU),” which is the entire watershed tributary to and including Lake Tahoe in California. This area (Figure 5-3) includes portions of Alpine, El Dorado, and Placer Counties. The TRPA Compact established the “Lake Tahoe Region,” which is defined by P.L. 96-551. The Lake Tahoe Region includes lands in El Dorado and Placer Counties (California) and Douglas, Carson City, and Washoe Counties (Nevada) that are tributary to Lake Tahoe. It does not include the Alpine County portion of the Lake Tahoe watershed, but does include part of the Truckee River HU, between the Lake Tahoe outlet dam and the Bear Creek confluence (Figure 5-4).

The Alpine County portion of the watershed is almost all National Forest land, but includes some State highway right-of-way and part of the South Tahoe Public Utility District (STPUD) wastewater export pipeline. The Regional Board has reviewed fisheries management activities, grazing permits, and proposed watershed restoration activities in this portion of the Tahoe Basin. It is a popular recreation area that includes a segment of the Pacific Crest Trail. All of the control measures discussed below for construction and other activities on National Forest lands, or for road and right-of-way construction and maintenance, apply in this area, even though TRPA permits may not apply. The Regional Board will consider issuing or revising waste discharge permits for activities in this area as necessary to protect water quality.

In the portion of the Truckee River watershed that is within TRPA's jurisdiction, the Lahontan Regional

Board implements a separate set of water quality standards, discharge prohibitions, and exemption criteria. This area includes existing residential, commercial, and highway development.

Figure 5-1
ANNUAL AVERAGE SECCHI DISK DEPTH
AT THE INDEX STATION, LAKE TAHOE
(UC DAVIS, 2010)

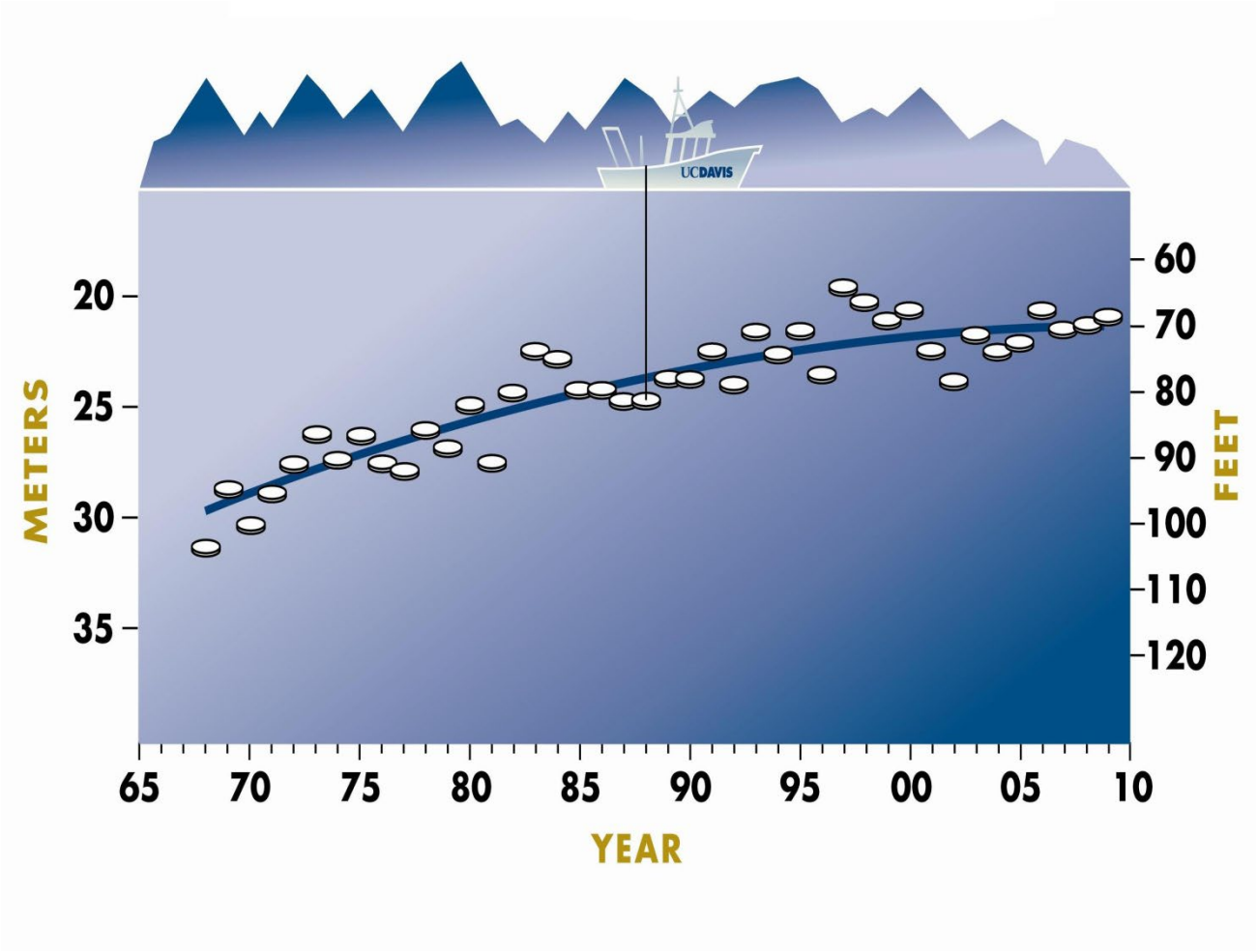


Figure 5-2
PRIMARY PRODUCTIVITY
AT THE INDEX STATION, LAKE TAHOE
(UC DAVIS, 2010)

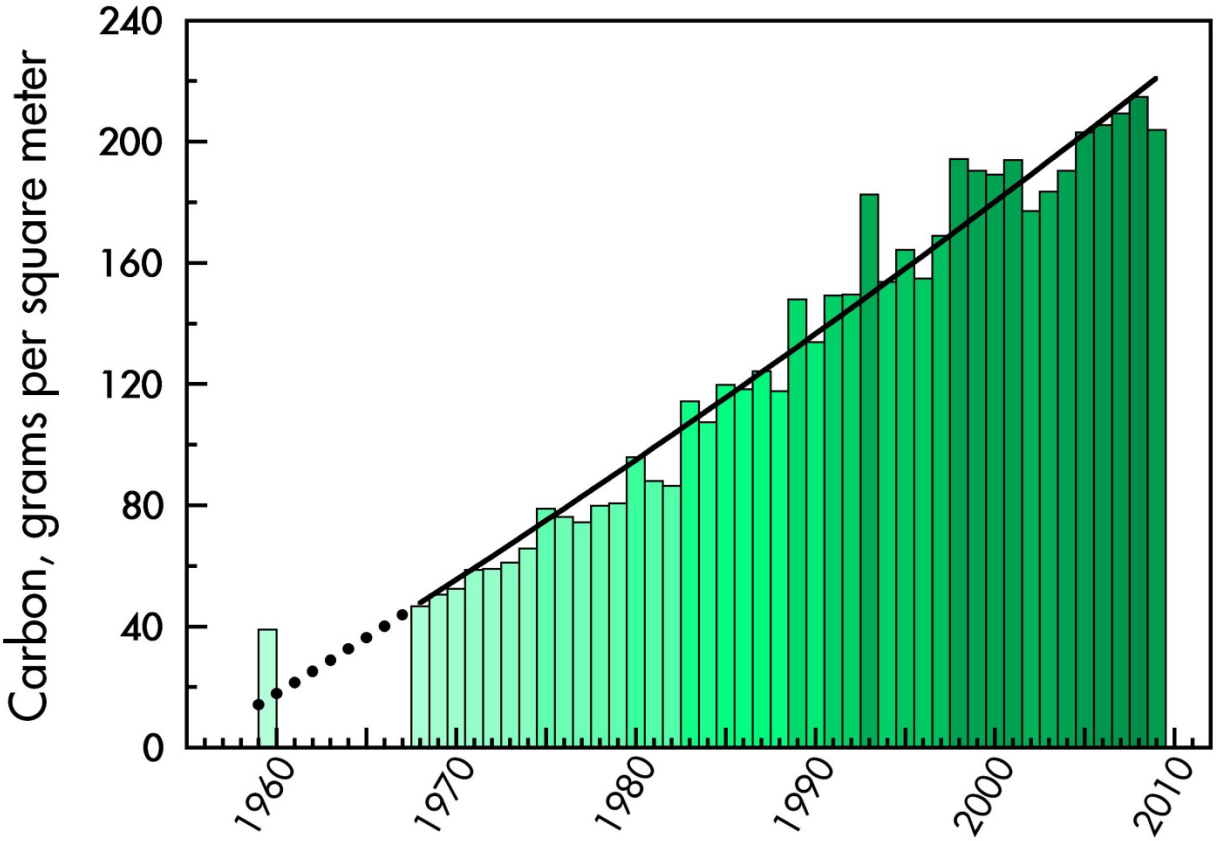
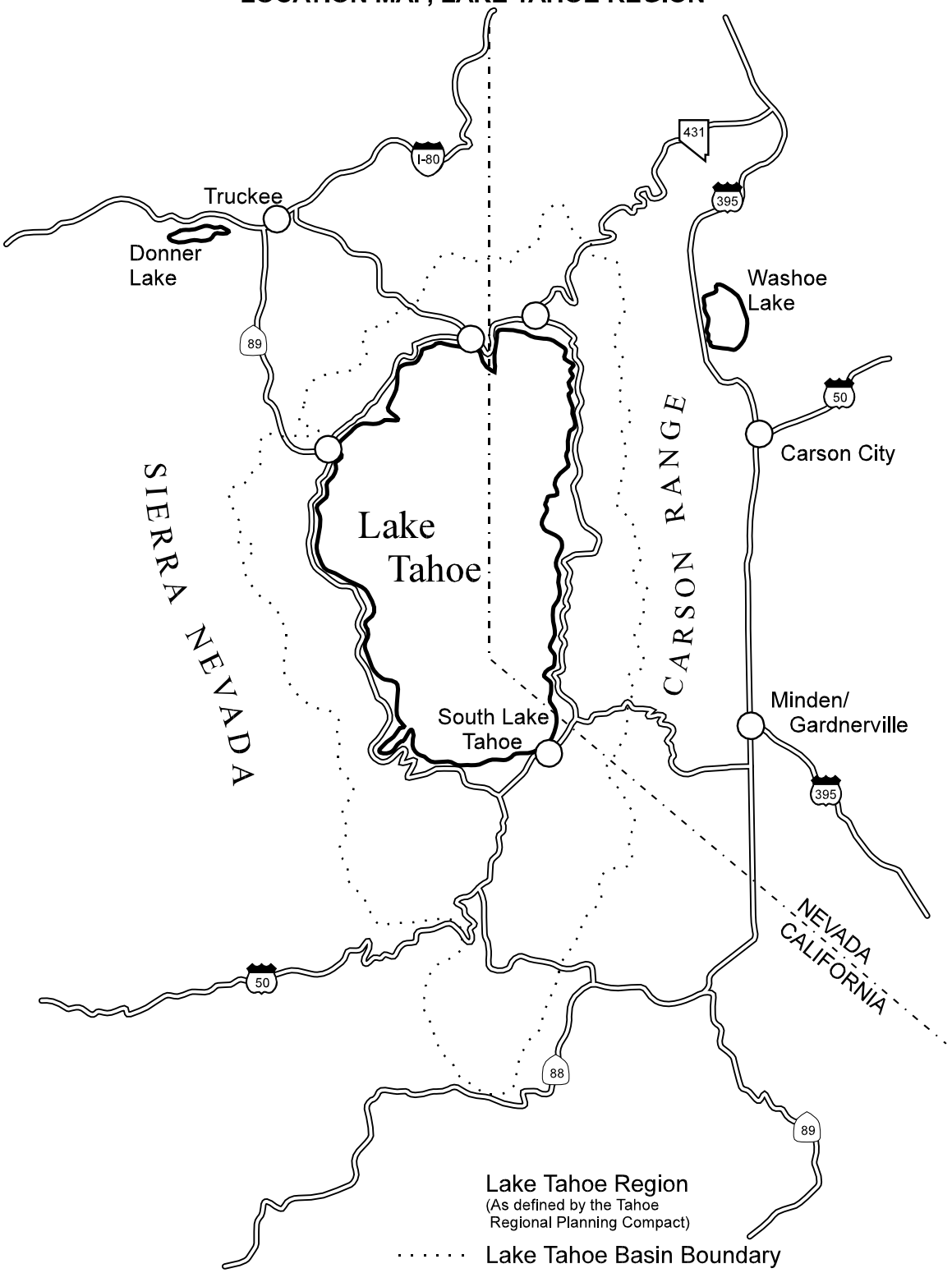
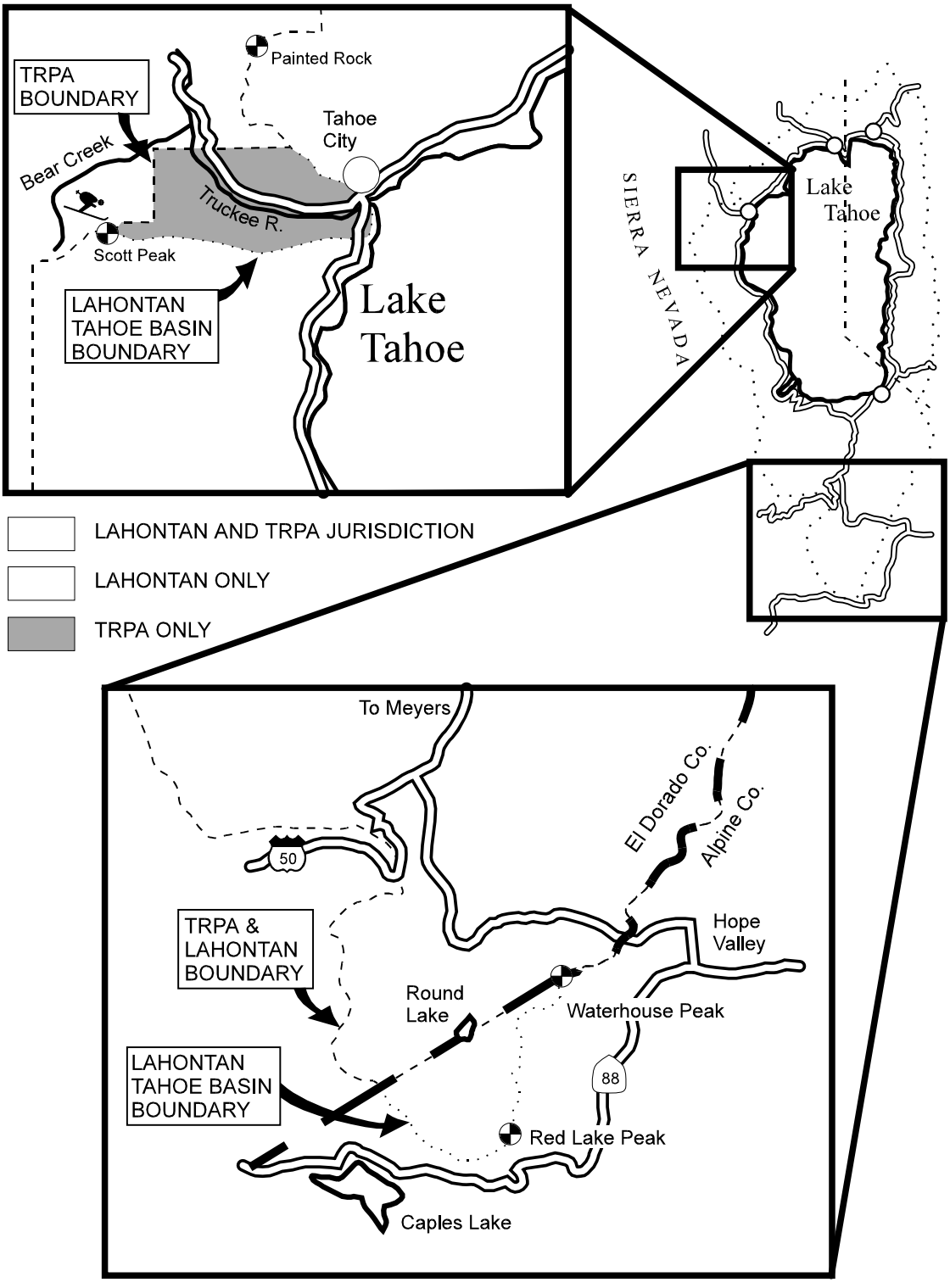


Figure 5-3
LOCATION MAP, LAKE TAHOE REGION



Redrawn from TRPA, 1988, Vol.1

Figure 5-4
LAHONTAN AND TRPA VARIATIONS IN JURISDICTIONAL BOUNDARIES FOR THE LAKE TAHOE BASIN



5.1 WATER QUALITY STANDARDS

The federal Clean Water Act defines "water quality standards" to include both "designated uses" (i.e., beneficial uses) and "water quality criteria" (i.e., water quality objectives). Thus, the designated beneficial uses and the water quality objectives listed below are the California water quality standards for waters of the Lake Tahoe Hydrologic Unit (HU).

Twenty-three beneficial uses and their definitions were developed by the State Board staff and recommended for use in the Regional Board Basin Plans. Three of those beneficial uses (Marine Habitat, Estuarine Habitat, and Shellfish Harvesting) are not found within the Region. Regional Board staff added two additional uses (Water Quality Enhancement, Flood Peak Attenuation/Flood Water Storage). Thus, the following nine beneficial use designations have been added since adoption of the 1975 Basin Plans: Industrial Process Supply, Fish Spawning, Fish Migration, Navigation, Commercial and Sport Fishing, Water Quality Enhancement, Preservation of Biological Habitats of Special Significance, Aquaculture, and Flood Peak Attenuation/Flood Water Storage. Specific wetland habitats and their associated beneficial uses has been added in recognition of the value of protecting wetlands. This Chapter contains two tables (Tables 5.1-1 and 5.1-2) designating the beneficial uses of surface waters and ground waters in the Lake Tahoe HU.

Definitions of Beneficial Uses

AGR **Agricultural Supply**. Beneficial uses of waters used for farming, horticulture, or ranching, including, but not limited to, irrigation, stock watering, and support of vegetation for range grazing

AQUA **Aquaculture**. Beneficial uses of waters used for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, and harvesting of aquatic plants and animals for human consumption or bait purposes.

BIOL **Preservation of Biological Habitats of Special Significance**. Beneficial uses of waters that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, and Areas of Special Biological Significance (ASBS), where the preservation and enhancement of natural resources requires special protection.

COLD **Cold Freshwater Habitat**. Beneficial uses of waters that support cold water ecosystems including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.

COMM **Commercial and Sportfishing**. Beneficial uses of waters used for commercial or recreational collection of fish or other organisms including, but not limited to, uses involving organisms intended for human consumption.

FLD **Flood Peak Attenuation/Flood Water Storage**. Beneficial uses of riparian wetlands in flood plain areas and other wetlands that receive natural surface drainage and buffer its passage to receiving waters.

FRSH **Freshwater Replenishment**. Beneficial uses of waters used for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).

GWR **Ground Water Recharge**. Beneficial uses of waters used for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

IND **Industrial Service Supply**. Beneficial uses of waters used for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, geothermal energy production, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.

MIGR **Migration of Aquatic Organisms**. Beneficial uses of waters that support habitats necessary for migration, acclimatization between fresh and salt water, or temporary activities by aquatic organisms, such as anadromous fish.

MUN **Municipal and Domestic Supply**. Beneficial uses of waters used for community, military, or individual water supply systems including, but not limited to, drinking water supply.

NAV **Navigation**. Beneficial uses of waters used for shipping, travel, or other transportation by private, military, or commercial vessels.

POW **Hydropower Generation**. Beneficial uses of waters used for hydroelectric power generation.

PRO **Industrial Process Supply**. Beneficial uses of waters used for industrial activities that depend primarily on water quality.

RARE **Rare, Threatened, or Endangered Species**. Beneficial uses of waters that support habitat necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened or endangered.

REC-1 **Water Contact Recreation**. Beneficial uses of waters used for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, and use of natural hot springs.

REC-2 **Non-contact Water Recreation**. Beneficial uses of waters used for recreational activities involving proximity to water, but not normally involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, and aesthetic enjoyment in conjunction with the above activities.

SAL **Inland Saline Water Habitat**. Beneficial uses of waters that support inland saline water ecosystems including, but not limited to, preservation and enhancement of aquatic saline habitats, vegetation, fish, and wildlife, including invertebrates.

SPWN **Spawning, Reproduction, and Development**. Beneficial uses of waters that support high quality aquatic habitat necessary for reproduction and early development of fish and wildlife.

WARM **Warm Freshwater Habitat**. Beneficial uses of waters that support warm water ecosystems including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates

WILD **Wildlife Habitat**. Beneficial uses of waters that support wildlife habitats including, but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl.

WQE **Water Quality Enhancement**. Beneficial uses of waters that support natural enhancement or improvement of water quality in or downstream of a water body including, but not limited to, erosion control, filtration and purification of naturally occurring water pollutants, streambank stabilization, maintenance of channel integrity, and siltation control.

Historical Beneficial Uses

The 1975 Basin Plans included brief discussions of the history of human water use in the Lahontan Region, and tables of “historical” beneficial use designations from earlier interstate water policies and “interim” final Basin Plans. Earlier beneficial use designations were primarily on a watershed basis; the 1975 Plans designated uses for specific water bodies. Copies of historical information from the 1975 Plans may be obtained by contacting Regional Board staff. The 1975 beneficial use designations were based on knowledge of the existing and potential water uses, with emphasis on the former. For example, many high quality surface waters of the North Lahontan Basin were not designated for municipal use because water supplies in these areas were taken from ground water sources. Historical beneficial uses have been incorporated into Tables 5.1-1 and 5.1-2 as potential uses (a use which once existed could potentially exist again).

No beneficial use designations adopted in the 1975 Basin Plans have been removed from waters of the Lake Tahoe HU. Removal of a use designation requires a “Use Attainability Analysis,” using U.S. Environmental Protection Agency methodology, to show that the use does not occur and cannot reasonably be attained.

Present and Potential Beneficial Uses

In the Basin Planning process, a number of beneficial uses are usually identified for a given body of water. Water quality objectives are established (see below) which are sufficiently stringent to protect the most sensitive use. The Regional Board reserves the right to resolve any

conflicts among beneficial uses, based on the facts in a given case. It should be noted that the assimilation of wastes is **not** a beneficial use.

In the tables of beneficial uses (Tables 5.1-1 and 5.1-2), an "X" indicates an existing or potential use. Many of the existing uses are documented by biological data or human use statistics; some are not. Lakes and streams may have potential beneficial uses established because: (1) plans already exist to put the water to those uses, (2) conditions (location, demand) make such future use likely, (3) the water has been identified as a potential source of drinking water based on the quality and quantity available (see Sources of Drinking Water Policy, in Appendix B), and/or (4) existing water quality does not support these uses, but remedial measures may lead to attainment in the future. The establishment of a potential beneficial use can have different purposes such as: (1) establishing a water quality goal which must be achieved through control actions in order to re-establish a beneficial use as in No. 4, above, or (2) serving to protect the existing quality of a water source for eventual use.

The water body listings in Tables 5.1-1 and 5.1-2 name all significant surface waters and ground water basins. Maps of the hydrologic units and the ground water basins are included as part of this Basin Plan (see Plates 1A and 2A). Hydrologic units and ground water basins are listed from north to south. Unit and basin numbers are provided in the tables for reference to the Department of Water Resources standardized maps. Unless otherwise specified, beneficial uses also apply to all tributaries of surface waters identified in Table 5.1-1 (i.e., specific surface waters which are not listed have the same beneficial uses as the streams, lakes, wetlands, or reservoirs to which they are tributary). Other minor surface waters, including wetlands, springs, streams, lakes, and ponds, are included under one heading for each hydrologic unit. These minor surface waters have an "X" to designate each potential or existing beneficial use. Also, ground waters which are not a part of the named basins are recognized as potential or existing "municipal and domestic water supply" (MUN). The beneficial uses for ground water which are contained in Table 5.1-2 are for each ground water basin or sub-basin as an entirety. Some ground water basins contain multiple aquifers or a single aquifer with varying water quality which may support different beneficial uses. Therefore, the placing of an "X" in Table 5.1-2 does not indicate that all of the ground waters in that particular location are suitable (without treatment) for a designated beneficial use. However, all waters are designated as MUN unless they have been specifically exempted by the Regional Board through adoption of a Basin Plan amendment after consideration of substantial evidence to exempt such waters (see Sources of Drinking Water Policy in Appendix B). Also, certain surface waters, including internal drainage lakes, may have varying water quality from changes in natural conditions (e.g., change in water volume). The designation of multiple beneficial uses in Table 5.1-1, which may appear conflicting for a particular surface water, indicates existing or probable future beneficial uses that may occur only temporarily.

In most cases, removing a beneficial use designation from Table 5.1-1 will require a Use Attainability Analysis (UAA) to be conducted (using USEPA methodology). If there is substantial evidence to remove a use designation from a specific water body, the Regional Board will consider adoption of a Basin Plan amendment to remove a designated beneficial use. However, there are many beneficial uses which are not intended to apply to the entire length of a stream or to a surface water during certain temporal conditions (see above). The beneficial use designations that may be considered for temporary or site specific designation include: IND, PRO, GWR, FRSH, NAV, POW, COLD, MIGR, SPWN, and WQE. For these situations, Regional Board staff, in order to make a recommendation to the Regional Board, will rely on site-specific documentation which may include: water quality data, field data, professional opinions (from Regional Board staff or other state and federal agencies, also universities), and other evidence collected by a discharger. The most sensitive existing or probable future use will be protected. Uses that did not exist, do not exist and will not exist in the foreseeable future, will not be required to be protected. The MUN designation will not be considered for a site-specific designation since it is designated for all waters, unless specifically exempted by the Regional Board in accordance with the State Board's Sources of Drinking Water Policy.

Water Quality Objectives

The Porter-Cologne Water Quality Control Act defines "water quality objectives" as the allowable "limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area." Thus, water quality objectives are intended to protect the public health and welfare, and to maintain or enhance water quality in relation to the existing and/or potential beneficial uses of the water. The objectives, when compared to future water quality data, will also provide the basis for detecting any future trend toward degradation or enhancement of basin waters.

Water quality objectives apply to "waters of the State" and "waters of the United States." Some of the waters

of the Lahontan Region are interstate waters, flowing into or from either Nevada or Oregon. The Lahontan Regional Board has a responsibility to ensure that waters leaving the state meet the water quality standards of the receiving state (see the discussion of "Interstate Issues" in the Introduction to Chapter 4).

Water Quality Objectives and Effluent Limits

It is important to recognize the distinction between ambient water quality objectives and "effluent limitations" or "discharge standards" which are conditions in state and federal waste discharge permits. Effluent limitations are established in permits both to protect water for beneficial uses within the area of the discharge, and to meet or achieve water quality objectives. Stormwater effluent limitations for the Lake Tahoe HU are discussed in Section 5.6.

Methodology for Establishing Water Quality Objectives

Water quality objectives are numerical or narrative. Narrative and numerical water quality objectives define the upper concentration or other limits that the Regional Board considers protective of beneficial uses.

The general methodology used in establishing water quality objectives involves, first, designating beneficial water uses; and second, selecting and quantifying the water quality parameters necessary to protect the most vulnerable (sensitive) beneficial uses.

In establishing water quality objectives, factors in addition to designated beneficial uses are considered. These factors include environmental and economic considerations specific to each hydrologic unit, the need to develop and use recycled water, as well as the level of water quality that could be achieved through coordinated control of all factors that affect water quality in an area. Controllable water quality factors are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State, and that may be reasonably controlled.

Water quality objectives can be reviewed and, if appropriate, revised by the Lahontan Regional Board. Revised water quality objectives would then be adopted as part of this Basin Plan by amendment. Opportunities for formal public review of water quality objectives will be available at a minimum of once every three years following the adoption of this Basin Plan to determine the need for further review and revision.

USEPA water quality criteria and State Water Resources Control Board policies may result in statewide water quality objectives that are more restrictive than regionwide or waterbody-specific water quality objectives within this Basin Plan. For example, the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* implements the USEPA National Toxics Rule and the California Toxics Rule. The most stringent criterion or objective applies.

Establishment of Numerical Objectives for Specific Water Bodies

Where available data were sufficient to define existing ambient levels of constituents, these levels were used in developing the numerical objectives for specific water bodies. By utilizing annual mean, 90th percentile values and flow-weighted values, the objectives are intended to be realistic within the variable conditions imposed by nature. This approach provides an opportunity to detect changes in water quality as a function of time through comparison of annual means, while still accommodating variations in the measured constituents.

Objectives for specific water bodies generally reflect either historical (often pre-1975) water quality, or the levels of constituents needed to protect the most sensitive beneficial use. The waters of the Lake Tahoe Basin are generally of very high quality; however, in a few water bodies, State water quality objectives may be exceeded due to natural causes. For example, some wells in South Lake Tahoe have concentrations of uranium exceeding the drinking water maximum contaminant level. The Regional Board recognizes that such violations may occur, and will assess compliance with the objectives on a case-by-case basis.

Most of the numerical water quality objectives for Lake Tahoe and its tributaries, and the narrative objectives for clarity and productivity, are based on historical high quality. In 1980, the State Board revised the numerical objectives set for Lake Tahoe and its tributaries in the 1975 North Lahontan Basin Plan, with some modifications clarifying the standards for Lake Tahoe and revising the standards for tributary streams. The clarity and productivity objectives were based on monitoring data from the late 1960s and early 1970s and were set to stabilize the quality of Lake Tahoe at levels recorded in those years. The revised water quality objectives for tributary streams were based on data collected during TRPA's Section 208 planning effort in the 1970s for streams classified as draining disturbed or undisturbed watersheds. Weighted mean concentrations were determined for total nitrogen, total phosphorus, and iron for each tributary stream.

For a stream draining an undisturbed watershed, the water quality objectives for these three parameters in Table 5.1-3 represent the weighted mean concentrations determined for that specific stream. For streams draining disturbed watersheds, the objectives in Table 5.1-3 are based on the overall mean nutrient concentration for all streams draining undisturbed watersheds.

Numerical objectives have not yet been established for all streams tributary to Lake Tahoe in California. TRPA has requested that the Regional Board review and consider revising existing objectives for iron, since recent monitoring data show violations of objectives in some presumably undisturbed water bodies. Regional Board staff propose to review and consider further revision of objectives for tributaries of Lake Tahoe as part of the Triennial Review process as resources allow.

Achieving water quality objectives for tributary streams will also help to protect Lake Tahoe. Tributary objectives are in addition to, not a substitute for the standards for Lake Tahoe. Despite attainment of the standards for a stream, further reductions in the nutrient concentrations in the stream may be required so that the total nutrient load from all streams is reduced enough to prevent deterioration of Lake Tahoe.

Prohibited Discharges

Discharges that cause violation of any narrative or numerical water quality objective are prohibited. (See also Section 5.2, “Waste Discharge Prohibitions.”)

After application of reasonable control measures, ambient water quality shall conform to the narrative and numerical water quality objectives included in this Basin Plan. When other factors result in the degradation of water quality beyond the limits established by these water quality objectives, controllable human activities shall not cause further degradation of water quality in either surface or ground waters.

Compliance with Water Quality Objectives

The purpose of text, in italics, following certain water quality objectives is to provide specific direction on compliance with the objective. General direction on compliance with objectives is described in the last section of this Chapter. It is not feasible to cover all circumstances and conditions which could be created by all discharges. Therefore, it is within the discretion of the Regional Board to establish other, or additional, direction on compliance with objectives of this Basin Plan. The purpose of the italic text is to provide direction only, and **not** to specify method of compliance.

Antidegradation Policy

This policy applies to **all** waters of the Lahontan Region (including surface waters, wetlands, and ground waters.)

On October 28, 1968, the State Water Resources Control Board adopted Resolution No. 68-16, “Statement of Policy with Respect to Maintaining High Quality of Waters in California,” establishing an antidegradation policy for the protection of water quality. This policy requires continued maintenance of existing high quality waters. Whenever the existing quality of water is better that the quality of water established in this Basin Plan as objectives (both narrative and numerical), such existing quality shall be maintained unless appropriate findings are made under the policy. The U.S. Environmental Protection Agency, Region IX, has also issued detailed guidelines for implementation of federal antidegradation regulations for surface waters (40 CFR § 131.12). For more information, see the discussion on “General Direction Regarding Compliance With Objectives” at the end of this Chapter.

The State Board designated Lake Tahoe an Outstanding National Resource Water (ONRW) in 1980, both for its recreational and its ecological value, and stated:

“Viewed from the standpoint of protecting beneficial uses, preventing deterioration of Lake Tahoe requires that there be no significant increase in algal growth rates. Lake Tahoe's exceptional recreational value depends on enjoyment of the scenic beauty imparted by its clear, blue waters. ...Likewise, preserving Lake Tahoe's ecological value depends on maintaining the extraordinarily low rates of algal growth which make Lake Tahoe an outstanding ecological resource.”

Section 114 of the federal Clean Water Act also indicates the need to “preserve the fragile ecology of Lake Tahoe.”

Water Quality Objectives for Surface Waters

(See Tables 5.1-3 through 5.1-6)

Unless otherwise specified, the following objectives (listed alphabetically) apply to all surface waters of the Lahontan Region, including the Lake Tahoe HU (see Figures 5-3 and 5-4):

Ammonia

The neutral, unionized ammonia species ($NH_3°$) is highly toxic to freshwater fish. The fraction of toxic $NH_3°$ to total ammonia species ($NH_4^+ + NH_3°$) is a function of temperature and pH. Tables 5.1-5 and 5.1-6 were derived from USEPA ammonia criteria for freshwater. Ammonia concentrations shall not exceed the values listed for the corresponding conditions in these tables. For temperature and pH values not explicitly in the these tables, the most conservative value neighboring the actual value may be used or criteria can be calculated from numerical formulas developed by the USEPA. For one-hour (1h-NH_3) and four-day (4d-NH_3) unionized ammonia criteria, the following equations apply:

$$1h\text{-}NH_3 = 0.52 \div (FT \times FPH \times 2)$$

$$4d\text{-}NH_3 = 0.80 \div (FT \times FPH \times RATIO)$$

where:

$FT = 10^{[0.03(20-TCAP)]}$
for: $TCAP \leq T \leq 30$

$FT = 10^{[0.03(20-T)]}$
for: $0 \leq T \leq TCAP$

$FPH = (1+10^{(7.4-pH)}) \div 1.25$
for: $6.5 \leq pH \leq 8.0$

$FPH = 1$
for: $8.0 \leq pH \leq 9.0$

$RATIO = 20.25 \times (10^{(7.7-pH)}) \div (1+10^{(7.4-pH)})$
for: $6.5 \leq pH \leq 7.7$

$RATIO = 13.5$
for: $7.7 \leq pH \leq 9.0$

and:

T = temperature in °C

TCAP = temperature cap in °C

For 1h-NH_3, TCAP is 20°C with salmonids present and 25°C with salmonids absent. For 4d-NH_3, TCAP is 15°C with salmonids present and 20°C with salmonids absent.

For interpolation of total ammonia ($NH_4^+ + NH_3°$) criteria, the following equations can be used:

$$n_{1h} = 1h\text{-}NH_3 \div f, \text{ or } n_{4d} = 4d\text{-}NH_3 \div f$$

where:

n_{1h} is the one-hour criteria for total ammonia species ($NH_4^+ + NH_3°$)

n_{4d} is the four-day criteria for total ammonia species ($NH_4^+ + NH_3°$)

$f = 1 \div (10^{(pKa-pH)}+1)$

$pKa = 0.0901821 + [2729.92 \div (T+273.15)]$

and:

pKa is the negative log of the equilibrium constant for the $NH_4^+ \rightleftharpoons NH_3° + H^+$ reaction

f is the fraction of unionized ammonia to total ammonia species: $[NH_3° \div (NH_4^+ + NH_3°)]$

Values outside of the ranges 0-30°C or pH 6.5-9.0 cannot be extrapolated from these relationships. Site-specific objectives must be developed for these conditions. A microcomputer spreadsheet to calculate ammonia criteria was developed by Regional Board staff. An example of output from this program is given in Table 5.1- 7. Contact the Regional Board if a copy is desired.

Bacteria, Coliform

Waters shall not contain concentrations of coliform organisms attributable to anthropogenic sources, including human and livestock wastes.

The fecal coliform concentration during any 30-day period shall not exceed a log mean of 20/100 ml, nor shall more than 10 percent of all samples collected during any 30-day period exceed 40/100 ml. *The log mean shall ideally be based on a minimum of not less than five samples collected as evenly spaced as practicable during any 30-day period. However, a log mean concentration exceeding 20/100 ml for any 30-day period shall indicate violation of this objective even if fewer than five samples were collected.*

Biostimulatory Substances

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect the water for beneficial uses.

Chemical Constituents

Waters designated as MUN shall not contain concentrations of chemical constituents in excess of the maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL) based upon drinking water standards specified in the following provisions of Title 22 of the California Code of Regulations which are incorporated by reference into this plan: Table 64431-A of Section 64431 (Inorganic Chemicals), Table 64431-B of Section 64431 (Fluoride), Table 64444-A of Section 64444 (Organic Chemicals), Table 64449-A of Section 64449 (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits), and Table 64449-B of Section 64449 (Secondary Maximum Contaminant Levels-Ranges). This incorporation-by-reference is prospective including future changes to the incorporated provisions as the changes take effect.

Waters designated as AGR shall not contain concentrations of chemical constituents in amounts that adversely affect the water for beneficial uses (i.e., agricultural purposes).

Waters shall not contain concentrations of chemical constituents in amounts that adversely affect the water for beneficial uses.

Chlorine, Total Residual

For the protection of aquatic life, total chlorine residual shall not exceed either a median value of 0.002 mg/L or a maximum value of 0.003 mg/L. Median values shall be based on daily measurements taken within any six-month period.

Color

Waters shall be free of coloration that causes nuisance or adversely affects the water for beneficial uses.

Dissolved Oxygen

The dissolved oxygen concentration, as percent saturation, shall not be depressed by more than 10 percent, nor shall the minimum dissolved oxygen concentration be less than 80 percent of saturation.

For waters with the beneficial uses of COLD, COLD with SPWN, WARM, and WARM with SPWN, the minimum dissolved oxygen concentration shall not be less than that specified in Table 5.1-8.

Floating Materials

Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect the water for beneficial uses.

For natural high quality waters, the concentrations of floating material shall not be altered to the extent that such alterations are discernable at the 10 percent significance level.

Oil and Grease

Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect the water for beneficial uses.

For natural high quality waters, the concentration of oils, greases, or other film or coat generating substances shall not be altered.

Nondegradation of Aquatic Communities and Populations

All wetlands shall be free from substances attributable to wastewater or other discharges that produce adverse physiological responses in humans, animals, or plants; or which lead to the presence of undesirable or nuisance aquatic life.

All wetlands shall be free from activities that would substantially impair the biological community as it naturally occurs due to physical, chemical and hydrologic processes.

pH

In fresh waters with designated beneficial uses of COLD, changes in normal ambient pH levels shall not exceed 0.5 pH units. For all other waters, the pH shall not be depressed below 6.5 nor raised above 8.5.

The Regional Board recognizes that some waters of the Region may have natural pH levels outside of the 6.5 to 8.5 range. Compliance with the pH objective for these waters will be determined on a case-by-case basis.

Radioactivity

Radionuclides shall not be present in concentrations which are deleterious to human, plant, animal, or aquatic life nor which result in the accumulation of radionuclides in the food web to an extent which presents a hazard to human, plant, animal, or aquatic life.

Waters designated as MUN shall not contain concentrations of radionuclides in excess of the limits specified in Table 4 of Section 64443 (Radioactivity) of Title 22 of the California Code of Regulations which is incorporated by reference into this plan. This incorporation-by-reference is prospective including future changes to the incorporated provisions as the changes take effect.

Sediment

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect the water for beneficial uses.

Settleable Materials

Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or that adversely affects the water for beneficial uses. For natural high quality waters, the concentration of settleable materials shall not be raised by more than 0.1 milliliter per liter.

Suspended Materials

Waters shall not contain suspended materials in concentrations that cause nuisance or that adversely affects the water for beneficial uses.

For natural high quality waters, the concentration of total suspended materials shall not be altered to the extent that such alterations are discernible at the 10 percent significance level.

Suspended Sediment

Suspended sediment concentrations in streams tributary to Lake Tahoe shall not exceed a 90th percentile value of 60 mg/L. (This objective is equivalent to the Tahoe Regional Planning Agency's regional "environmental threshold carrying capacity" standard for suspended sediment in tributaries.) *The Regional Board will consider revision of this objective in the future if it proves not to be protective of beneficial uses or if review of monitoring data indicates that other numbers would be more appropriate for some or all streams tributary to Lake Tahoe.*

Taste and Odor

Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish or other edible products of aquatic origin, that cause nuisance, or that adversely affect the water for beneficial uses. For naturally high quality waters, the taste and odor shall not be altered.

Temperature

The natural receiving water temperature of all waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such an alteration in temperature does not adversely affect the water for beneficial uses.

For waters designated COLD, the temperature shall not be altered.

Temperature objectives for COLD interstate waters and WARM interstate waters are as specified in the "Water Quality Control Plan for Control of Temperature in The Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" including any revisions. This plan is summarized in Chapter 6 (Plans and Policies) and included in Appendix B.

Toxicity

All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. *Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration and/or other appropriate methods as specified by the Regional Board.*

The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary, for other control water that is consistent with the requirements for "experimental water" as defined in *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association, et al. 1998).

Turbidity

Waters shall be free of changes in turbidity that cause nuisance or adversely affect the water for beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10 percent.

Water Quality Objectives for Certain Water Bodies (Figure 5.1-1)

The following objectives (listed alphabetically) are in addition to the regionwide objectives specified above. These objectives apply to certain surface waters of the Lake Tahoe Hydrologic Unit (HU). Tables 5.1-3 and 5.1-4 also contain additional water quality objectives for certain water bodies within the Lake Tahoe HU.

Algal Growth Potential

For Lake Tahoe, the mean algal growth potential at any point in the Lake shall not be greater than twice the mean annual algal growth potential at the limnetic reference station. *The limnetic reference station is located in the north central portion of Lake Tahoe. It is shown on maps in annual reports of the Lake Tahoe Interagency Monitoring Program. Exact coordinates can be obtained from the U.C. Davis Tahoe Research Group.*

Biological Indicators

For Lake Tahoe, algal productivity and the biomass of phytoplankton, zooplankton, and periphyton shall not be increased beyond the levels recorded in 1967-71, based on statistical comparison of seasonal and annual means. *The "1967-71 levels" are reported in the annual summary reports of the "California-Nevada-Federal Joint Water Quality Investigation of Lake Tahoe" published by the California Department of Water Resources.*

Clarity

For Lake Tahoe, the vertical extinction coefficient shall be less than 0.08 per meter when measured below the first meter. When water is too shallow to determine a reliable extinction coefficient, the turbidity shall not exceed 3 Nephelometric Turbidity Units (NTU). In addition, turbidity shall not exceed 1 NTU in shallow waters not directly influenced by stream discharges. *The Regional Board will determine when water is too shallow to determine a reliable vertical extinction coefficient based upon its review of standard limnological methods and on advice from the U.C. Davis Tahoe Research Group.*

Conductivity, Electrical

In Lake Tahoe, the mean annual electrical conductivity shall not exceed 95 umhos/cm at 25°C at any location in the Lake.

pH

In Lake Tahoe, the pH shall not be depressed below 7.0 nor raised above 8.4.

Plankton Counts

For Lake Tahoe, the mean seasonal concentration of plankton organisms shall not be greater than 100 per ml and the maximum concentration shall not be greater than 500 per ml at any point in the Lake.

Suspended Sediment

Suspended sediment concentrations in streams tributary to Lake Tahoe shall not exceed a 90th percentile value of 60 mg/L. (This objective is equivalent to the Tahoe Regional Planning Agency's regional "environmental threshold carrying capacity" standard for suspended sediment in tributaries.) *The Regional Board will consider revision of this objective in the future if it proves not to be protective of beneficial uses or if review of monitoring data indicates that other numbers would be more appropriate for some or all streams tributary to Lake Tahoe.*

Transparency

For Lake Tahoe, the annual average Secchi disk deep water transparency shall not be decreased below 29.7 meters, the levels recorded in 1967-71.

Water Quality Objectives That Apply to All Ground Waters

Bacteria, Coliform

In ground waters designated as MUN, the median concentration of coliform organisms over any seven-day period shall be less than 1.1/100 milliliters.

Chemical Constituents

Ground waters designated as MUN shall not contain concentrations of chemical constituents in excess of the maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL) based upon drinking water standards specified in the following provisions of Title 22 of the California Code of Regulations which are incorporated by reference into this plan: Table 64431-A of Section 64431 (Inorganic Chemicals), Table 64431-B of Section 64431 (Fluoride), Table 64444-A of Section 64444 (Organic Chemicals), Table 64449-A of Section 64449 (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits), and Table 64449-B of Section 64449 (Secondary Maximum Contaminant Levels-Ranges). This incorporation-by-reference is prospective including future changes to the incorporated provisions as the changes take effect.

Waters designated as AGR shall not contain concentrations of chemical constituents in amounts that adversely affect the water for beneficial uses (i.e., agricultural purposes).

Ground waters shall not contain concentrations of chemical constituents that adversely affect the water for beneficial uses.

Radioactivity

Ground waters designated as MUN shall not contain concentrations of radionuclides in excess of the limits specified in Table 4 of Section 64443 (Radioactivity) of Title 22 of the California Code of Regulations which is incorporated by reference into this plan. This incorporation-by-reference is prospective including

future changes to the incorporated provisions as the changes take effect.

Taste and Odor

Ground waters shall not contain taste or odor-producing substances in concentrations that cause nuisance or that adversely affect beneficial uses. For ground waters designated as MUN, at a minimum, concentrations shall not exceed adopted secondary maximum contaminant levels specified in Table 64449-A of Section 64449 (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits), and Table 64449-B of Section 64449 (Secondary Maximum Contaminant Levels-Ranges) of Title 22 of the California Code of Regulations which is incorporated by reference into this plan. This incorporation-by-reference is prospective including future changes to the incorporated provisions as the changes take effect.

General Direction Regarding Compliance With Objectives

This section includes general direction on determining compliance with the narrative and numerical objectives described in this Chapter. (Specific direction on compliance with certain objectives is included, in italics, following the text of the objective.) It is not feasible to cover all circumstances and conditions which could be created by all discharges. Therefore, it is within the discretion of the Regional Board to establish other, or additional, direction on compliance with objectives of this Plan. Where more than one objective is applicable, the **stricter objective shall apply**. (The only exception is where a regionwide objective has been superseded by the adoption of a site-specific objective by the Regional Board.) Where objectives are not specifically designated, downstream objectives apply to upstream tributaries.

Antidegradation Policy

To implement State Board Resolution No. 68-16, the "Statement of Policy with Respect to Maintaining High Quality Waters in California," the Regional Board follows guidance such as that in the USEPA's 1993 *Water Quality Standards Handbook* and the State Board's October 7, 1987 legal memorandum titled "Federal Antidegradation Policy" (Attwater 1987). The State Board has interpreted the Resolution No. 68-16 to incorporate the federal antidegradation policy in order to ensure consistency with federal Clean Water Act requirements (see State Board Order No. WQ 86-17, pages 16-24). For detailed information on the federal antidegradation policy, see USEPA Region IX's *Guidance on Implementing the Antidegradation Provisions of 40 CFR 131.12* and USEPA's *Questions and Answers on Antidegradation*. The Regional Board's procedures for implementation of State and federal antidegradation policies are summarized below. It is important to note that the federal policy applies only to surface waters, while the State policy applies to both surface and ground waters.

Under the State Antidegradation Policy, whenever the existing quality of water is better than that needed to protect all existing and probable future beneficial uses, the existing high quality shall be maintained until or unless it has been demonstrated to the State that any change in water quality will be consistent with the maximum benefit of the people of the State, and will not unreasonably affect present and probable future beneficial uses of such water. Therefore, unless these conditions are met, background water quality concentrations (the concentrations of substances in natural waters which are unaffected by waste management practices or contamination incidents) are appropriate water quality goals to be maintained. If it is determined that some degradation is in the best interest of the people of California, some increase in pollutant level may be appropriate. However, in no case may such increases cause adverse impacts to existing or probable future beneficial uses of waters of the State.

Where the federal antidegradation policy applies, it does not absolutely prohibit any changes in water quality. The policy requires that any reductions in water quality be consistent with the three-part test established by the policy, as described below.

Part One—Instream Uses

[40 CFR § 131.12(a)(1)]

The first part of the test establishes that "existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." Reductions in water quality should not be permitted if the change in water quality would seriously harm any species found in the water (other than an aberrational species). Waters of this type are generally referred to as "Tier I" waters.

Part Two—Public Interest Balancing

[40 CFR § 131.12(a)(2)]

The second part of the test applies where water quality is higher than necessary to protect existing instream beneficial uses. This part of the test allows reductions in water quality if the state finds "that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located" **and** existing beneficial uses are protected. Waters of this type are generally referred to as "Tier II" waters.

Part Three—Outstanding National Resource Waters (ONRWs) [40 CFR § 131.12(a)(3)]

The third part of the test established by the federal policy requires that the water quality of the waters which constitute an outstanding national resource be maintained and protected. No permanent or long-term reduction in water quality is allowable in areas given special protection as Outstanding National Resource Waters (48 Fed. Reg. 51402). Waters which potentially could qualify for ONRW designation are generally classified as "Tier III" waters.

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 ONRW 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, should be given the special protection assigned to ONRWs.

Narrative and Numerical Objectives

The sections below provide additional direction on determining compliance with the narrative and numerical objectives of this Basin Plan.

Pollution and/or Nuisance

In determining compliance with narrative objectives which include the terms "pollution" and or "nuisance," the Regional Board considers the following definitions from the Porter-Cologne Water Quality Control Act.

Pollution -- an alteration of the waters of the State by waste to the degree which unreasonably affects either of the following:

- such waters for beneficial uses.
- facilities which serve these beneficial uses.

"Pollution" may include "contamination." Contamination means an impairment of the quality of the waters of the State by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. Contamination includes any equivalent effect resulting from the disposal of waste, whether or not waters of the State are affected.

Nuisance -- Anything which meets all of the following requirements:

- Is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property.
- Affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal.
- Occurs during or as a result of the treatment or disposal of wastes.

References to Taste and Odor, Human Health and Toxicity (also see "acute toxicity" and "chronic toxicity," below):

In determining compliance with objectives including references to Taste and Odor, Human Health or Toxicity, the Regional Board will consider as evidence relevant and scientifically valid water quality goals from sources such as drinking water standards from the California Department of Health Services (State "Action Levels"), the National Interim Drinking Water Standards, Proposition 65 Lawful Levels, National Ambient Water Quality Criteria (USEPA's "Quality Criteria for Water" for the years 1986, 1976 and 1972; "Ambient Water Quality Criteria," volumes 1980, 1984, 1986, 1987 and 1989), the National Academy of Sciences' Suggested No-Adverse-Response Levels (SNARL), USEPA's Health and Water Quality Advisories, as well as other relevant and scientifically valid evidence.

References to Agriculture or AGR designations:

In determining compliance with objectives including references to the AGR designated use, the Regional Board will refer to water quality goals and recommendations from sources such as the Food and Agriculture Organization of the United Nations, University of California Cooperative Extension, Committee of Experts, and McKee and Wolf's "Water Quality Criteria" (1963).

References to "Natural High Quality Waters":

The Regional Board generally considers "natural high quality water(s)" to be those waters with ambient water quality equal to, or better than, current drinking water standards. However, the Regional Board also recognizes that some waters with poor chemical quality may support important ecosystems (e.g., Mono Lake).

References to "10 percent significance level":

A statistical hypothesis is a statement about a random variable's probability distribution, and a decision-making procedure about such a statement is a hypothesis test. In testing a hypothesis concerning the value of a population mean, the null hypothesis is often used. The null hypothesis is that there is no difference between the population means (e.g., the mean value of a water quality parameter after the discharge is no different than before the discharge.) First a level of significance to be used in the test is specified, and then the regions of acceptance and rejection for evaluating the obtained sample mean are determined.

At the **10 percent significance level**, assuming normal distribution, the acceptance region (where one would correctly accept the null hypothesis) is the interval which lies under 90 percent of the area of the standard normal curve. Thus, a level of **significance of 10 percent** signifies that when the population mean is correct as specified, the sample mean will fall in the areas of rejection only 10 percent of the time.

If the hypothesis is rejected when it should be accepted, a Type I error has been made. In choosing a **10 percent level of significance**, there are 10 chances in 100 that a Type I error was made, or the hypothesis was rejected when it should have been accepted (i.e., one is 90 percent *confident* that the right decision was made.)

The **10 percent significance level** is often incorrectly referred to as the 90 percent significance level. As explained above, the significance level of a test should be low, and the confidence level of a confidence interval should be high.

References to "Means" (e.g., annual mean, log mean, mean of monthly means), "Medians" and "90th percentile values":

"Mean" is the arithmetic mean of all data. "**Annual mean**" is the arithmetic mean of all data collected in a one-year period. **"Mean of monthly mean"** is the arithmetic mean of 30-day averages (arithmetic means). A logarithmic or "**log mean**" (used in determining compliance with bacteria objectives) is calculated by converting each data point into its log, then calculating the mean of these values, then taking the anti-log of this log-transformed average. The **median** is the value which half of the values of the population exceed and half do not. The **average value** is the arithmetic mean of all data. For a **90th percentile value**, only 10% of data exceed this value.

Compliance determinations shall be based on available analyses for the time interval associated with the discharge. If only one sample is collected during the time period associated with the water quality objective, (e.g., monthly mean), that sample shall serve to characterize the discharge for the entire interval. Compliance based upon multiple samples shall be determined through the application of appropriate statistical methods.

Standard Analytical Methods to Determine Compliance with Objectives

Analytical methods to be used are usually specified in the monitoring requirements of the waste discharge permits. Suitable analytical methods are:

- those specified in 40 CFR Part 136, and/or
- those methods determined by the Regional Board and approved by the USEPA to be equally or more sensitive than 40 CFR Part 136 methods and appropriate for the sample matrix, and/or
- where methods are not specified in 40 CFR Part 136, those methods determined by the Regional Board to be appropriate for the sample matrix

All analytical data shall be reported uncensored with method detection limits and either practical quantitation levels or limits of quantitation identified. Acceptance of data should be based on demonstrated laboratory performance.

For **bacterial analyses**, sample dilutions should be performed so the range of values extends from 2 to 16,000. The detection method used for each analysis shall be reported with the results of the analysis. Detection methods used for coliforms (total and fecal) shall be those presented in *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association et al. 1998), or any alternative method determined by the Regional Board to be appropriate.

For **acute toxicity**, compliance shall be determined by short-term toxicity tests on undiluted effluent using an established protocol (e.g., American Society for Testing and Materials [ASTM], American Public Health Association, USEPA, State Board).

For **chronic toxicity**, compliance shall be determined using the critical life stage (CLS) toxicity tests. At least three approved species shall be used to measure compliance with the toxicity objective. If possible, test species shall include a vertebrate, an invertebrate, and an aquatic plant. After an initial screening period, monitoring may be reduced to the most sensitive species. Dilution and control waters should be obtained from an unaffected area of the receiving waters. For rivers and streams, dilution water should be obtained immediately upstream of the discharge.

Standard dilution water can be used if the above sources exhibit toxicity greater than 1.0 Chronic Toxicity Units. All test results shall be reported to the Regional Board in accordance with the "Standardized Reporting Requirements for Monitoring Chronic Toxicity" (State Board Publication No. 93-2 WQ).

Application of Narrative and Numerical Water Quality Objectives to Wetlands

Although not developed specifically for wetlands, many surface water **narrative objectives** are generally applicable to most wetland types. However, the Regional Board recognizes, as with other types of surface waters such as saline or alkaline lakes, that natural water quality characteristics of some wetlands may not be within the range for which the narrative objectives were developed. The Regional Board will consider site-specific adjustments to the objectives for wetlands (bacteria, pH, hardness, salinity, temperature, or other parameters) as necessary on a case-by-case basis.

The **numerical criteria** to protect one or more beneficial uses of surface waters, where appropriate, may directly apply to wetlands. For example, wetlands which actually are, or which 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. 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. The Regional Board will consider developing site-specific objectives for wetlands on a case-by-case basis.

Variances from Water Quality Objectives

The USEPA allows states to grant variances from water quality standards under the narrow circumstances summarized below (USEPA Water Quality Standards Handbook, Second Edition, 1993, Chapter 5). Such variances must be "built into" the standards themselves, and thus variances cannot be granted in California without Basin Plan amendments.

According to the USEPA, variances from standards "are both discharger and pollutant specific, are time-limited, and do not forego the currently designated use". The USEPA recommends use of variances instead of removal of beneficial uses when the State believes that standards can ultimately be attained. Variances can be used with NPDES permits to ensure reasonable progress toward attainment of standards without violation of Clean Water Act Section 402(a)(1), which requires NPDES permits to meet applicable water quality standards.

The USEPA "has approved State-adopted variances in the past and will continue to do so if:

- each individual variance is included as part of the water quality standard;
- the State demonstrates that meeting the standard is unattainable based on one or more of the grounds outlined in 40 CFR 131.10(g) for removing a designated use;
- the justification submitted by the State includes documentation that treatment more advanced than that required by sections 303(c)(2)(A) and (B) has been carefully considered, and that alternative effluent control strategies have been evaluated;
- the more stringent State criterion is maintained and is binding upon all other dischargers on the stream or stream segment;
- the discharger who is given a variance for one particular constituent is required to meet the applicable criteria for other constituents;
- the variance is granted for a specific period of time and must be rejustified upon expiration but at least every 3 years (Note: the 3-year limit is derived from the triennial review requirements of section 303(c) of the Act.);
- the discharger either must meet the standard upon the expiration of this time period or must make a new demonstration of "unattainability";
- reasonable progress is being made toward meeting the standards; and
- the variance was subjected to public notice, opportunity for comment, and public hearing. (See section 303(c)(1) and 40 CFR 131.20.) The public notice should contain a clear description of the impact of the variance upon achieving water quality standards in the affected stream segment."

(The "section" references in the quoted language above are to the Clean Water Act. As used in this language, "criteria" and "criterion" are equivalent to "water quality objective[s].")

Key to Table 5.1-1

"HU No." This column contains numbers used by the California Department of Water Resources in mapping surface water Hydrologic Units, Hydrologic Areas, and Hydrologic Subareas (watersheds and subwatersheds). See Plate 1A. The Lake Tahoe Basin is divided into three separate Hydrologic Areas, including the lake itself and "North Tahoe" and "South Tahoe" Hydrologic Areas including tributary waters.

"Hydrologic Unit/Subunit/Drainage Feature" This column contains (in bold type) the names of watersheds and subwatersheds corresponding to the Hydrologic Unit numbers in the preceding column, and the names of surface waterbodies, including lakes, streams, and wetlands. Wetlands of the Lake Tahoe Basin were not delineated by the Regional Board's wetlands identification contractor to the same level of detail as those in other parts of the Lahontan Region such as the Owens River HU. Wetland names in this column are generally indicators of location rather than "official" geographic names. More precise information on wetland locations is available in the Regional Board's wetlands database.

"Waterbody Class Modifier" This column includes descriptive information on each waterbody in the preceding column (i.e., distinction between lakes, streams, and wetlands). The modifiers in the entries for "minor wetlands" indicate that such wetlands may include springs, seeps, emergent wetlands, and marshes. The term "emergent" refers to wetlands dominated by erect, rooted, herbaceous aquatic plants such as cattails, which extend above the water surface (Mitsch and Gosselink 1986). Marshes are one type of emergent wetland.

"Beneficial Uses" The subheadings under this heading are abbreviations of beneficial use names which are defined in the text of Section 5.1. An "x" in a column beneath one of these subheadings designates an existing or potential beneficial use for a given waterbody.

"Receiving Water" This column names the waterbody to which a "drainage feature" named at the far left side of the table is tributary.

TABLE 5.1-1. BENEFICIAL USES OF SURFACE WATERS OF THE LAKE TAHOE HU

Unless otherwise specified, beneficial uses also apply to all tributaries of surface waters identified in Table 5.1-1.

HU No.	HYDROLOGIC UNIT/SUBUNIT DRAINAGE FEATURE	WATERBODY CLASS MODIFIER	BENEFICIAL USES																					RECEIVING WATER
			MUN	AGR	PRO	IND	GWR	FRSH	NAV	POW	REC-1	REC-2	COMM	AQUA	WARM	COLD	SAL	WILD	BIOL	RARE	MIGR	SPWN	WQE	FLD	
634.00	**LAKE TAHOE HYDROLOGIC UNIT**																								
634.10	**SOUTH TAHOE HYDROLOGIC AREA**																								
	TAHOE MEADOWS WETLANDS	WETLANDS	X				X				X	X				X		X					X	X	
	HEAVENLY VALLEY CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X		X	X	X			TROUT CREEK
	COLD CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X			X	X			TROUT CREEK
	TROUT CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X			X	X			UPPER TRUCKEE RIVER
	SAXON CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X			X	X			TROUT CREEK
	GRASS LAKE WETLANDS	WETLANDS	X	X			X				X	X	X			X		X	X			X	X	X	
	GRASS LAKE	LAKE	X	X			X				X	X	X			X		X	X			X			GRASS LAKE CREEK
	GRASS LAKE CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X				X			UPPER TRUCKEE RIVER
	MEISS MEADOWS/WETLANDS	WETLANDS	X	X			X				X	X				X		X		X		X	X	X	
	MEISS LAKE	LAKE	X	X			X				X	X	X			X		X		X		X			UPPER TRUCKEE RIVER
	UPPER TRUCKEE RIVER	PERENNIAL STREAM	X	X			X		X		X	X	X			X		X			X	X			LAKE TAHOE
	ECHO LAKES	LAKES	X				X		X		X	X	X			X		X				X			ECHO CREEK/U. TRUCKEE RIVER
	UPPER ANGORA LAKE	LAKE	X	X			X		X		X	X	X			X		X				X			LOWER ANGORA LAKE
	LOWER ANGORA LAKE	LAKE	X	X			X		X		X	X	X			X		X				X			ANGORA CREEK
	GLEN ALPINE CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X				X			FALLEN LEAF LAKE
	FALLEN LEAF LAKE	LAKE	X						X		X	X	X			X		X				X			TAYLOR CREEK
	TAYLOR CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X			X	X			LAKE TAHOE
	TAYLOR CREEK MEADOW MARSH	WETLANDS	X	X			X				X	X				X		X		X	X	X	X	X	
	TALLAC CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X				X			LAKE TAHOE
	CASCADE LAKE	LAKE	X						X		X	X	X			X		X		X		X			CASCADE CREEK
	CASCADE CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X				X			LAKE TAHOE
	MEEKS CREEK MEADOW/WETLANDS	WETLANDS	X	X			X				X	X				X		X					X	X	
	POPE MARSH/WETLANDS	WETLANDS	X				X				X	X				X		X					X	X	
	OSGOOD SWAMP	WETLANDS	X				X				X	X				X		X	X				X	X	
	EAGLE CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X				X			LAKE TAHOE
	MINOR SURFACE WATERS		X	X			X				X	X	X			X		X				X			
	MINOR WETLANDS	SPRINGS/SEEPS/EMERGENT/MARSHES	X	X			X	X			X	X	X			X		X	X	X	X	X	X	X	
634.20	**NORTH TAHOE HYDROLOGIC AREA**																								
	LONELY GULCH CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X				X			LAKE TAHOE
	MEEKS CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X			X	X			LAKE TAHOE
	GENERAL CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X			X	X			LAKE TAHOE
634.20	**NORTH TAHOE HYDROLOGIC AREA (continued)**																								
	McKINNEY CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X				X			LAKE TAHOE

TABLE 5.1-1. BENEFICIAL USES OF SURFACE WATERS OF THE LAKE TAHOE HU

Unless otherwise specified, beneficial uses also apply to all tributaries of surface waters identified in Table 5.1-1.

HU No.	HYDROLOGIC UNIT/SUBUNIT DRAINAGE FEATURE	WATERBODY CLASS MODIFIER	BENEFICIAL USES																						RECEIVING WATER
			MUN	AGR	PRO	IND	GWR	FRSH	NAV	POW	REC-1	REC-2	COMM	AQUA	WARM	COLD	SAL	WILD	BIOL	RARE	MIGR	SPWN	WQE	FLD	
	MADDEN CREEK	PERENNIAL STREAM	X				X				X	X	X			X		X				X			LAKE TAHOE
	BLACKWOOD CREEK	PERENNIAL STREAM	X								X	X	X			X		X			X	X			LAKE TAHOE
	WARD CREEK	PERENNIAL STREAM	X				X				X	X	X			X		X			X	X			LAKE TAHOE
	BURTON CREEK	PERENNIAL STREAM	X				X				X	X	X			X		X				X			LAKE TAHOE
	DOLLAR CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X				X			LAKE TAHOE
	WATSON CREEK	PERENNIAL STREAM	X				X				X	X	X			X		X				X			LAKE TAHOE
	SNOW CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X				X			LAKE TAHOE
	CARNELIAN CREEK	PERENNIAL STREAM	X	X			X				X	X	X			X		X				X			LAKE TAHOE
	GRIFF CREEK	PERENNIAL STREAM	X				X				X	X	X			X		X				X			LAKE TAHOE
	MINOR SURFACE WATERS		X	X			X	X			X	X	X			X		X				X			LAKE TAHOE
	MINOR WETLANDS	SPRINGS/SEEPS/EMERGENT/MARSHES	X	X			X	X			X	X	X			X		X			X	X	X	X	
634.30	**TAHOE LAKE BODY HYDROLOGIC AREA**																								
	LAKE TAHOE	LAKE	X	X			X		X		X	X	X			X		X	X		X	X			TRUCKEE RIVER
	MINOR SURFACE WATERS		X	X			X	X			X	X	X			X		X	X		X	X			
	MINOR WETLANDS	EMERGENT/MARSHES	X	X			X	X			X	X	X			X		X	X		X	X	X	X	

Table 5.1-2
BENEFICIAL USES FOR GROUND WATERS OF THE TAHOE BASIN

BASIN DWR NO.	BASIN NAME	BENEFICIAL USES					
		MUN	AGR	IND	FRSH	AQUA	WILD
6-5.01	TAHOE VALLEY -SOUTH	X	X	X			
6-5.02	TAHOE VALLEY -NORTH	X	X				

Table 5.1-3
WATER QUALITY OBJECTIVES FOR CERTAIN WATER BODIES
LAKE TAHOE HYDROLOGIC UNIT

See Fig. 5.1-1	Surface Waters	Objective (mg/L except as noted) [1,2]						
		TDS	Cl	SO_4	B	N	P	Fe
1	Lake Tahoe	60 65	3.0 4.0	1.0 2.0	0.01 -	0.15 -	0.008 -	--
2	Fallen Leaf Lake	50 -	0.30 0.50	1.3 1.4	0.01 0.02	See Table 5.1-4 for additional objectives		
3	Griff Creek	80 -	0.40 -	--	--	0.19 -	0.010 -	0.03 -
4	Carnelian Bay Creek	80 -	0.40 -	--	--	0.19 -	0.015 -	0.03 -
5	Watson Creek	80 -	0.35 -	--	--	0.22 -	0.015 -	0.04 -
6	Dollar Creek	80 -	0.30 -	--	--	0.16 -	0.030 -	0.03 -
7	Burton Creek	90 -	0.30 -	--	--	0.16 -	0.015 -	0.03 -
8	Ward Creek	70 85	0.30 0.50	1.4 2.8	--	0.15 -	0.015 -	0.03 -
9	Blackwood Creek	70 90	0.30 -	--	--	0.19 -	0.015 -	0.03 -
10	Madden Creek	60 -	0.10 0.20	--	--	0.18 -	0.015 -	0.015 -
11	McKinney Creek	55 -	0.40 0.50	--	--	0.19 -	0.015 -	0.03 -
12	General Creek	50 90	1.0 1.5	0.4 0.5	--	0.15 -	0.015 -	0.03 -
13	Meeks Creek	45 -	0.40 -	--	--	0.23 -	0.010 -	0.07 -
14	Lonely Gulch Creek	45 -	0.30 -	--	--	0.19 -	0.015 -	0.03 -
	continued...							

Table 5.1-3 (continued)
WATER QUALITY OBJECTIVES FOR CERTAIN WATER BODIES
LAKE TAHOE HYDROLOGIC UNIT

See Fig. 5.1-1	Surface Waters	Objective (mg/L except as noted) [1,2]						
		TDS	Cl	SO_4	B	N	P	Fe
15	Eagle Creek	35 -	0.30 -	--	--	0.20 -	0.010 -	0.03 -
16	Cascade Creek	30 -	0.40 -	--	--	0.21 -	0.005 -	0.01 -
17	Tallac Creek	60 -	0.40 -	--	--	0.19 -	0.015 -	0.03 -
18	Taylor Creek	35 -	0.40 0.50	--	--	0.17 -	0.010 -	0.02 -
19	Upper Truckee River	55 75	4.0 5.5	1.0 2.0		0.19 -	0.015 -	0.03 -
20	Trout Creek	50 60	0.15 0.20	--	--	0.19 -	0.015 -	0.03 -

[1] Annual average value/90th percentile value.
[2] Objectives are as mg/L and are defined as follows:
B Boron
ClChloride
SO_4 Sulfate
Fe Iron, Total
N Nitrogen, Total
P Phosphorus, Total
TDS Total Dissolved Solids (Total Filterable Residues)

Table 5.1-4
WATER QUALITY OBJECTIVES FOR CERTAIN WATER BODIES
FALLEN LEAF LAKE, LAKE TAHOE HYDROLOGIC UNIT

Constituent	Objective (See Fig. 5.1-1, location 2)
pH[a]	6.5 - 7.9
Temperature[b]	Hypolimnion - ≤15ºC Bottom (105m) - ≤7.5ºC at no time shall water be increased by more than 2.8ºC (5ºF).
Dissolved oxygen[c]	% saturation above 80% and DO >7 mg/L except if saturation exceeds 80% DO at bottom (105m) > 6mg/L
Total nitrogen[d]	0.087[e]/0.114[f]/0.210[g]
Dissolved inorganic - N[h]	0.007 / 0.010 / 0.023
Total phosphorus	0.008 / 0.010 / 0.018
Soluble reactive - P	0.001 / 0.002 / 0.009
Soluble reactive iron	0.004 / 0.005 / 0.012
Total reactive iron	0.005 / 0.007 / 0.030
Chlorophyll-a [ij]	0.6 / 0.9 / 1.5
Clarity - Secchi depth[k] - Vertical extinction coefficient	 18.5 / 16.0[l] / 13.6[m] 0.146 / 0.154 / 0.177[n]
Phytoplankton cell counts[o]	219 / 280 / 450

a 0.5 units above and 0.5 units below 1991 maximum and minimum values. Also reflects stability of this constituent throughout the year.

b Based on 1991 data. Indicates that if temperature in the hypolimnion during the summer exceeds 15ºC or if the water at 105m exceeds 7.5ºC this would constitute a significant change from existing conditions. Unless there is a anthropogenic source of thermal effluent, which does not currently exist, changes in water temperature in Fallen Leaf Lake are natural. Objectives apply at any time during the defining period.

c Based on coldwater habitat protection and 1991 data base. The need for an objective for the bottom (105m) results from the desire to control primary productivity and deposition of organic matter on the bottom. A decline in bottom DO to below 6 mg/L would indicate a fundamental shift in the trophic state of Fallen Leaf Lake.

d Because of the similarity between the mid-lake and nearshore sites, Fallen Leaf Lake objectives for N, P and Fe are based on the combined mid-lake 8 m and 45 m, and nearshore 8 m concentrations. Units are mg N/L, mg P/L and mg Fe/L.

e Mean annual concentration (May - October) unless otherwise noted.

f 90th percentile value unless otherwise noted.

g Maximum allowable value; 1.5 times the maximum 1991 value. No single measurement should exceed this value unless otherwise noted.

h DIN = NO_3+NO_2+NH_4

i Corrected for phaeophytin degradation pigments.

j Units are µg chl-a/L.

k Units are meters.

l 10th percentile since clarity increases with increasing Secchi depth.

m Represents 15% loss of clarity from 10th or 90th percentile value.

n Calculated in the photic zone between 1 m below surface to 35 m. Units are per meter.

o Units are cells per milliliter.

Figure 5.1-1
WATER QUALITY OBJECTIVES FOR CERTAIN WATER BODIES
LAKE TAHOE HYDROLOGIC UNIT

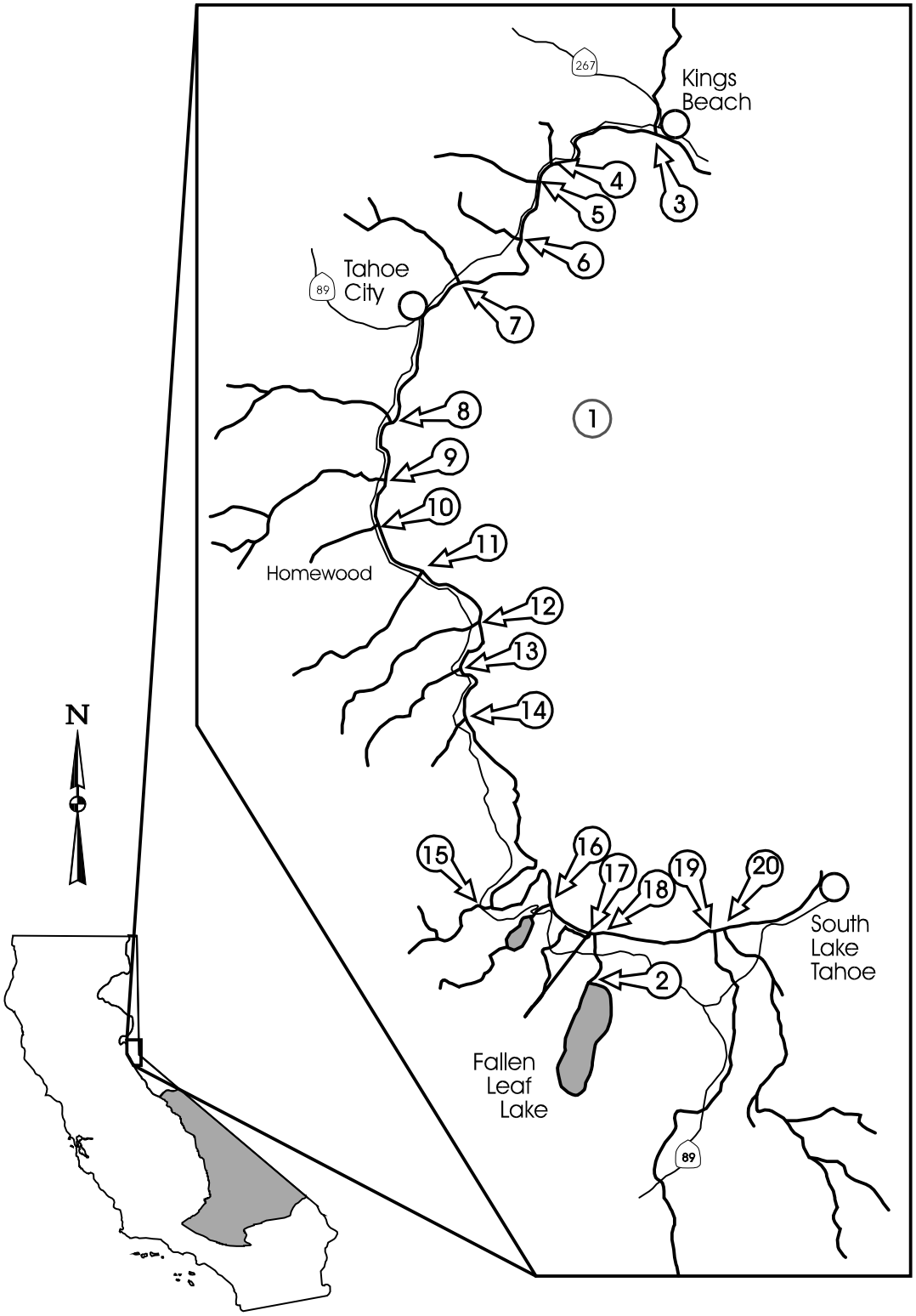


Table 5.1-5
ONE-HOUR AVERAGE CONCENTRATION FOR AMMONIA[1,2]

Waters Designated as COLD, COLD with SPWN, COLD with MIGR (Salmonids or other sensitive coldwater species present)

	Temperature, °C						
pH	0	5	10	15	20	25	30
Un-ionized Ammonia (mg/liter NH_3)							
6.50	0.0091	0.0129	0.0182	0.026	0.036	0.036	0.036
6.75	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
7.00	0.023	0.033	0.046	0.066	0.093	0.093	0.093
7.25	0.034	0.048	0.068	0.095	0.135	0.135	0.135
7.50	0.045	0.064	0.091	0.128	0.181	0.181	0.181
7.75	0.056	0.080	0.113	0.159	0.22	0.22	0.22
8.00	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.25	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.50	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.75	0.065	0.092	0.130	0.184	0.26	0.26	0.26
9.00	0.065	0.092	0.130	0.184	0.26	0.26	0.26
Total Ammonia (mg/liter NH_3)							
6.50	35	33	31	30	29	20	14.3
6.75	32	30	28	27	27	18.6	13.2
7.00	28	26	25	24	23	16.4	11.6
7.25	23	22	20	19.7	19.2	13.4	9.5
7.50	17.4	16.3	15.5	14.9	14.6	10.2	7.3
7.75	12.2	11.4	10.9	10.5	10.3	7.2	5.2
8.00	8.0	7.5	7.1	6.9	6.8	4.8	3.5
8.25	4.5	4.2	4.1	4.0	3.9	2.8	2.1
8.50	2.6	2.4	2.3	2.3	2.3	1.71	1.28
8.75	1.47	1.40	1.37	1.38	1.42	1.07	0.83
9.00	0.86	0.83	0.83	0.86	0.91	0.72	0.58

1 To convert these values to mg/liter N, multiply by 0.822
2 Source: U. S. Environmental Protection Agency. 1986. Quality criteria for water, 1986. EPA 440/5-86-001.

Table 5.1-6
FOUR DAY AVERAGE CONCENTRATION FOR AMMONIA[1,2]

Waters Designated as COLD, COLD with SPWN, COLD with MIGR (Salmonids or other sensitive coldwater species present)

	Temperature, °C						
pH	0	5	10	15	20	25	30
Un-ionized Ammonia (mg/liter NH_3)							
6.50	0.0008	0.0011	0.0016	0.0022	0.0022	0.0022	0.0022
6.75	0.0014	0.0020	0.0028	0.0039	0.0039	0.0039	0.0039
7.00	0.0025	0.0035	0.0049	0.0070	0.0070	0.0070	0.0070
7.25	0.0044	0.0062	0.0088	0.0124	0.0124	0.0124	0.0124
7.50	0.0078	0.0111	0.0156	0.022	0.022	0.022	0.022
7.75	0.0129	0.0182	0.026	0.036	0.036	0.036	0.036
8.00	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.25	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.50	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.75	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
9.00	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
Total Ammonia (mg/liter NH_3)							
6.50	3.0	2.8	2.7	2.5	1.76	1.23	0.87
6.75	3.0	2.8	2.7	2.6	1.76	1.23	0.87
7.00	3.0	2.8	2.7	2.6	1.76	1.23	0.87
7.25	3.0	2.8	2.7	2.6	1.77	1.24	0.88
7.50	3.0	2.8	2.7	2.6	1.78	1.25	0.89
7.75	2.8	2.6	2.5	2.4	1.66	1.17	0.84
8.00	1.82	1.70	1.62	1.57	1.10	0.78	0.56
8.25	1.03	0.97	0.93	0.90	0.64	0.46	0.33
8.50	0.58	0.55	0.53	0.53	0.38	0.28	0.21
8.75	0.34	0.32	0.31	0.31	0.23	0.173	0.135
9.00	0.195	0.189	0.189	0.195	0.148	0.116	0.094

1 To convert these values to mg/liter N, multiply by 0.822.
2 Source: U. S. Environmental Protection Agency. 1992. Revised tables for determining average freshwater ammonia concentrations.

Table 5.1-7
EXAMPLE AMMONIA SPREADSHEET OUTPUT
(USEPA AMMONIA CRITERIA CALCULATOR*)

Required user inputs: 1-h Temp. Cap = 20°; 4-d Temp. Cap = 15°; Temp., °C = 10; pH = 7.0

One-hour criteria not to exceed, mg/L as NH_3

	0<T<TCAP			TCAP<T<30		
Parameter	6.5<pH<7.7	7.7<pH<8.0	8.0<pH<9.0	6.5<pH<7.7	7.7<pH<8.0	8.0<pH<9.0
FT	1.995	1.995	1.995	1.000	1.000	1.000
FPH	2.810	2.810	1.000	2.810	2.810	1.000
Unionized NH_3	0.0464	0.0464	0.1303	0.0925	0.0925	0.2600
Total NH_3+NH_4	25.0369	25.0369	70.3414	49.9552	49.9552	140.3495

Four-day criteria not to exceed, mg/L as NH_3

	0<T<TCAP			TCAP<T<30		
Parameter	6.5<pH<7.7	7.7<pH<8.0	8.0<pH<9.0	6.5<pH<7.7	7.7<pH<8.0	8.0<pH<9.0
FT	1.995	1.995	1.995	1.413	1.413	1.413
FPH	2.810	2.810	1.000	2.810	2.810	1.000
RATIO	28.899	13.500	13.500	28.899	13.500	13.500
Unionized NH_3	0.0049	0.0106	0.0297	0.0070	0.0149	0.0420
Total NH_3+NH_4	2.6657	5.7064	16.0322	3.7654	8.0605	22.6461

Chemical thermodynamic constants**
pKa = 9.731432321
f = 0.001852518

* A Microsoft Excel spreadsheet
Use only that temperature and pH column which applies to the input data
T = Temperature, °C; TCAP = Temperature Cap, °C

** pKa: -log K; K is equilibrium constant for ammonium
f is the fraction of unionized NH_3/(Total NH_3+NH_4)

Table 5.1-8
WATER QUALITY CRITERIA FOR
AMBIENT DISSOLVED OXYGEN CONCENTRATION[1,2]

	Beneficial Use Class	
	COLD & SPWN[3]	COLD
30 Day Mean	NA[4]	6.5
7 Day Mean	9.5 (6.5)	NA
7 Day Mean Minimum	NA	5.0
1 Day Minimum[5,6]	8.0 (5.0)	4.0

1 From: USEPA. 1986. Ambient water quality criteria for dissolved oxygen. Values are in mg/L.

2 These are water column concentrations recommended to achieve the required intergravel dissolved oxygen concentrations shown in parentheses. For species that have early life stages exposed directly to the water column (SPWN), the figures in parentheses apply.

3 Includes all embryonic and larval stages and all juvenile forms to 30-days following hatching (SPWN).

4 NA (Not Applicable).

5 For highly manipulatable discharges, further restrictions apply.

6 All minima should be considered as instantaneous concentrations to be achieved at all times.

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5.2 WASTE DISCHARGE PROHIBITIONS

Section 13243 of the Water Code gives Regional Boards, in Basin Plans or waste discharge requirements, authority to "specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted." Regional Boards may take enforcement action for violations of waste discharge prohibitions. The Water Code may also contain waste discharge prohibitions that are applicable in the Lahontan Region.

Waste discharge prohibitions applicable within the Lake Tahoe Hydrologic Unit are discussed below. Regionwide prohibitions also apply in the Lake Tahoe Hydrologic Unit. See section 4.1 for regionwide prohibitions.

Waste discharge prohibitions in this chapter do not apply to discharges of stormwater when wastes in the discharge are controlled through the application of management practices or other means and the discharge does not cause a violation of water quality objectives. For existing discharges, waste discharge requirements, including, if authorized, NPDES permits, may contain a time schedule for the application of control measures and compliance with water quality objectives. In general, the Regional Board expects that control measures will be implemented in an iterative manner as needed to meet applicable receiving water quality objectives.

Water Code sections 13950 through 13952.1 include special water quality provisions for the Lake Tahoe Basin related to sewage disposal that function as waste discharge prohibitions. Exemptions to those prohibitions are also identified within those sections of the Water Code.

Discharge Prohibitions for the Lake Tahoe Hydrologic Unit (HU)

1. The discharge attributable to human activities of any waste or deleterious material to surface waters of the Lake Tahoe HU is prohibited.

   An exemption to this prohibition may be granted whenever the Regional Board finds all of the following:

   a. The discharge of waste will not, individually or collectively, directly or indirectly, adversely affect beneficial uses, *and*

   b. There is no reasonable alternative to the waste discharge, *and*

   c. All applicable and practicable control and mitigation measures have been incorporated to minimize potential adverse impacts to water quality and beneficial uses.

2. The discharge attributable to human activities of any waste or deleterious material to land below the highwater rim of Lake Tahoe or within the 100-year floodplain of any tributary to Lake Tahoe is prohibited.

3. The discharge attributable to human activities of any waste or deleterious material to Stream Environment Zones (SEZs) in the Lake Tahoe HU is prohibited.

The Regional Board may grant exemptions to Prohibitions 2 and 3 above, for projects relocating existing structures below the highwater rim of Lake Tahoe, within the 100-year floodplain, or within an SEZ, where the area of the structure is relocated on the same parcel or within a defined project area and where the following finding can be made (a "project area" may include multiple adjacent or non-adjacent parcels):

The relocation must result in net or equal water quality benefit. Net or equal benefit is defined as an improvement in or maintenance of function of the associated area below the highwater rim of Lake Tahoe, 100-year floodplain or SEZ. Net or equal benefit may include, but is not limited to, one or more of the following:

a. Relocation of structure to an area further away from the stream channel or wetlands;

b. Protection of restored 100-year floodplain or SEZ or an equivalent area (at a 1:1 ratio for floodplain or 1.5:1 for SEZ) of offsite 100-year floodplain or SEZ through deed restriction or conveyance to a mitigation bank or land conservancy or similar. For projects involving disturbance of wetlands, offsite mitigation may involve larger mitigation ratios;

c. For projects involving the relocation of more than 1000 square feet of impervious coverage within a 100-year floodplain or SEZ, a finding, based on a report prepared by a qualified professional, that the relocation will improve the functioning of the floodplain or SEZ and will not negatively affect the quality of existing habitats.

d. For pier relocation projects in spawning habitat, a finding that equivalent or greater area of spawning habitat is restored or created.

The Regional Board may also grant exemptions to Prohibitions 2 and 3, above, under the following circumstances:

(1) For erosion control projects, habitat restoration projects, wetland rehabilitation projects, SEZ restoration projects, and similar projects, programs, and facilities, if all of the following findings can be made:

(a) There is no reasonable alternative, including relocation, that avoids or reduces the extent of encroachment below the highwater rim of Lake Tahoe, within the 100-year floodplain, or within the SEZ; and

(b) Impacts are fully mitigated.

(2) For public outdoor recreation facilities or private piers if all of the following findings can be made:

(a) The project by its nature must be sited below the high water rim of Lake Tahoe, within the 100-year floodplain, or within the SEZ;

(b) There is no feasible alternative that would reduce the extent of encroachment below the highwater rim of Lake Tahoe, within the 100-year floodplain, or within the SEZ;

(c) Impacts are fully mitigated;

(d) SEZs are restored in an amount 1.5 times the area of SEZ disturbed or developed for the project; and

(e) Wetlands are restored in an amount at least 1.5 times the area of wetland disturbed or developed. Certain wetland areas may require restoration of greater than 1.5 times the area disturbed or developed.

(3) For public service facilities if all of the following findings can be made:

(a) The project is necessary for public health, safety or environmental protection;

(b) There is no reasonable alternative, including spans, that avoids or reduces the extent of encroachment;

(c) The impacts are fully mitigated;

(d) SEZ lands are restored in an amount 1.5 times the area of SEZ developed or disturbed by the project; and

(e) Wetlands are restored in an amount at least 1.5 times the area of wetland disturbed or developed. Certain wetlands may require restoration of greater than 1.5 times the area disturbed or developed.

(4) For projects that require access across SEZs or 100-year floodplains to otherwise buildable sites if all of the following findings can be made:

(a) There is no reasonable alternative that avoids or reduces the extent of encroachment within the SEZ or 100-year floodplain;

(b) Impacts are fully mitigated;

(c) SEZ lands are restored in an amount 1.5 times the area of SEZ disturbed or developed by the project; and

(d) Wetlands are restored in an amount at least 1.5 times the area of wetland disturbed or developed by the project. Certain wetland areas may require restoration of greater than 1.5 times the area disturbed or developed.

(5) For repair or replacement of existing structures, provided that the repair or replacement does not involve the loss of additional lake habitat, or SEZ or floodplain function. Prior to granting any such exemption, the Regional Board shall require that all applicable and practicable control and mitigation measures have been incorporated into the project to minimize any discharges of wastes to surface waters during or following construction.

(6) Projects for monitoring or scientific research related to natural resources and environmental quality. This category includes equipment or structure installation for basic data collection, research, experimental management and resource evaluation activities that do not result in a significant adverse effect on water quality or beneficial uses. Prior to granting any such exemption, the Regional Board shall require that all applicable and practicable control and mitigation measures have been incorporated into the project to minimize any discharges of

wastes to surface waters during or following construction.

5. The discharge of garbage or other solid waste to lands within the Lake Tahoe Basin is prohibited.

6. The discharge of industrial waste within the Lake Tahoe Basin is prohibited. Industrial waste is defined as any waste resulting from any process or activity of manufacturing or construction. Stormwater discharges from industrial facilities are not prohibited when wastes in the discharge are controlled through the application of management practices or other means and the discharge does not cause a violation of water quality objectives.

General Guidance for Prohibition Exemptions

Full mitigation of impacts, as used in the findings above, includes, but is not limited to, proper design and implementation of all applicable and practicable control measures and the 1.5:1 restoration requirements for SEZs. However, the 1.5:1 restoration requirement shall not apply to erosion control projects, habitat restoration projects, wetland rehabilitation projects or SEZ restoration projects.

Projects "to control existing sources of erosion or water pollution" are interpreted to include projects that enhance beneficial uses of water bodies, including wetlands. These may include erosion control projects, habitat restoration projects, wetland rehabilitation projects, and similar projects, programs and facilities.

In Regional Board review of proposed exemptions for public or private recreation projects, the determination whether a project, by its very nature, must be built where construction would otherwise be impossible without violation of a prohibition shall be based on the kind of project proposed, not the particular site proposed.

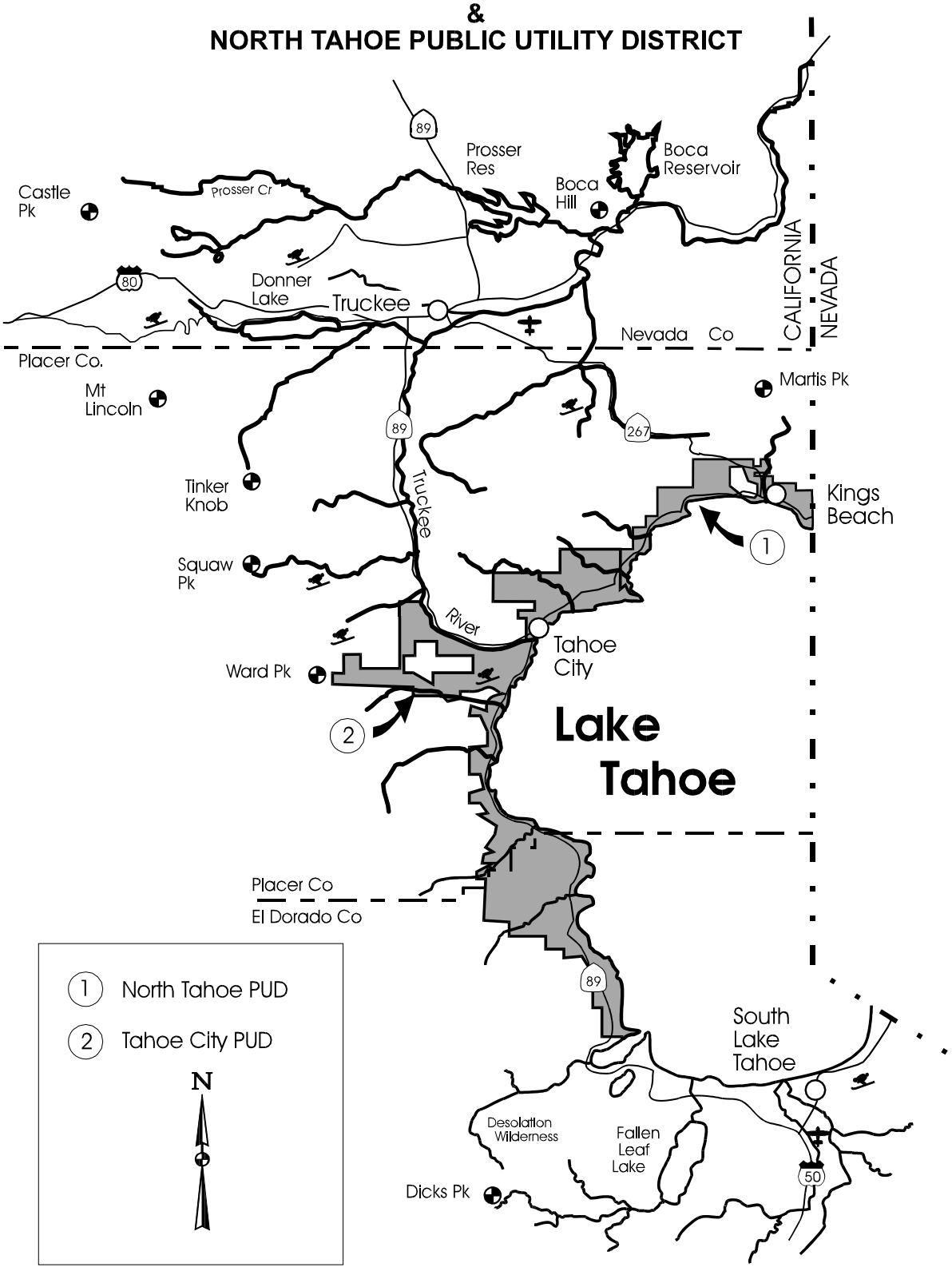
In Regional Board review of proposed exemptions for public health and safety projects, projects necessary to protect public health or safety shall include projects needed to protect the health and safety of occupants of existing structures, including private dwellings, and forest management activities to reduce the risk and severity of wildfires.

Definitions:

"Necessary" shall mean when the appropriate government agency findings that a project is needed to protect public health and safety, or to provide essential services.

"Public recreation" shall mean a project which can be enjoyed by an entire community or neighborhood, or a considerable number of persons. In previously altered floodplain areas (defined as floodplain areas where soils, vegetation and hydrology are found by the Regional Board to have been substantially altered by human activities which occurred prior to June 26, 1975) "public recreation" is limited to public outdoor recreation facilities and/or activities such as hiking trails, bike paths, and similar recreation facilities/activities that do not involve construction of buildings or similar structures.

Figure 5.2-1
TAHOE CITY PUBLIC UTILITY DISTRICT
&
NORTH TAHOE PUBLIC UTILITY DISTRICT



5.3 BEST MANAGEMENT PRACTICES

As noted in the introduction to Chapter 4 of this Basin Plan, Best Management Practices (BMPs) are:

"methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs include but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during and after pollution producing activities to reduce or eliminate the introduction of pollutants into receiving waters"

(40 CFR § 103.2[m])

The State Water Resources Control Board has historically certified BMPs for use in California as part of its approval of water quality management plans prepared by other agencies, although they can be approved separately. The State Board first adopted a statewide *Nonpoint Source Management Plan* in 1988. In 2000, this plan was replaced by the *Plan for California's Nonpoint Source Pollution Control Program.* In 2004 the State Board adopted a "Policy for the Implementation and Enforcement of the Nonpoint Source Pollution Control Program." This policy summarizes the authority of the State and Regional Boards to control nonpoint source discharges under the Porter-Cologne Act.

All current and proposed nonpoint source discharges that could affect the quality of waters of the state should be regulated under WDRs, waivers of WDRs, waste discharge prohibitions, or some combination of these regulatory tools. The State and Regional Boards also implement a broad program of outreach, education, technical assistance and financial incentives. This program is supplemented by collaborative activities with other agencies and non-governmental organizations to facilitate control of nonpoint sources.

The use of BMPs is required under stormwater NPDES permits, although the State and Regional Boards cannot specify the particular BMPs to be selected. Because of the sensitivity of Lake Tahoe and tributary waters, the State Board adopted the following mandatory requirement for BMPs in 1980:

"For construction in the Tahoe Basin allowed under this plan, the structures or facilities built must incorporate best management practices to control erosion and surface runoff."

Specific examples of BMPs given were slope stabilization, protective surface cover or vegetation, and adequate drainage facilities.

This Basin Plan continues the 1980 requirement for BMPs, and the endorsement of the Tahoe Regional Planning Agency's *Best Management Practices Handbook*. Most practices in the Handbook are concerned directly with erosion and stormwater control, but it also addresses other topics such as dredging and antifouling coatings on boats.

The use of BMPs does **not** provide assurance of compliance with concentration-based effluent limitations or TMDL load allocation requirements. Compliance with water quality discharge standards can only be determined on a site-by-site basis.

The Regional Board may consider approval of alternative management practices for use in specific projects on a case-by-case basis. TRPA may also approve alternative BMPs to meet water quality standards when special circumstances occur. Such circumstances may include but are not limited to: streets, highways, and bike trails, existence of high water tables, unusual upstream or downstream flow conditions, and the presence of unusual concentrations of pollutants.

Both the Regional Board and TRPA require a regional grading deadline. Grading, filling, and clearing of vegetation that disturbs soil, and other disturbances of soil are prohibited during inclement weather and for the resulting period of time when the site is covered with snow or in a saturated, muddy or unstable condition. Special regulations and construction techniques will apply to construction activities occurring between October 15 and May 1. All project sites must be adequately winterized by October 15 as a condition for continued work on the site. The Executive Officer may permit exceptions to this grading deadline when finding that controls are in place to protect water quality.

The BMP Handbook also identifies the 20-year, 1-hour design storm for stormwater control facilities, as specified in the TRPA Code of Ordinances (see the section of this Chapter on stormwater problems).

The Lahontan Regional Board requires the use of BMPs in its waste discharge permits for new Tahoe Basin projects, and may issue waste discharge permits to require the "retrofit" of BMPs to existing developed or disturbed sites that are causing water quality problems. Retrofit is also addressed in the areawide municipal stormwater NPDES permits (see the discussions of stormwater later in this Chapter). The Regional Board prefers that detailed, design-level

mitigation proposals, including proposed BMPs, be submitted as early as possible in the review process for waste discharge permits.

Under TRPA's Regional Plan, all persons who own land, and all public agencies which manage public land, are required to install and maintain BMPs. The Regional Plan requires that TRPA permits for new projects that modify structures or establish land coverage shall require application of BMPs to the area affected by the project. As part of its permitting process, TRPA also requires the preparation of a plan and schedule for retrofit of BMPs to the remainder of the parcel.

BMPs for specific types of water quality problems (e.g., problems associated with livestock grazing) are discussed in greater detail in separate sections of this Chapter, below.

5.4 LAND CAPABILITY AND COVERAGE LIMITATIONS

In 1980, the State Board determined that limits on land disturbance and impervious surface coverage are necessary to prevent further increases in nutrient loading to Lake Tahoe from erosion and stormwater runoff. These limits are implemented largely through the land capability system and associated land use restrictions and discharge prohibitions. The Tahoe Regional Planning Agency implements a complex set of land coverage rules through its Regional Plan ordinances.

A system developed by the USFS in 1971, in cooperation with TRPA, provides a relative quantification of tolerance of land in the Lake Tahoe Basin to human disturbance (Bailey 1974). The Lake Tahoe Basin land capability system should not be confused with the U.S. Department of Agriculture system used to classify the suitability of agricultural lands for growing crops. It should also not be confused with the more recent USFS "Cumulative Watershed Effects" methodology (USFS 1988), which provides a different way to assess the sensitivity of watersheds to disturbance (see the discussion of ski areas later in this Chapter).

The land coverage rules are implemented through TRPA and local government programs. The Regional Board implements prohibitions on waste discharges in 100-year floodplains and Stream Environment Zones that reduce land disturbance and coverage that may adversely affect water quality and the beneficial uses of waters.

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5.5 REMEDIAL PROGRAMS AND OFFSET

The water quality impacts of current watershed disturbance will continue to be felt for years to come unless remedial projects are implemented to offset their impacts. In 1980, the State Board adopted prohibitions against discharges or threatened discharges from new development that is not offset by remedial work, and directed the Lahontan Regional Board to adopt an offset policy or approve such a policy if adopted by another agency.

A variety of TRPA programs function to offset the impacts of past development, including excess coverage mitigation, transfer of development rights, and requirements for remedial work as a condition of approval of permits for new or remodeled development.

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5.6 STORMWATER PROBLEMS AND CONTROL MEASURES

Surface runoff from urban areas is the principal controllable source of pollutants affecting Lake Tahoe, contributing fine sediment particles and nutrients to the lake. Development and continued soil disturbance associated with developed land has greatly accelerated natural erosion rates, increased stormwater runoff intensity, and increased fine sediment particle and nutrient loading in stormwater. Disturbance of soils and vegetation, particularly in Stream Environment Zones, has reduced the natural treatment capacity for nutrients and fine sediment particles in stormwater. Impervious surfaces collect pollutants from vehicles and atmospheric sources and discharge them in stormwater. Infiltration of precipitation is greatly reduced; surface runoff dramatically increases, and downstream rill and gully erosion are increased. Stormwater from some land use types, such as golf courses and other areas of heavy fertilizer use, may be particularly rich in nutrients.

Chapter 4 of this Basin Plan includes a more general discussion of stormwater problems and regionwide control measures. Most of the control measures discussed in this Chapter (including limits on development of fragile lands and on total impervious surface coverage, remedial erosion control, excess coverage mitigation and SEZ restoration programs, fertilizer management, and requirements for use of BMPs for erosion and drainage control) are meant to prevent or mitigate stormwater impacts.

Management practices should also infiltrate runoff to negate the effects of increased impervious coverage and drainage density. Management practices should ensure that snow disposal does not harm water quality, and that snow removal from unpaved areas does not expose soils to runoff and further disturbance, contributing to sediment and nutrient loading to receiving waters. This section focuses on effluent limitations, Lake Tahoe TMDL stormwater requirements, stormwater permits and areawide stormwater treatment systems.

Effluent Limitations

In 1980, the State Board adopted an earlier version of the stormwater effluent limitations set forth in Table 5.6-1. The “design storm” for stormwater control facilities in the Lake Tahoe Basin is the 20-year, 1-hour storm; however, containment of a storm of this size does not necessarily ensure compliance with effluent limitations or receiving water quality standards.

The Lahontan Regional Board applies the numbers in Table 5.6-1 on a site- or project-specific basis in response to identified erosion or runoff problems.

The effluent limitations at the top of Table 5.6-1 apply to stormwater discharges to surface waters, and generally to surface runoff leaving a specific project site. If surface runoff enters a project site from upgradient, its quality and volume may together with the quality and volume of runoff generated onsite, affect the quality of runoff leaving the site. Regional Board stormwater permits for sites where offsite stormwater enters the property will take these effects into consideration. In general, where the quality of runoff entering the site is worse than that of runoff generated on site, there should be no statistically significant increase (at a 90 percent confidence level) in pollutants in the water discharged from the site. If the quality of runoff entering the site is equal to or better than the quality of runoff generated on the site, stormwater exiting the site should be of the quality which would be expected if there were no onsite runoff (i.e., onsite stormwater should not degrade clean runoff flowing through the site).

The effluent limitations at the bottom of Table 5.6-1 apply to stormwater discharges to infiltration systems. Infiltration systems include, but are not limited to, trenches, dry wells, ponds, vaults, porous pavement and paving stones. Infiltration effectively filters out sediments and results in reductions in heavy metals, oil and grease, and nutrients bound to particulate matter. Dissolved nutrient concentrations can be reduced by incorporating vegetation and an organic soil layer into the infiltration system (e.g., grass-lined swales, vegetated ponds, etc.) Since runoff is treated by infiltration through vegetation and soil layers, the effluent limits are greater for discharges to infiltration systems. Locating infiltration systems in areas of high ground water may result in ground water contamination and reduced percolation rates. Therefore, discharges to infiltration systems located in areas where the separation between the highest anticipated ground water level and the bottom of the infiltration system is less than five (5) feet may be required to meet the effluent limits for stormwater discharges to surface waters.

Stormwater Management and the Lake Tahoe TMDL

The goal of the Lake Tahoe TMDL is to protect the lake and achieve the deep water transparency standard. To this end, the TMDL identifies the maximum annual average amounts of fine sediment particles, nitrogen, and phosphorus that the lake can

assimilate and meet the deep water transparency standard. The amount of fine sediment particles is quantified by particle number, while nitrogen and phosphorus are quantified by mass.

In baseline estimates, the largest source of fine sediment particles is runoff from developed urban lands, which contribute an estimated 72 percent of the fine sediment particle load to Lake Tahoe. Consequently, the Lake Tahoe TMDL implementation strategy emphasizes actions to reduce fine sediment particle loads from urban stormwater runoff.

Municipal stormwater permits issued to the City of South Lake Tahoe, the Counties of El Dorado and Placer, and to the California Department of Transportation include enforceable load reduction requirements linked to TMDL allocation milestones. In accordance with NPDES permitting requirements, each jurisdiction will be required to develop, implement, and maintain a Pollutant Load Reduction Plan (PLRP) to guide stormwater activities and project implementation. The PLRP shall describe how the municipality plans to achieve required pollutant load reductions for each five year permit term.

Sustainable Development Practices

State Water Resources Control Board Resolution No. 2008-0030 highlights the importance of implementing stormwater management techniques that maintain or restore the natural hydrologic functions of a site by detaining water onsite, filtering pollutants, and infiltrating runoff from impervious surfaces. Such measures have been, and continue to be, the foundation of stormwater management policy in the Lake Tahoe basin.

Infiltration is the most effective method for controlling urban stormwater runoff volumes and reducing associated pollutant loads. Infiltrating stormwater through soil effectively removes fine sediment particles and reduces nutrient concentrations. Additionally, infiltration reduces the volume of stormwater thereby reducing its erosive effects. Consequently, infiltration remains the preferred method for urban stormwater treatment and all new development projects, existing development retrofit projects, and roadway runoff treatment projects should first evaluate and implement all opportunities to infiltrate stormwater discharges from impervious surfaces.

Municipal and Public Roadway Stormwater Treatment Requirements

Municipal jurisdictions and state highway departments must meet load reduction requirements specified by the Lake Tahoe TMDL (Tables 5.17-2, 5.17-3, and 5.17-4). These agencies will likely consider a variety of different design storms, alternative treatment options, and roadway operations practices, and local ordinances to reduce average annual pollutant loads from selected areas to meet waste load allocation requirements.

The Lake Tahoe TMDL requires Lake Tahoe basin municipalities and the California Department of Transportation to develop and implement comprehensive Pollutant Load Reduction Plans (PLRPs) describing how proposed operations and maintenance activities, capital improvements, facilities retrofit projects, ordinance enforcement, and other actions will meet required pollutant load reduction requirements. PLRPs provide responsible jurisdictions the opportunity to prioritize pollutant load reduction efforts and target sub-watersheds that generate the highest annual average pollutant loads. The Water Board developed the Lake Clarity Crediting Program to establish protocols for tracking and accounting for load reductions. The Lake Clarity Crediting Program links actions to improve urban stormwater quality to expected fine sediment particle and nutrient loads and provides the flexibility for the discharger to maximize pollutant load reduction opportunities.

New Development, Redevelopment, and Existing Development Stormwater Treatment Requirements

For new development and re-development projects and private property Best Management Practice retrofit efforts, project proponents shall first consider opportunities to infiltrate stormwater runoff from impervious surfaces. At a minimum, permanent stormwater infiltration facilities must be designed and constructed to infiltrate runoff generated by the 20 year, 1-hour storm which equates to approximately one inch of runoff over all impervious surfaces during a 1-hour period.

Where conditions permit, project proponents should consider designing infiltration facilities to accommodate runoff volumes in excess of the 20 year, 1-hour storm to provide additional stormwater treatment.

Runoff from parking lots, retail and commercial fueling stations, and other similar land uses may

contain oil, grease, and other hydrocarbon pollutants. Project proponents designing treatment facilities for these areas must include pre-treatment devices to remove hydrocarbon pollutants prior to infiltration or discharge and develop and implement contingency plans to prevent spills from polluting groundwater.

Infiltrating runoff volumes generated by the 20 year, 1-hour storm may not be possible in some locations due to shallow depth to seasonal groundwater levels, unfavorable soil conditions, or other site constraints such as existing infrastructure or rock outcroppings. For new development or redevelopment projects, site constraints do not include the existing built environment.

In the event that site conditions do not provide opportunities to infiltrate the runoff volume generated by a 20 year, 1-hour storm, project proponents must either (1) meet the numeric effluent limits in Table 5.6-1, or (2) document coordination with the local municipality or state highway department to demonstrate that shared stormwater treatment facilities treating private property discharges and public right-of-way stormwater are sufficient to meet the municipality's average annual fine sediment and nutrient load reduction requirements.

Stormwater Permits

The Lahontan Regional Board regulates stormwater discharges in the Lake Tahoe Basin through waste discharge requirements for individual dischargers, and through stormwater NPDES permits. As noted in elsewhere in this Chapter, the Regional Board has an active program to ensure the retrofit of BMPs to existing development in the Lake Tahoe Basin. This includes the retrofit of stormwater control measures. The regionwide stormwater NPDES permit program is summarized in Chapter 4; additional information is provided in the statewide BMP Handbooks for municipal, construction, and industrial stormwater NPDES permits (APWA Task Force, 1993).

In 1980, the State Board adopted a requirement that municipal and stormwater NPDES permits be issued for local governments on the California side of the Lake Tahoe Basin (and also recommended that such permits be issued on the Nevada side). This direction preceded the USEPA's development of nationwide regulations for stormwater NPDES permits, and the USEPA was reluctant for such permits to be issued at Lake Tahoe in the early 1980s. The Lahontan Regional Board adopted areawide stormwater waste discharge requirements for local governments (Placer and El Dorado Counties and the City of South Lake Tahoe) in 1984. Following the development of nationwide USEPA stormwater regulations, the Regional Board adopted municipal stormwater NPDES permits for these entities in 1992. (Although the permanent resident populations of these municipalities within the Lake Tahoe Basin are less than 100,000, too small to trigger the automatic requirement for municipal stormwater NPDES permits, the State has determined that stormwater from these areas in a significant contributor of pollutants to Lake Tahoe, and that such permits are necessary.)

Municipal NPDES permits require preparation of stormwater management programs, which must cover the topics summarized in Table 5.6-2. Municipal stormwater management programs must (1) address appropriate planning and construction procedures, (2) ensure BMP implementation, inspection and monitoring at construction sites, and (3) provide for education or training for construction site operators.

Coordination among municipal, industrial and construction stormwater permittees in the same geographic area is expected as part of the NPDES process. As noted in Chapter 4, NPDES permit conditions to control stormwater from state highways may be included in the municipal permit or in a separate permit issued to the highway authority. In 1993, the Regional Board has adopted a separate municipal stormwater NPDES permit for Caltrans to address discharges from California State highways within the Lake Tahoe Basin.

The municipal stormwater NPDES permits for the Lake Tahoe Basin will be important vehicles for ensuring implementation of the remedial Capital Improvements and Stream Environment Zone Restoration Programs and obtaining compliance with BMP retrofit schedules.

The statewide construction stormwater NPDES permit for projects involving one-time or cumulative disturbance of five or more acres does **not** apply within the Lake Tahoe Basin. The Regional Board has the authority to issue individual stormwater NPDES permits for larger Tahoe construction projects, and has adopted a general NPDES permit for such projects, which will be implemented together with current general waste discharge requirements for small commercial, recreation public works, and multifamily residential projects. New projects are reviewed individually, and are required to submit reports of waste discharge before being placed under the general requirements.

There is no heavy manufacturing industry in the Lake Tahoe Basin. However, certain Tahoe dischargers (e.g., recycling facilities, transportation facilities such

as the airport and some marinas, and the South Tahoe Public Utility District wastewater treatment plant) are classified as “industrial” for purposes of the statewide industrial stormwater NPDES permit (see the summary of “industrial” categories and the explanation of the statewide NPDES permitting process in Chapter 4). Because of the sensitivity of affected waters, the Regional Board generally adopts and maintains individual stormwater waste discharge requirements for such facilities; individual stormwater NPDES permits may also be issued.

Some of the areas which need surface runoff management systems are on federal land. The sites are operated under special use permits form the USFS, Lake Tahoe Basin Management Unit. The USFS requires, and should continue to require, compliance with BMPs as a condition of these special use permits. The Regional Board may issue individual stormwater NPDES permits to projects on National forest lands if necessary to protect water quality.

Table 5.6-1
Stormwater Effluent Limitations

These limits shall apply in addition to any more stringent effluent limitations for the constituents below, or to limitations for additional constituents, which are necessary to achieve all applicable water quality objectives for specific receiving waters.

Surface Discharges

Surface water runoff which directly enters Lake Tahoe or a tributary thereto, shall meet the following constituent levels:

Constituent	Maximum Concentration
Total Nitrogen as N	0.5 mg/l
Total Phosphate as P*	0.1 mg/l
Total Iron	0.5 mg/l
Turbidity	20 NTU
Grease and Oil	2.0 mg/l

See the text for discussion of the application of these limits to runoff generated on a discharge site in relation to the quality of runoff entering the site.

Runoff Discharged to Infiltration Systems

Waters infiltrated into soils should not contain excessive concentrations of nutrients which may not be effectively filtered out by soils and vegetation. See the text for further discussion of the application of these limits:

Constituent	Maximum Concentration
Total Nitrogen as N	5 mg/l
Total Phosphate as P*	1 mg/l
Total Iron	4 mg/l
Turbidity	200 NTU
Grease and Oil	40 mg/l

Note: *Total phosphate is measured as "total phosphorus."

Table 5.6-2
Activities to be Addressed in Municipal Stormwater Management Programs (Adapted from: APWA Task Force, 1993)

For Residential/Commercial Activities:

- Roadway and drainage facility operations and maintenance programs
- BMP planning for new development and redevelopment projects
- Retrofitting existing or proposed flood control projects with BMPs
- Municipal waste handling and disposal operations
- Pesticide, herbicide, and fertilizer use controls

For Improper Discharge Activities:

- Prevention, detection and removal program for illegal connections to storm drains
- Spill prevention, containment and response program
- Program to promote proper use and disposal of toxic materials
- Reduction of stormwater contamination by leaking/overflowing separate sanitary sewers

For Industrial Activities:

- Inspection and control prioritization and procedures
- Monitoring of significant industrial discharges

For Construction and Land Development Activities:

- Water quality and BMP assessments during site planning
- Site inspection and enforcement procedures
- Training for developers and contractors

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5.7 STREAM ZONES, FLOODPLAINS, SHOREZONES, AND GROUND WATER

Stream Environment Zones

An important component of water quality protection programs in the Lake Tahoe Basin is the preservation and restoration of "Stream Environment Zones" (SEZs). Although SEZs are generally synonymous with "wetlands" and "riparian areas" as discussed elsewhere in this Basin Plan, the criteria for field delineation of SEZs, and SEZ control measures, are unique to the Lake Tahoe Basin (and the Tahoe Regional Planning Agency's "Lake Tahoe Region," which includes part of the Truckee River watershed). One of the differences between the TRPA and federal criteria is the use of both primary and secondary SEZ indicators in the TRPA system.

The Lahontan Regional Board's regionwide control measures for protection and restoration of wetlands are discussed in Chapter 4. In the Lake Tahoe Basin, the Regional Board implements waste discharge prohibitions to protect SEZs; these prohibitions and applicable exemption criteria are discussed in the section of this Chapter on waste discharge prohibitions.

The dense vegetation of SEZs is capable of rapid nutrient uptake and incorporation, while the moist to saturated soils are conducive to denitrification. Studies of nutrient removal by SEZs have shown that:

- Sheet flow across SEZs provides the most effective treatment of water
- The natural treatment capability of SEZs is destroyed where development causes channelization, and
- Channelized SEZs may actually increase sediment and nutrient loading in areas where erosion is caused by concentrated flow.

While SEZs have been found to be very effective in removing nutrients and sediment, during certain rainfall and snowmelt episodes, and following the fall die-off of vegetation, SEZs can also act as a source of nutrients and sediments, especially if they are disturbed. Nevertheless, the effect of an undisturbed SEZ as a sink for nutrients and sediment remains.

In addition to removing nutrients from stormwater, naturally functioning SEZs can reduce flood peaks, diffuse flow, increase evapotranspiration, and increase the retention time of surface water. SEZs also have many other values related to water quality, such as scenic, wildlife, fishery, and vegetation values.

In 1982, following a "threshold study" to evaluate existing environmental conditions, TRPA estimated that 4,376 of the 9,196 acres of SEZs in its jurisdiction had been developed, disturbed or subdivided. In addition to the 9,196 acres of SEZs in the urbanized areas, TRPA reported 15,971 acres existing on public lands. TRPA estimates that development in SEZs has resulted in approximately 10 times the impervious surface coverage that the Bailey coefficients would allow. Because most of the significant SEZ disturbance has occurred in urbanized areas close to Lake Tahoe, the loss of natural treatment capacity for sediment and nutrients in stormwater from these areas, and the consequent increased pollutant loading to Lake Tahoe, is of special concern.

Identification of SEZs and SEZ Setbacks

SEZs are biological communities that owe their characteristics to the presence of surface water or a seasonal high ground water table. Specific criteria for defining SEZs have changed over time and remain subject to future change.

The following criteria are used by TRPA for identification of SEZs. A Stream Environment Zone is determined to be present if any one of the following key indicators is present, or in the absence of a key indicator, if any three of the following secondary indicators are present. Plant communities are identified in accordance with the definitions and procedures contained in the report entitled *Vegetation of the Lake Tahoe Region, A Guide for Planning* (TRPA 1971).

1. **Key Indicators:** Key indicators are:

   (a) Evidence of surface water flow, including perennial, ephemeral, and intermittent streams, but not including rills or man-made channels; or

   (b) Primary riparian vegetation; or

   (c) Near surface groundwater; or

   (d) Lakes or ponds; or

   (e) Beach (Be) soils; or

(f) One of the following alluvial soils:

(i) Elmira loamy coarse sand, wet variant (Ev)

(ii) Marsh (Mh).

2. **Secondary Indicators:** Secondary indicators are:

(a) Designated floodplain

(b) Groundwater between 20-40 inches

(c) Secondary riparian vegetation

(d) One of the following alluvial soils:

(i) Loamy alluvial land (Lo), or

(ii) Celio gravelly loamy coarse sand (Co), or

(iii) Gravelly alluvial land (Gr).

The boundary of a SEZ is the outermost limit of the key indicators; the outermost limit where three secondary indicators coincide; or if Lo, Co or Gr soils are present, the outermost limit where two secondary indicators coincide, whichever establishes the widest SEZ at any point. The outermost boundaries of a stream are the bank-full width of such stream which is defined as the level of frequent high flow, i.e., the level of flood with a recurrence interval of approximately 1.5 years. Other definitions of terms used in the criteria above are given in Table 5.7-1.

Note that SEZs can include bodies of open water as well as wet meadows without defined stream channels. SEZs are generally identical with Bailey land capability Class 1b lands (see the section of this Chapter on land capability, above). One hundred year floodplains are sometimes, but not always, included within SEZs; see the separate section of this Chapter on 100-year floodplain protection for control measures associated with 100-year floodplains which are not also SEZs.

The SEZ criteria can be compared to the federal definition of wetlands (40 CFR § 110.1[f]). Federal “jurisdictional” wetlands are areas which 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.”

TRPA's official land capability maps shall be used to identify SEZs initially, but are subject to field verification in every instance.

All new development should be set back from the edge of SEZs to buffer the SEZs from erosion, runoff, alteration, and human activities associated with that development. In addition to preserving the integrity of the SEZ, setbacks preserve the important wildlife and scenic values of the edge zone created by the SEZ and the adjoining vegetation types.

SEZ Protection

During development of the land capability system, TRPA and the U.S. Forest Service recognized the importance of protecting SEZs. Bailey (1974) recommended that no more than 1% impervious surface coverage or permanent disturbance be allowed within SEZs. Although early land use plans for the Lake Tahoe Basin endorsed protection for SEZs, protective measures were not strictly enforced until the State Water Resources Control Board adopted SEZ discharge prohibitions discussed earlier in this Chapter, and TRPA adopted similar land use restrictions.

TRPA's Goals and Policies provide that SEZs shall be protected and managed for their natural values, and that ground water development in SEZs shall be discouraged when such development might impact associated plant communities or instream flow. The Regional Plan recognizes that, because of their importance to water quality, encroachment on SEZs should be severely restricted, and areas of existing encroachment should be restored wherever possible. These preventative BMPs are cost effective ways to protect water quality.

The Regional Board and TRPA exemption findings include requirements for a minimum 1.5:1 restoration offset for new disturbance and development which is permitted in SEZs. Implementation of this offset restoration is expected to help fulfill TRPA's SEZ restoration goals and to provide a margin of safety in the event that restored SEZs are not functionally equivalent to natural SEZs.

Relocation of coverage in SEZs may be permitted when there is a net benefit to the SEZs. The findings that must be made to permit relocation are found in section 5.2 of this Chapter.

Additional restrictions on SEZ disturbance apply to resource management activities such as timber harvest and livestock grazing; see the discussions of these activities elsewhere in this Chapter.

Protection of SEZs is also being achieved through land acquisition under the California Tahoe Conservancy and U.S. Forest Service Santini-Burton programs.

In addition to the SEZ protection and restoration programs, TRPA's regional "environmental threshold carrying capacity" standards for the protection of vegetation resources call for the maintenance of existing species richness by providing for the maintenance of nine plant associations, including the deciduous riparian association, the meadow association, and the wetland associations, and require that at least four percent of the total undisturbed vegetation in the Region remain deciduous riparian vegetation. TRPA's wildlife threshold standards state that a non-degradation standard shall apply to significant wildlife habitat consisting of deciduous trees, wetlands, and meadows while providing for opportunities to increase the acreage of such riparian associations.

SEZ Restoration

The restoration of disturbed SEZs has been carried out by the U.S. Forest Service as part of its watershed restoration program, by the California Tahoe Conservancy, as part of erosion control projects implemented by local governments, and by private parties as mitigation for specific projects.

In 1982, TRPA adopted an "environmental threshold carrying capacity" management standard which directs that agency to:

"...preserve existing naturally functioning SEZ lands in their natural condition and restore 25 percent of the SEZ lands that have been identified as disturbed, developed, or subdivided, to attain a 5 percent total increase in the areas of naturally functioning SEZ lands."

In addition to the formal SEZ restoration program, SEZ restoration is required as a condition of approval for exemptions from land use and discharge prohibitions for other projects. TRPA's Code of Ordinances also provides incentives for SEZ restoration in the form of "bonus" multifamily residential or tourist accommodation development allocations for developers.

Where full SEZ restoration is not being proposed, BMPs should be used to reduce the impacts of existing development on SEZs and their water quality-related functions. Specific measures which can be used to protect and enhance disturbed SEZs are discussed later in this Chapter in connection with specific problem sources such as livestock grazing.

SEZ Creation

The potential also exists for creation of new SEZs, or expansion of the boundaries of existing SEZs in the Lake Tahoe Basin to increase the potential for stormwater treatment. A few small wetlands have already been created in associations with specific Tahoe Basin projects. As for wetlands restoration, scientific criteria are being developed for wetlands creation (Costlier and Candela 1990), and many of the same concerns about development of natural wetland functions apply. The Regional Board generally encourages additional SEZ creation in the Lake Tahoe Basin, but the impacts of each proposal on water quality and beneficial uses must be carefully evaluated. For example, a water diversion to support a created SEZ could adversely affect beneficial uses at the diversion site.

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 1988). 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 certain 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 SEZs/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, location, type of waste to be treated, degree of isolation of the created wetlands, and other appropriate factors. Any discharge from a created wetland which does not qualify as "waters of the U.S." must meet applicable water quality standards of its receiving water(s).

Floodplain Protection

Flooding in the Lake Tahoe Basin results from rapid surface water runoff from rainfall, snowmelt, or both, that exceeds the capacity of the natural and manmade drainage systems. Localized flooding occurs throughout the urbanized areas of the Lake Tahoe Region, but is most prevalent in low-lying areas of the south shore, with its broad alluvial plain. Flooding from seiches (abnormally large waves generated by earthquakes or landslides) is also possible in the shorezone of Lake Tahoe and other lakes in the Region.

As noted in Chapter 4 of this Basin Plan, development in floodplains contributes to water quality problems as well as exposing people and property to flood hazards. In addition to providing natural treatment capacity for water pollutants, undisturbed floodplains reduce the intensity of downstream flows, and thus the potential for streambank erosion. In developed floodplains, flood waters can also adversely affect water quality by rupturing sewer lines, and mobilizing stored toxic substances.

Control Measures for Floodplain Protection

This Basin Plan includes Regional Board waste discharge prohibitions to protect 100-year floodplains in the Lake Tahoe Basin and the Truckee River watershed that are separate from the prohibitions for protection of Stream Environment Zones (SEZs).

The criteria for definition of SEZs, outlined in the previous section of this Chapter, include 100-year floodplains as secondary indicators, but unless other indicators are also present, a 100-year floodplain is **not** automatically considered to be a SEZ. When a 100-year floodplain **is** considered a SEZ, the SEZ exemption criteria in this Chapter apply. TRPA (has land use restrictions against construction within 100-year floodplains, and has adopted a set of floodplain exemption criteria, which are very similar to the SEZ exemption criteria, for projects in floodplains which are not also SEZs.

In evaluating proposed measures to “minimize” impacts for floodplain projects, the Regional Board should use the regionwide criteria in Chapter 4.

In evaluating proposed exemptions to discharge prohibitions for environmental protection projects that are related to protection or enhancement of parameters other than water quality and beneficial uses (e.g., transportation, noise, energy conservation) the Regional Board should give the highest priority to water quality protection.

All public utilities, transportation facilities, and other necessary public uses located in the 100-year floodplain must be constructed and maintained so as to prevent damage from flooding and not to cause flooding.

In remote locations and other locations where 100-year floodplain maps have not yet been prepared by TRPA, the U.S. Army Corps of Engineers, the U.S. Geological Survey, or the Federal Emergency Management Agency (FEMA), and where there is reason to believe that a flood hazard may exist, the Regional Board will require project applicants to accurately delineate the 100-year floodplain in their applications for waste discharge permits.

The Regional Board's 100-year floodplain prohibitions for the Lake Tahoe HU also apply to the area below the high water rim of Lake Tahoe, which corresponds to part of the area which TRPA considers “shorezone.” TRPA's development restrictions and exemption findings for 100-year floodplains do not apply to the shorezone of Lake Tahoe, except where the project site is determined to be within the 100-year floodplain of a tributary stream. Instead, TRPA uses the shorezone provisions of its Code of Ordinances. See section 5.2 for findings that must be made by the Regional Board to approve exemptions to the floodplain discharge prohibitions for projects affecting the “shorezone” of Lake Tahoe.

Shorezone Protection

The littoral (nearshore) areas of lakes are often the most biologically productive. Warmer temperatures and penetration of light to the bottom encourage plant growth which in turn supports invertebrates and fish. Littoral areas are often very important for fish spawning and the early life-cycle stages of young fish. Human activities in and near the littoral zone can physically alter fish habitat and contribute nutrients leading to eutrophication and the alteration of food webs. Rocky shorezones are generally considered better fish habitat than sandy or silty areas; erosion and sedimentation can degrade habitat quality. Lakeshore areas near tributary stream deltas are important “staging areas” for lake fish which migrate up the streams to spawn. Increased growth of attached algae and rooted plants in the shorezone is the most visible sign of eutrophication to human recreational users of lakes.

Piers, marinas, buoys, breakwaters, floating docks, and jetties are found in the nearshore of Lake Tahoe, along with most “prime fish habitat.” Prime fish habitat consists of areas of rock, rubble, or cobble substrates which provide suitable conditions to support prey organisms and spawning. The shorezone is also particularly attractive to many species of wildlife, including bald eagles, ospreys, and waterfowl. TRPA has adopted regional “environmental threshold carrying capacity” standards for the protection of nearshore fish habitat and wildlife, including waterfowl habitat.

Fish habitat maps have been adopted as part of TRPA's regional land use plan (TRPA 1987). These maps, and the habitat classifications used, differ somewhat from the maps and habitat classifications derived from a joint study by the U.S. Fish and Wildlife

Service, the California Department of Fish and Wildlife, and the Nevada Department of Wildlife.

In 1982, much of the fish habitat in Lake Tahoe rated "good" under the TRPA system experienced moderate to heavy boat traffic, contributing to the decrease in its rating from "excellent" to "good." Siltation and alteration of the lake bottom also contribute to degraded lake habitat.

Shoreline erosion and sediment transport are natural processes, which contribute to beach replenishment; their interruption can result in beach erosion and deep water beaches. Human activities can accelerate shoreline erosion. Tributary streams can create barrier beaches which protect backshore areas from wave action. Encroachment on delta areas can interrupt barrier beach formation and create severe backshore erosion, liberating stored sediment and nutrients. Unnatural fluctuations in lake level may also contribute to water quality problems, eroding large quantities of sediments and nutrients from the shoreline. A dam at the outlet of Lake Tahoe has regulated its maximum level at 6229.1 feet above mean sea level (6.1 feet above the natural level) since 1934.

Shorezone disturbance has the potential to jeopardize the survival of the endangered plant species Tahoe yellow cress, *Rorippa subumbellata,* which is currently found only in the shorezone of Lake Tahoe.

The shorezone of Lake Tahoe is especially vulnerable to the impacts of development, recreation, and underwater construction activities to support recreation (see the separate section of this Chapter on impacts of and control measures for water quality problems related to boating). The following is a general discussion of shorezone protection programs.

Control Measures for Shorezone Protection

Regional Board staff participate in the interagency review process for proposed projects in the shorezone of Lake Tahoe, and may draft waste discharge requirements if necessary to protect water quality. (See the section of this Chapter on recreation for more information on Regional Board regulation of dredging and construction in Lake Tahoe.) The prohibitions against discharges and threatened discharges within SEZs and within 100-year floodplains or below the high water rim of Lake Tahoe apply to portions of the shorezone and are primary measures to protect the shorezone.

Section 401 and 404 Permits

As discussed in Chapter 4 of this Basin Plan, Section 401 of the federal Clean Water Act requires state "water quality certification" for certain types of permits granted by federal agencies such as the Federal Energy Regulatory Commission (FERC) and the U.S. Army Corps of Engineers. In some cases the State Board handles Section 401 certifications directly, and in some cases it delegates authority to the Regional Boards. Applicants for Section 401 certification for Lake Tahoe Basin projects should contact Regional Board staff for information on current certification procedures.

Section 404 of the Clean Water Act requires permits from the U.S. Army Corps of Engineers for dredge and fill activities in "waters of the United States," which include essentially all surface waters and "jurisdictional wetlands" in the Lake Tahoe Basin. In order to simplify its permitting process, the Corps has issued a variety of "nationwide permits" for certain types of activities. To be effective in California, the Corps nationwide permits require Section 401 certification by the State Board.

Protection of Lakes and Streams Tributary to Lake Tahoe

Control measures designed to protect and enhance Lake Tahoe are expected to protect tributary lakes and streams.

The Lake Tahoe Basin includes about 170 lakes and ponds other than Lake Tahoe, most of which are in California. Many of these are within the Desolation Wilderness or in National Forest lands managed for dispersed recreation use, and the major threats to water quality are from human wastes and watershed disturbance due to recreational overuse (see the section of this Chapter on control of recreational impacts). Several of the larger lakes have residential or recreational development within their watersheds (Fallen Leaf, Cascade, and Upper and Lower Echo Lakes). Threats to water quality of tributaries of Lake Tahoe include nutrients from past use of septic systems, watershed disturbance, stormwater runoff from roads and parking areas, livestock grazing, and vessel wastes. Taste and odor problems have been reported in water supplies from Fallen Leaf Lake; they appear to be associated with blooms of an algal species usually associated with eutrophic conditions. The U.S. Forest Service is monitoring water quality in a Desolation Wilderness lake to determine the impacts of atmospheric deposition.

Development around Fallen Leaf Lake has been sewered. Development near other larger lakes discharges toilet wastes to holding tanks; graywater discharges to leachfields are permitted in some circumstances (see the section of this Chapter on wastewater treatment, export, and disposal). The Regional Board should continue to review monitoring data for these lakes to determine the need for further controls on wastewater.

Problems affecting streams tributary to Lake Tahoe, and their beneficial uses (including fish habitat) include siltation, channelization, dredging, removal of rock or gravel, culverts, bridges, diversions, urban runoff, snow disposal and littering. Stream flows for fish habitat may be endangered by diversions for domestic use, irrigation, and snowmaking.

Streams themselves are included in the definition of the term “Stream Environment Zone,” and all of the SEZ protection measures discussed in this Chapter apply. TRPA requires development adjacent to tributaries to fully mitigate adverse impacts to the fishery.

The control measures discussed throughout this Chapter, which are implemented by the Regional Board, TRPA, and other agencies, will protect the tributaries of Lake Tahoe as well as the lake itself. See especially the sections on SEZs, shorezone protection, and 100-year floodplain protection.

Ground Water Protection

Ground water contributes an estimated 13 percent of the annual nutrient loading to Lake Tahoe, but is assumed to contribute no fine sediment particles to the lake. Loeb (1987) found ground water concentrations of nitrate in three watersheds to be lowest (by a factor of two to ten) in areas farthest upgradient from Lake Tahoe and to increase downgradient toward the lake. This corresponds to the degree of land disturbance. The TMDL relies on findings of the Army Corps of Engineers (ACOE) Groundwater Evaluation report (2003). The study divided the Tahoe basin watershed into five ground water basins, and also analyzed the average nutrient concentrations of land use types based on ground water monitoring wells (Table 5.7-2). Findings by the ACOE study support previously asserted hypotheses that urbanization can significantly increase nitrate concentration in ground water through fertilizer addition, sewer line exfiltration, infiltration of urban runoff, and leachate from abandoned septic systems. Future development and/or continued soil disturbance in already developed areas may increase nutrient transport in ground water by removing vegetation which normally recycles nutrients in the watershed. Although ground water disposal of stormwater is generally preferable to surface discharge because it provides for prolonged contact with soils and vegetation which remove nutrients, infiltration of urban stormwater in areas with high groundwater tables may be undesirable because of possible contamination of drinking water supplies from toxic runoff constituents.

In addition to contributing nutrients, human activities in the Lake Tahoe Basin have led to localized ground water contamination through leaks, spills, and illegal disposal of fuels and solvents. The impacts of infiltration of stormwater containing petroleum products, heavy metals, and deicing chemicals on ground water quality at Lake Tahoe have not been well studied, but are of concern. Local naturally high concentrations of uranium and arsenic in groundwater have also limited the use of some potential municipal supplies. Because of these problems, and because total consumptive use of surface and ground water in the Tahoe Basin is limited by interstate agreement, it is important to protect the remaining good quality ground water for municipal use.

Control Measures for Ground Water Protection

Further increases in nutrient concentrations in Tahoe Basin ground waters can be prevented through control measures discussed elsewhere in this Chapter, including use of alternatives to infiltration in areas with high ground water, fertilizer management, maintenance and upgrading of sewer systems, and vegetation protection and revegetation of denuded areas. Because ground water tables are often very near the surface in Stream Environment Zones, protection of SEZs will also protect ground water quality.

Many of the control measures needed to control erosion and surface runoff are also needed to protect ground water. The surface and ground water systems of the Lake Tahoe Basin are interconnected, and the control measures are directed towards protecting both.

Programs used to control surface runoff will incorporate measures to protect ground water. The prohibitions adopted to prevent development which threatens water quality include prohibitions against discharges to ground water. The limitations on vegetation removal set to prevent erosion from timber harvesting, ski areas, and other sources will also help protect ground water. Programs to enforce BMPs at sites with onsite surface water problems will also incorporate those Best Management Practices adopted to protect ground water.

Controls on solid waste disposal and on toxic leaks and spills (discussed elsewhere in this Chapter, and in greater detail in Chapter 4) will also protect ground water quality in the Lake Tahoe Basin. Because redevelopment of existing urban areas is expected to be an important component of future development in the Basin, Regional Board staff should continue to cooperate with local governments in identification of soil and ground water contamination from past development, and in requiring cleanup of identified problems before new development takes place.

Table 5.7-1
DEFINITIONS OF SEZ TERMINOLOGY

Alluvial Soils - All the following soil types owe their major characteristics to the presence of surface or subsurface water:

(a) Loamy alluvial land (Lo).
(b) Elmira loamy coarse sand, wet variant (Ev).
(c) Celio gravelly loamy course sand (Co).
(d) Marsh (Mh).
(e) Gravelly alluvial land (Gr).
(f) Fill land (Fd)

Confined - Stream types classified under major categories A and B, and stream type C2, as defined in the report entitled "A Stream Classification System", David L. Rosgen, April, 1985.

Designated Flood Plain - The limits of the intermediate Regional Flood where established for creeks by the U.S. Army Corps of Engineers, or the limits of the 100-year flood where established for creeks by the U. S. Army Corps of Engineers.

Ephemeral Stream - Flows sporadically only in response to precipitation, with flows lasting a short time.

Groundwater between 20-40 inches - Evidence of ground water between 20 and 40 inches below the ground surface (somewhat poorly drained soil).

Intermittent Stream- Flows in response to precipitation or snow melt.

Lake - A water body greater 20 acres in size, exceeding two meters deep at low water and lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 20 percent areal coverage.

Man-Made Channel - A channel constructed by man for the purpose of conveying water or a channel created by water being discharged from a man-made source, such as a culvert or pipe.

Near Surface Groundwater - Evidence of ground water within 20 inches of the ground surface (poorly drained soil).

Perennial Stream - Permanently inundated surface stream courses. Surface water flows throughout the year except in years of infrequent drought. Perennial streams shall be those shown as solid blue lines on USGS Quad Maps, or streams determined to be perennial by TRPA.

Pond - A standing water body of less than 20 acres in size and/or less than two meters deep at low water.

Table 5.7-1 (continued)
DEFINITIONS OF SEZ TERMINOLOGY

Primary Riparian Vegetation - the following vegetative community types as identified in the 1971 TRPA report entitled "Vegetation of the Lake Tahoe Region, A Guide for Planning" (see TRPA, 1988, Vol. I, Attachment 4 for species composition):

(a) Type 0: Open water - Open water, swamps and pools and vernal pools.
(b) Type 2: Herbaceous - Wet marsh or meadow and Sphagnum bog.
(c) Type 7: Riparian shrub - Willow thicket and Alder thicket.
(d) Type 9: Broadleaf - Low elevations.

SEZ Setbacks- A strip of land adjacent to the edge of a SEZ, the designated width of which is considered the minimum width necessary to protect the integrity of the various characteristics of the SEZ. The width of the setback shall be established in accordance with the procedure set forth in Subsection 37.3.D of the TRPA Code of Ordinances.

Secondary Riparian Vegetation - The following vegetative types as identified in the 1971 TRPA report entitled "Vegetation of the Lake Tahoe Region, A Guide for Planning" (see TRPA, 1988, Vol. I, Attachment 4 for species composition):

(a) Type 2: Herbaceous - Wet mesic meadow.
(b) Type 9: Broadleaf - High elevations.
(c) Type 19: Lodgepole - Wet type.

Slope Condition - The condition of the slope located adjacent to the steam channel or edge of the SEZ shall be defined as follows. The extent of existing slope protection, which is defined as the percent cover of original duff layer, down logs, low growing vegetation or rock fragments greater than 1-2 inches in diameter, shall be given primary consideration when determining slope condition.

(a) Good - Slopes show little or no evidence of surface (sheet, rill, gully) erosion or mass wasting. Slopes are typically covered 90 percent or more with original duff layer, down logs, slash, low growing vegetation or rock fragments greater than 1-2 inches in diameter. Slope gradient is commonly less than 30 percent. Soil horizons are usually cohesive and consolidated.
(b) Average - Slopes show evidence of surface (sheet, rill, gully) erosion or mass wasting over 5 to 25% of the slope surface. Slopes are typically covered between 50 to 90 percent with original duff layer, down logs, slash, low growing vegetation or rock fragments greater than 1-2 inches in diameter. Slope gradient is commonly between 30 and 70 percent. Soil horizons are typically moderately cohesive and consolidated.
(c) Poor - Slopes show evidence of active and pronounced surface (sheet, rill, gully) erosion or mass wasting over more than 50 percent of the slope surface. Slopes are typically covered less than 50 percent with original duff layer, down logs, slash, low growing vegetation or rock fragments greater than 1-2 inches in diameter. Slope gradient is often greater than 70 percent. Soil horizons are typically non-cohesive and unconsolidated. Evidence of seeping is often present.

Terrace - A moderately flat land area, above the flood plain, generally less than 20 percent slope.

Unconfined - Stream types classified under major categories C (excluding stream type 2), D and E as defined in the report entitled "A Stream Classification System", David L. Rosgen, April 1985.

Table 5.7-2
AVERAGE NUTRIENT CONCENTRATIONS OF GROUNDWATER WELLS BASED ON LAND USE TYPES (USACE 2003)

Land-use	Nitrogen Ammonia + Organic Dissolved (mg/L)	Nitrogen Nitrite plus Nitrate Dissolved (mg/L)	Total Dissolved Nitrogen (mg/L)	Dissolved Orthophosphorus (mg/L)	Total Dissolved Phosphorus (mg/L)
Residential	0.26	0.37	0.63	0.081	0.11
Commercial	0.16	0.51	0.67	0.092	0.12
Recreational	0.40	1.2	1.6	0.073	0.10
Ambient	0.16	0.11	0.27	0.040	0.049

5.8 WASTEWATER TREATMENT, EXPORT, AND DISPOSAL

The Porter-Cologne Act (§ 13950-13952) includes specific language regarding domestic wastewater disposal in the Lake Tahoe Basin. It requires the export of all domestic wastewater from the California portion of the Lake Tahoe Basin; an Executive Order of the Governor of Nevada requires export on the Nevada side. The TRPA also prohibits the discharge of domestic, municipal, or industrial wastewater within its jurisdiction, with the types of exceptions noted below.

Under the Porter-Cologne Act, the Regional Board allows exceptions to the mandate for export for a small number of summer homes in remote areas of the Lake Tahoe Basin where sewering would be environmentally damaging. Toilet wastes must be disposed to holding tanks, or incinerator toilets; holding tank wastes or ashes must be exported from the Lake Tahoe Basin (see the discussion of septage disposal in Chapter 4). Disposal of graywater (sink and shower wastes only) to leachfields may be allowed. Food wastes must be exported or incinerated. Garbage grinders, washing machines, dishwashers, and phosphate-based detergents are not allowed. Proper long-term maintenance of exempted facilities (both holding tanks and greywater systems) is very important. Regional Board staff should continue surveillance of these exempted facilities, and their exemptions should be revoked if the Regional Board cannot continue to find that they will not individually or collectively, directly or indirectly, adversely affect the quality of the waters of Lake Tahoe. The Forest Service periodically reviews its permits for summer home tracts. Regional Board staff should continue to review and comment on proposals for permit extensions, to ensure that wastewater issues are adequately addressed. The Regional Board shall make sure that the conditions of exemptions are complied with before extending the exemptions for septic system discharges. The Regional Board will also reconsider the exemptions in the light of technical advances permitting installation of low pressure sewers in environmentally sensitive areas.

Proper disposal of domestic wastewater from holding tanks and chemical toilets in boats and recreational vehicles is an issue of concern in the Lake Tahoe Basin. See the discussions of control measures for campgrounds and day use areas, and for impacts of boating recreation in the section of this Chapter on recreational impacts, below.

Occasionally, existing structures in more urbanized areas of the Lake Tahoe Basin are found not to be connected to a sewer system. Wastewater collection and treatment agencies should continue to review records and use appropriate field methods to survey for unconnected wastewater discharges within their jurisdictions, and should inform Regional Board staff when such discharges are found. Where necessary, the Regional Board may use enforcement action to prevent discharges from unconnected structures. The Tahoe Regional Planning Agency requires all projects involving a new structure, or reconstruction or expansion of an existing structure, which is designed or intended for human occupancy, and which generates wastewater, to be served by facilities for the treatment and export of wastewater from the Lake Tahoe Basin. To be considered served, a service connection shall be required to transport wastewater from the parcel to a treatment plant.

The Porter-Cologne Act (§ 13952) allows the Regional Board to consider approval of pilot reclamation projects for the use of reclaimed domestic wastewater for beneficial purposes within the Lake Tahoe Basin, provided that such projects will not individually or collectively, directly or indirectly, adversely affect the quality of the waters of Lake Tahoe. The Regional Board shall place conditions on any approved project to include specification of maximum project size. The Regional Board may suspend or terminate an approved project for cause at any time.

In order to prevent raw sewage overflows, all sewerage agencies within the Lake Tahoe Basin are required to have preventative maintenance and spill response programs; enforcement actions may be taken if spills occur. Enforcement orders and grant conditions will require measures such as installation of monitoring equipment and any necessary reconstruction or relocation of sewerlines.

The Regional Board should continue to incorporate requirements for preventative maintenance and spill response programs into waste discharge requirements and National Pollutant Discharge Elimination System (NPDES) permits for all wastewater treatment agencies in the California portion of the Lake Tahoe Basin. These could include requirements for the installation of monitoring equipment, or for the reconstruction or relocation of defective sewerlines. If a sewerline has a series of overflows due to design deficiencies, it should be reconstructed. Bolted down, sealed manhole covers should be added to sewerlines that parallel the Lake Tahoe shoreline or are located in SEZs to prevent

spills from exiting via loose manhole covers. In other areas, sewerlines in or adjacent to stream channels should be relocated to high ground and fitted with sealed manhole covers.

Grants, NPDES permits, and waste discharge requirements for wastewater collection and treatment facilities serving the Lake Tahoe Basin should be conditioned to prohibit the sewerage agencies from providing any connection serving new development which is not in accordance with this Basin Plan. This includes development which is not in compliance with the waste discharge prohibitions discussed in section 5.2 of this Chapter. State and federal buyout programs for sensitive lots include payment of wastewater treatment plant assessments for lots which cannot be built upon without violation of these prohibitions. The Regional Board shall require that the necessary information be submitted in reports of waste discharge to determine whether applications are consistent with the waste discharge prohibitions.

Due to aging infrastructure, the likelihood of exfiltration problems in the Tahoe Basin sewer systems may have increased since the early 1980s. Further study of **all** potential sources of nitrogen in Tahoe Basin ground water should be encouraged as part of the ongoing interagency monitoring program. Waste discharge requirements could be used to require correction of sewer exfiltration problems if such problems are shown to be significant in the future. Proposals for study and correction of exfiltration problems could be eligible for grant funding.

Waste discharge requirements for Tahoe Basin sewerage agencies should include a requirement that these agencies submit annual reports providing information needed to update estimates of available capacity, including information on flows, connections during the past year, and remaining unused treatment plant capacity.

The three sewerage agencies on the California side of the Lake Tahoe Basin also function as water purveyors. The State Board has directed that waste discharge requirements for these agencies should include conditions designed to prevent water use in the basin beyond the limits of the California-Nevada Interstate Water Compact (portions of this Compact which deal with the Lake Tahoe Basin were ratified by Congress in 1990 as PL 101-618).

The South Tahoe Public Utility District (STPUD) provides wastewater collection and treatment for the southern part of the Tahoe Basin in California, and exports treated effluent to Alpine County, where it is stored and used for pasture irrigation. The North Tahoe Public Utility District (NTPUD) and Tahoe City Public Utility District (TCPUD) operate collection systems and export sewage for treatment and disposal by the regional Tahoe-Truckee Sanitation Agency (TTSA), located in Truckee in Nevada County. Chapter 4 of this Basin Plan contains additional information on the STPUD and TTSA facilities, including their operations outside of the Lake Tahoe Basin. The following is a summary of important issues related to these facilities and to the Tahoe Basin implementation program.

South Tahoe Public Utility District

The South Tahoe Public Utility District (STPUD) provides collection and treatment for municipal wastewater from most of the El Dorado County portion of the Lake Tahoe Basin. Wastewater is given advanced secondary treatment and pumped over Luther Pass to the East Fork Carson River in Alpine County, where it is stored in Harvey Place Reservoir and used for pasture irrigation.

Tahoe-Truckee Sanitation Agency

The regional wastewater treatment facilities of the Tahoe-Truckee Sanitation Agency (TTSA), located in Truckee in Nevada County, provide tertiary treatment for wastewater collected by the North Tahoe and Tahoe City Public Utility Districts in the Lake Tahoe Basin. (TTSA also serves other member districts outside of the Lake Tahoe Basin.) Wastewater is carried from member districts by an interceptor pipeline which generally parallels the Truckee River. TTSA's member districts formerly operated separate wastewater treatment plants but now operate and maintain collection facilities. Discharge prohibitions for the Truckee River Hydrologic Unit (HU), cited in the prohibition section of this Chapter, include prohibitions affecting further operation of these treatment plants, and discharges from septic tank/leachfield systems from current and future development in the portion of the HU within TRPA's jurisdiction. Additional information on TTSA's treatment and disposal operations in relation to water quality in the Truckee River HU is provided in Chapter 4 of this Basin Plan.

5.9 WATER RIGHTS AND WATER USE

In 1988, there were approximately 57 water purveyors providing domestic supplies to development within the California portion of the Lake Tahoe Basin.

There were about 17 suppliers in California using over 100 acre-feet per annum (afa4). Water supplies are obtained from public and private wells, intakes from Lake Tahoe, and surface water diversions from tributaries. In the past, some water purveyors did not always treat well water prior to distribution, although chlorination might be provided at certain times of the year. Drinking water from surface intakes, both from streams and Lake Tahoe, has historically been filtered and chlorinated prior to distribution. New federal drinking water regulations require higher treatment levels for surface sources; because of these regulations, water purveyors are increasingly changing from surface to ground water sources.

Total water diversion for consumptive use in the Lake Tahoe Basin is limited by the California-Nevada Interstate Water Compact, an agreement which, after 13 years of negotiation, was ratified by the legislatures of both states in 1970 and 1971, and partly ratified by Congress in 1990 as P.L. 101-618. On the California side of the Lake Tahoe Basin, total diversions for consumptive use from all sources (both surface and ground waters) are limited to 23,000 afa.

The State Water Resources Control Board, which is responsible for administering California's water rights program, issued a *Report on Water Use and Water Rights in the Lake Tahoe Basin* in January 1980. The report determined that after water rights held by the USFS, State Parks requirements, and certain exports and depletions are taken into account, 19,000 afa is available for use on private lands on the California side of the Basin. The report also estimated the amount of water used at different levels of projected development.

The State Board has adopted a policy of limiting new water rights permits in accordance with the Compact allocation. The State Board does not have permit authority over all diversions, however. The largest group of diversions not subject to permit is ground water diversions, which made up 54% of the total diversions for use on the California side of the Lake Tahoe Basin in 1980. Local government has authority to regulate ground water pumping, and special ground water districts can be created, but current State law does not require local government to act, even when ground water pumping exceeds available supply.

The water rights study recommended that the State Board issue new water rights permits subject to conditions which ensure that issuance of the permits will not result in use in excess of the amount available under the Interstate Water Compact. It further recommended that water available for use on private lands be allocated among three zones corresponding to the boundaries of the North Tahoe, Tahoe City, and South Tahoe Public Utility Districts. Water rights permits would be issued to the utilities, allowing them to divert amounts equal to the amount allocated to the zone minus the total of all other diversions, including ground water diversions, for use on private lands within the zone.

Current levels of consumptive water use in the Lake Tahoe Basin are unknown. (Most water use is not metered.) State law (AB 2572) enacted in 2004 requires all water suppliers to install water meters on all customer connections by January 1, 2025.New residential construction has occurred since 1982, but conservation efforts (e.g., landscape watering restrictions and requirements for ultra-low flow toilets) have increased due to drought conditions. As of 2010 there are fewer than 5000 private, undeveloped, potentially buildable parcels throughout all jurisdictions in the Lake Tahoe Basin. At the highest rate of residential building allowed by TRPA, 294 building allocations per year, these parcels could be built in 16 years.

The State Board's water rights report recommends that local and regional agencies involved in land use planning consider the limitations set by the Interstate Water Compact, and that the State's water quality program take the availability of water into account. The California Water Code directs the State and Regional Boards to take water supply into account during water quality planning, and in issuing waste discharge requirements. The public utility districts provide sewerage service, for which they are subject to waste discharge requirements issued by the Lahontan Regional Board. Any additional development in the Lake Tahoe Basin which will increase water use will not be possible without a connection to the sewerage system. The number of units which may connect to the sewerage systems is limited by sewage collection, treatment, and disposal capacity. Accordingly, this Basin Plan requires that waste discharge requirements issued for these sewerage systems include conditions designed to prevent water use in the Lake Tahoe Basin beyond the Compact limitations. The conditions could take several different forms, ranging from connection limitations to water conservation programs. The precise form the conditions shall take will be determined when waste discharge requirements are renewed or modified.

TRPA requires all projects proposing a new structure, or reconstruction or expansion of an existing structure designed or intended for human occupancy to have adequate water rights or water supply systems. TRPA cannot approve additional development requiring water unless it has, or provides, an adequate water supply within a water right recognized under state law.

TRPA recognizes that many water supply systems are in need of upgrading to insure delivery of adequate quantities of water for domestic and fire suppression purposes. Needed improvements include water lines, storage facilities, and additional hydrants. TRPA requires all additional development requiring water to have systems to deliver an adequate quantity and quality of water for domestic consumption and fire protection. Applicable local, state, federal, or utility district standards determine adequate fire flows, but where no such standards exist, the TRPA Code of Ordinances provides minimum fire flow requirements. TRPA may waive the fire flow requirements for its plan areas which are “zoned” for conservation and recreation uses, and for single family development if fire departments serving the development meet the requirements of the TRPA Code. Individual water suppliers will have to maintain their existing water supply systems, and upgrade them as appropriate to meet fire flow requirements, peak demand, and the need for backup supplies. Water suppliers will also have to provide treatment for drinking water from surface diversions in accordance with state and federal standards and regulations.

This Basin Plan provides exemptions from discharge prohibitions for public health and safety projects, including projects associated with domestic water supply systems. As noted above, new treatment requirements are leading to an increase in ground water diversions. New wells in SEZs may affect SEZ functions both through direct disturbance for construction of wells and distribution lines, and through the impacts of ground water drawdown on SEZ soils and vegetation. When considering exemptions from discharge prohibitions for new or expanded ground water diversions in SEZs, the Regional Board should evaluate the water quality impacts and “reasonableness” of these projects in relation to those of the alternative of continued use of a surface source, even if treatment costs are higher.

The remedial erosion control projects proposed in this Chapter require use of irrigation water for revegetation. However, native plants will be used except for some temporary stabilization, and once established will not require irrigation. To ensure that the irrigation needed for revegetation can be carried out within the limits of water supply, the State Board's water rights decisions should reserve water for revegetation. Once it is determined that reserving water for revegetation is no longer necessary, the water can be made available for municipal and domestic use.

5.10 SOLID AND HAZARDOUS WASTE

Solid Waste Disposal

No solid waste disposal has been permitted in the Lake Tahoe Basin since 1972. To require continued export of all solid waste from the Lake Tahoe Basin, the State Board adopted the following prohibition in 1980:

"The discharge of garbage or other solid waste to lands within the Lake Tahoe Basin is prohibited."

The State Board recommended in 1980 that BMPs be developed for the disposal of excavated soil from construction sites, and that consideration be given to their use to reclaim abandoned mines, quarries, and borrow pits. It also recommended that dredged material should be considered for similar uses. Other construction wastes should be exported from the Basin.

Problems associated with former solid waste disposal in the Lake Tahoe Basin were recognized as early as 1966; they include leachate from the disposal sites, erosion due to lack of vegetation, and uncontrolled runoff from landfill surfaces. There were formerly four disposal sites within the Basin; none were operated as sanitary landfills. The USFS has done extensive erosion and drainage control work at the old Meyers Landfill, and continues to monitor its effects on water quality. All of the closed sites in California are under the ongoing surveillance of the California Integrated Waste Management Board (CIWMB). The Lahontan Regional Water Quality Control Board, in cooperation with the CIWMB and the USFS, shall continue surveillance and monitoring of old disposal sites within the Tahoe Basin to ensure that leachate and eroded sediment do not impair water quality. Where water quality problems at these sites are identified, corrective measures shall be implemented in the same manner as for sites requiring erosion control projects.

It has been estimated that, because of the seasonal nature of the Tahoe Basin's population and the inaccessibility of some homes due to weather and terrain, only 85 percent of the refuse generated in the Basin is collected for export. Illegal dumping and littering impair the visual appeal of surface waters and stream environment zones, and contribute leachate to surface runoff. Efforts should be made to increase the amount of Basin refuse which is actually collected for export or recycling. Local governments are responsible for efforts to increase the effectiveness of refuse collection. Existing anti-litter laws should be strictly enforced. Public education and cleanup programs should be expanded. The California Conservation Corps can assist in cleanup programs.

Industrial Wastes

Except for stormwater, which is addressed elsewhere in this Chapter, no industrial discharges are allowed in the Lake Tahoe Basin. Discharges of industrial wastes into Lake Tahoe or any stream in the Basin are prohibited in both California and Nevada (see the section of this Chapter on prohibitions). Current prohibitions against a discharge of industrial waste in the Lake Tahoe Basin should be continued and enforced.

Toxic and Hazardous Substance Spills

Considering the amount of urbanization and the fact that a major interstate truck route (U.S. Highway 50) passes through the Lake Tahoe Basin, possible spills of hazardous materials such as gasoline, diesel fuels, fuel oil, aviation fuel, pesticides, solvents, chlorine, and other substances create the potential for serious water quality problems. Infrequent spills of petroleum products have resulted from transportation accidents in the Lake Tahoe Basin. Numerous small spills occur at construction sites, usually due to vandalism or improper storage. Spill prevention and abatement programs are necessary to control the risk of spills affecting Lake Tahoe and its tributaries, and the ground waters and lands of the Lake Tahoe Region. In addition, hazardous waste management programs are needed to ensure that potentially hazardous substances such as paints, pesticides, household solvents, and waste motor oil are properly managed and disposed of and not discharged to lands or waters.

The Lahontan Regional Board's regionwide control measures for hazardous waste leaks, spills, and illegal discharges (Chapter 4 of this Basin Plan) are applicable to the Lake Tahoe Basin, as are statewide requirements for the preparation and implementation of local government hazardous waste management plans. When reviewing environmental documents and drafting waste discharge permits for marinas, tour boat and waterborne transit operations, and other activities on or near surface waters which may involve use or storage of fuels, Regional Board staff should give special attention to contingency measures for prevention and cleanup of spills.

The USEPA, Region IX, has prepared a new interagency spill response plan for the Lake Tahoe Basin, as a supplement to its *Mainland Oil and Hazardous Substance Pollution Contingency Plan* (USEPA 1994). This plan addresses topics such as the roles, responsibilities, and jurisdictional

boundaries of the agencies involved; priority resources for use by responders; training and response capabilities in the Tahoe Basin and needs for further training; and evacuation/shelter-in-place procedures. It also includes a standardized notification checklist which addresses spill response scenarios.

5.11 ROADS AND RIGHTS-OF-WAY

There are approximately 1000 miles of streets, roads, and highways in the Lake Tahoe Region. Past road construction, both for public streets and highways and for timber harvest and other purposes on USFS and private forest lands, has contributed significantly to sediment and nutrient loading to Lake Tahoe. Sediment loading from new subdivisions and associated roads has been a particular problem (see the section of this Chapter on development restrictions). Existing unpaved roads, and unstabilized cut and fill slopes, drainage ditches, and road shoulders continue to act as sediment sources. Winter road maintenance, including sanding and the use of deicing chemicals including salt, affects stormwater quality. The Lake Tahoe TMDL concluded that all roads, regardless of jurisdiction, have significant impacts on water quality. Roads increase impervious surface, magnifying surface runoff and often direct it toward surface waters. The application and subsequent pulverization of traction abrasive material during the winter months can also adversely affect water quality.

Because of the significance of roads in erosion problems on forest lands, the USFS's Cumulative Watershed Effects methodology for assessing watershed problems (USFS 1988) uses “equivalent roaded acres” as a measure of disturbance. Erosion problems on forest roads are similar to those associated with offroad vehicle use (see the section of this Chapter on outdoor recreation).

Road maintenance requirements are not always proportional to traffic use. In the Lake Tahoe Basin, weather is more likely to increase maintenance needs than the amount of traffic. The use of road deicing chemicals (also discussed in Chapter 4) is of special concern in the Lake Tahoe Basin because the death of vegetation from road salt can contribute to increased erosion.

Control Measures

Erosion Problems

Except where roads are essential for fire control or for other emergency access, erosion from dirt forest roads in the Lake Tahoe Basin should be controlled through closure, stabilization and drainage control, and revegetation.

Wherever possible, roads must be eliminated from high erosion hazard lands and Stream Environment Zones. For some of the roads which are not closed, protective surfacing, relocation, or installation of drainage facilities will be necessary. Best Management Practices should be required for all dirt roads which are not closed, stabilized, and revegetated.

The U.S. Forest Service, Lake Tahoe Basin Management Unit (LTBMU) has an ongoing watershed restoration program which includes closing and revegetating some roads, construction of bridges to prevent erosion at stream crossings, and installation of roadside drainage controls.

Revegetation, resurfacing, or other measures to control erosion from dirt roads on private forest lands should be enforced through regulatory programs adopted by local and regional agencies. Where these agencies have not made a commitment to implement controls, waste discharge requirements and cleanup orders issued by the Lahontan Regional Board shall require landowners to correct erosion problems from dirt roads. Regulatory programs should include an inventory of old forest roads to identify the problems needing correction. TRPA and the Lahontan Regional Board have the authority to require the performance of remedial erosion control work on private forest lands.

Maintenance Problems

Effective street and parking lot sweeping are among the most important maintenance control measures for onsite problems. Street sweeping with high efficiency sweepers (capable of removing particles 10 microns and less) removes many fine sediment particles that could be potentially entrained in urban runoff and reduces the amount of material that can become airborne. Sweeping following traction abrasive application can also prevent abrasive material from being pulverized into finer sediment particles.

Fine sediment particles are the largest single contributor to impairment of lake clarity, and controlling these pollutants at the source can improve the effectiveness of downstream treatment facilities. The reduction in dissolved nutrients from sweeping will be minor, but the reduction in particulate bound nutrients from street sweeping will be comparable to the reduction in suspended sediments. Street and parking lot sweeping also helps prevent clogging of infiltration facilities.

Proper management of runoff from areas of intensive vehicular use requires installation of onsite drainage facilities and adherence to operating practices to control water quality deterioration. A program of intensive maintenance, including periodic vacuum sweeping and cleanup of debris, is required in all cases. Drainage systems should be designed to

convey runoff to the treatment or infiltration facility and then to a stable discharge point.

Large parking lots have high priority in the Regional Board's strategy for retrofit of BMPs to existing development. The Board regulates road maintenance activities through its municipal stormwater NPDES permits (see the “Stormwater” sections of this Chapter and of Chapter 4).

Snow and Ice Control

The Regional Board may allow the use of road salt to continue in the Lake Tahoe Basin as one component of a comprehensive winter maintenance program. However, the Regional Board should continue to require that it be applied in a careful, well-planned manner, by competent, trained crews. Should even the “proper” application of salt be shown to cause adverse water quality impact, the Regional Board should consider requiring that it no longer be used in the Tahoe Basin. Similarly, should an alternative deicer be shown to be effective, environmentally safe, and economically feasible, its use should be encouraged in lieu of salt. Stormwater permits, which may include controls on deicing chemicals, are discussed earlier in this Chapter.

Remedial erosion and drainage control projects can reduce the need for ice control on roads by collecting snowmelt runoff and conveying it in stable drainage systems rather than allowing it to flow across roadways where it can freeze in thin layers which require ice control for public safety.

State highway departments and other major users of salt and abrasives are required to initiate a tracking program to monitor the use of deicing salt in their jurisdictions. Snow removal from dirt roads is subject to TRPA regulation. When TRPA approves snow removal from an unpaved road it shall specify required winterization practices, BMPs, the specific means of snow removal, and a schedule for either paving the dirt road or ceasing snow removal.

Heavily used roads and driveways requiring winter snow removal should be paved. Less heavily used roads and driveways should be surfaced with gravel. Unneeded dirt roads and driveways should be revegetated.

Snow disposal areas should be located entirely upon high capability land with rapid permeability, should be separated from Stream Environment Zones, and should be contained within berms to avoid surface runoff.

The use of deicing salt and abrasives may be restricted where damage to vegetation in specific areas may be linked to their use, or where their use would result in a violation of water quality standards. Required mitigation for the use of road salt or abrasives may include use of alternative substances, and/or changes in the pattern, frequency, and amount of application. Revegetation of parcels may be required where there is evidence that deicing salts or abrasives have caused vegetation mortality. TRPA may enter into MOUs with highway and street maintenance entities to address the use of salts or abrasives in relation to safety requirements.

Retrofit Requirements and the Capital Improvements Program

As noted in the section of this Chapter on remedial programs and offset, remedial controls for the water quality impacts of past development in the Lake Tahoe Basin are essential for the prevention of further degradation of Lake Tahoe.

Building on the capital improvement program (CIP) established with the original Regional Plan, the TRPA developed the Environmental Improvement Program (EIP) in conjunction with the 1997 Lake Tahoe Presidential Forum. Much of the TRPA Regional Plan has focused on ensuring there are no environmental impacts relating to future growth. However, there remains a considerable amount of environmental degradation that is a result of historic development and land use patterns. The EIP is aimed at addressing environmental degradation, attainment of the TRPA Thresholds and compliance with the Tahoe Regional Planning Compact. The EIP is a cooperative effort to preserve, restore and enhance the unique natural and human environment of the Lake Tahoe Region. The EIP defines restoration needs for attaining environmental goals, and through a substantial investment of resources, increases the pace at which the TRPA Environmental Thresholds will be attained. The EIP also includes a global climate change component consistent with TRPA Regional Plan policies that address strategies for reducing greenhouse gases. The CIP includes a project priority system related to the capability of each watershed to deliver sediment and nutrients to Lake Tahoe. TRPA gives high priority for erosion and runoff control to projects which affect SEZs (particularly wetland and riparian areas), which reduce or repair disturbance of seasonally saturated variable source areas, and which attempt to restore a more natural hydrologic response in the watershed.

This Basin Plan designates Caltrans as the agency with primary responsibility for implementing erosion control projects on California state highways. The Lahontan Regional Board will monitor Caltrans' progress to ensure that the projects are properly designed and built on schedule. Some state highways are on National Forest lands and are subject to special use permits issued by the Forest Service. The USFS can require correction of erosion problems as part of these special use permits.

The cities and counties have authority to carry out projects on public streets and roads. When these agencies carry out erosion control projects, their responsibilities will include detailed facilities planning, design, construction, and maintenance. The technical and advisory services of the Resource Conservation Districts can be used to help meet these responsibilities.

To the extent feasible, this Basin Plan will rely on local governments to construct the erosion control projects required on city and county streets and roads, with financial assistance provided by state and federal grants. Local governments may also establish special assessment districts for the purpose of carrying out erosion and runoff control projects.

Where state transportation departments or local agencies fail to carry out erosion and urban runoff control projects, regulatory programs must be adopted to require them to carry out the projects. These agencies own the roads causing erosion; they can be held responsible for correcting the problem.

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5.12 FOREST MANAGEMENT ACTIVITIES

Accessible pine and fir forest lands in the Lake Tahoe Basin were heavily logged by clearcut methods in the middle to late 1800s. Most private timberlands in the basin which had not been harvested earlier were logged between 1950 and 1971. Although the Forest Management Plan for the USFS Lake Tahoe Basin Management Unit (LTBMU) emphasizes watershed restoration and forest health over commercial timber sales, excessive forest fuel build-up, large-scale tree dieoffs from drought-related stresses in the 1980s and early 1990s, and local forest fires have prompted proposals for extensive tree removal and vegetation management to reduce fire hazard and increase forest health throughout the Lake Tahoe Basin on private and public lands. The Regional Board encourages public and private vegetation management to reduce fire hazard and to increase plant community diversity. Because much of the Lake Tahoe Basin is forested, land clearing for development projects often involves timber harvest.

Forest management activities can create water quality problems if sites are left bare of vegetation, if riparian vegetation is disturbed, or if soil is disturbed by road construction, skid trails, or use of vehicles off of roadways. Even if Best Management Practices are followed, some impact on water quality may occur from forest management activities.

Both remedial actions to correct problems from past timber harvest, and controls to prevent problems associated with future forest management activities are necessary for the protection of the waters of the Lake Tahoe Basin. The most important control measures needed on forest lands are remedial erosion control projects and control of erosion on forest dirt roads (see the sections of this Chapter on offset and on roads and rights-of-way). BMPs are also needed to minimize water quality problems from activities on forest lands. Controls should ensure that access roads, which increase drainage density, are well-placed and designed, and that skidding and related practices do not significantly disturb soils and vegetation. Since timber harvesting may take place on steep slopes with poor land capability, required management practices should take slope differences into account. As noted in Section 5.3 (BMPs), no one BMP is 100 percent effective, and the use of BMPs does not provide assurance of compliance with state effluent limitations. BMPs must be monitored and maintained to ensure that measures are effective and that water quality is protected. If monitoring shows that a measure is ineffective, then additional measures must be applied to reduce or prevent addition of fine sediment to the surface waters of the Lake Tahoe Basin.

Control Measures

The Regional Board's general procedures for review of forest management activities on public and private lands are discussed in Chapter 4. The Regional Board has a conditional waiver of waste discharge requirements for timber harvest and vegetation management activities in the Region, with specific conditions that apply to the Lake Tahoe Basin. The following is a summary of special measures which must be used in the Lake Tahoe Basin to protect sensitive watersheds and surface waters.

Forest management activities (in the Lake Tahoe Basin) should follow practices to protect vegetation not being removed, prevent damage to riparian vegetation, and provide for prompt soil stabilization and revegetation where necessary to prevent erosion.

Even stricter controls than the statewide Forest Practice Rules for silvicultural activities adopted by the California Board of Forestry may need to be applied in the Lake Tahoe Basin to take into account the unique conditions of the Basin and the mandate of the federal antidegradation standard. The Forest Practice Rules will not be certified as the BMPs applicable to silvicultural activities in the Tahoe Basin until they are revised to include the controls necessary to protect Lake Tahoe water quality.

Timber harvesting on National Forest land in the Lake Tahoe Basin is implemented by the LTBMU. The LTBMU uses the “Cumulative Watershed Effects” (CWE) method (USFS 1988) and the Watershed Erosion Prediction Program (WEPP) to evaluate the impacts of logging together with those of other disturbances in a watershed.

Private and State timber harvesting and other forms of tree removal in the Lake Tahoe Basin are regulated by the Regional Board’s waiver, state forestry departments, and by the Tahoe Regional Planning Agency.

The TRPA Code sets requirements for timber harvesting. In cases of substantial tree removal, the applicant is required to submit a harvest plan or tree removal plan prepared by a qualified forester. The plan shall set forth prescriptions for tree removal, water quality protection, vegetation protection, reforestation, and other considerations, and shall become part of the project's conditions of approval.

Management techniques for tree removal shall be consistent with the objectives of SEZ restoration, protection of sensitive lands, minimization of new road construction, revegetation of existing temporary roads, minimization of SEZ disturbance, and provisions for revegetation.

TRPA requires that sufficient trees shall be reserved and left uncut to meet minimum acceptable stocking standards, except where patch cutting is necessary for regeneration harvest or early successional stage management. Patch cuts shall be limited in size to less than five acres.

Tree cutting within SEZs may be permitted to allow for early successional stage vegetation management (forest health or riparian improvement), sanitation cuts, fire prevention (fuel reduction) and fish and wildlife habitat improvement, provided that:

- all vehicles shall be restricted to areas outside the SEZ or to existing roads within SEZs, except for over-snow tree removal or use of low impact technology where permanent disturbance does not occur or where the Regional Board has granted an exemption to the prohibitions on discharges within SEZs, and

- work within SEZs shall be limited to times of year when soils are dry and stable or when snow depth is adequate for over-snow removal, and

- felled trees and harvest debris shall be kept out of all perennial and intermittent streams, and

- crossing of perennial streams or other wet areas shall be limited to improved crossings or to temporary bridge spans that can be removed upon project completion or the end of the work season, whichever is sooner, and damage to the SEZ associated with a temporary crossing shall be restored within one year of removal (unless the Regional Board has granted an exemption to the SEZ and floodplain discharge prohibitions), and

- special conditions shall be placed on tree harvest within SEZs or edge zones adjoining SEZs as necessary to protect instream values and habitat.

5.13 LIVESTOCK GRAZING AND CONFINEMENT

Water quality problems related to livestock grazing and livestock confinement facilities in the Lake Tahoe Basin are similar to those described in the sections of Chapter 4 on resource management and agriculture, but the number of animals involved is generally lower than in other parts of the Lahontan Region. Range grazing occurs on National Forest lands and on some other large publicly and privately owned parcels; there are several riding stables, and some "backyard horses." Because of the sensitivity of Lake Tahoe to sediment and nutrient loading, and the importance of SEZs, which have received the greatest historical grazing use, the following control measures have been adopted for the Tahoe Basin in addition to the regionwide control measures in Chapter 4.

Control Measures

The State Board adopted the following control measures in 1980: Existing stables and corrals in SEZs should be relocated outside of SEZs on low erosion hazard lands with surface slopes of five percent or less. Livestock confinement areas should have runoff management systems designed to prevent drainage from flowing through these areas or through manure storage sites. All surface runoff from the facility should be contained and disposed of through an infiltration system [or if high ground water is present, by other appropriate means approved by the Regional Board]. The intensity of grazing on private lands should be monitored and controlled to prevent water quality problems, and the Forest Service should continue to observe Best Management Practices to prevent overgrazing on National Forest lands.

A special use permit from the Forest Service is required to use National Forest lands for stables or livestock grazing. These permits can require compliance with the Best Management Practices needed to control erosion and runoff from livestock confinement areas or to prevent overgrazing.

The Regional Board shall consider adopting waste discharge requirements or taking other appropriate action if livestock grazing on public or private lands in the Lake Tahoe Basin is shown to result in degradation of water quality.

TRPA approval is required for any new livestock grazing or confinement project involving ten or more head of stock, expansion of existing activity outside of the current range, or an increase in livestock numbers of ten or more head at one time. An applicant for a grazing permit shall submit a grazing management plan prepared by a qualified range consultant. The grazing plan shall include pertinent information and a certification by the range consultant that the grazing plan complies with the TRPA Code of Ordinances.

Programs adopted by local governments to control onsite surface runoff problems under municipal stormwater permits should also set controls for stormwater from grazing and livestock confinement on private lands (see the discussions of municipal stormwater NPDES permits earlier in this Chapter and in Chapter 4). The Lahontan Regional Board shall issue waste discharge requirements or cleanup orders where local governments fail to set adequate controls.

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5.14 OUTDOOR RECREATION

Water quality problems and control measures related to dispersed and developed recreation throughout the Lahontan Region are discussed in Chapter 4 of this Basin Plan. Impacts of recreation are of special concern in the Lake Tahoe Basin, which receives as many as 20 million visitors annually.

The Regional Board may issue waste discharge permits to developed recreation facilities and/or take appropriate enforcement action to address the impacts of new construction, stormwater discharges, and maintenance activities such as fertilizer and pesticides use. Some recreational facilities may be subject to stormwater NPDES permits.

Public outdoor recreation projects may be exempted from TRPA's restrictions on development of land capability Class 1, 2, and 3 and SEZ lands, and from the Regional Board's discharge prohibitions related to floodplains and SEZs if specific findings regarding necessity, lack of reasonable alternatives, and mitigation can be made. The exemption criteria are set forth in the Section 5.2 of this Chapter. Exemptions are granted only for public outdoor recreation projects which “by their very nature” must be sited on sensitive lands; Table 5.2-1 provides specific guidance to be used in making this finding.

Campgrounds and Day Use Areas

The potential exists for construction and expansion of campground and day use facilities on both public and private lands in the Tahoe Basin.

Construction of new campgrounds should be subject to the same restrictions as apply to other development in the Tahoe Basin, including:

- Development shall not be permitted on high erosion hazard lands or in Stream Environment Zones, unless required exemption findings can be made.
- Coverage shall conform to the land capability system, unless required exemption findings can be made.
- Drainage, infiltration and sediment control facilities must be installed wherever water is concentrated by compacted or impervious surfaces.
- Best Management Practices for construction sites and temporary runoff management must be followed.

The Regional Board should continue to issue and enforce waste discharge permits for the construction, remodeling, and expansion of campgrounds and day use areas in the Tahoe Basin where there may be discharges of waste to water. The need for retrofit of BMPs, especially for facilities in SEZs, shorezone areas, and near tributary lakes and streams, should be evaluated, and WDRs can be used to require retrofit where necessary. Campgrounds and day use projects which involve one-time or cumulative soil disturbance of one acre or more will be subject to construction stormwater NPDES permits. Campground and day use facilities that accommodate large numbers of recreational vehicles should have properly designed and operated wastewater dumping stations, to discourage illegal dumping. (See the section of this Chapter on wastewater treatment, export, and disposal for a discussion of the requirement to export sewage from the Lake Tahoe Basin.) The Nevada Division of Environmental Protection should ensure that similar controls are enforced in Nevada.

Local or regional ordinances adopted to require surfacing or revegetation of private driveways or forest roads should also apply to dirt roads in campgrounds. Other control measures for existing campgrounds would require review of existing sites.

Construction of a developed campground on private land in the Lake Tahoe Basin requires permits from the city or county where the campground is built, and from TRPA. Permits for private campgrounds should prohibit development in SEZs or in excess of land capability, and should enforce the BMPs needed to prevent water pollution. Local governments in the Tahoe Basin should consider control of stormwater discharges from existing and potential private campgrounds and day use sites as part of their planning activities under their municipal stormwater NPDES permits.

Ski Areas

Water quality problems and control measures associated with ski areas are discussed in a regionwide context in Chapter 4 of this Basin Plan. Special provisions apply to ski areas in the Lake Tahoe Basin.

Ski areas are subject to the TRPA land use restrictions, State discharge prohibitions and exemption criteria related to floodplain and SEZ protection which are discussed elsewhere in this

Chapter. One of the required exemption findings for a recreational project is that "by its very nature," it must be located on sensitive lands.

Proposals for ski resort expansion must be carefully reviewed to prevent increases in erosion and surface runoff. New road construction must be kept to an absolute minimum, and is prohibited in Stream Environment Zones unless the exemption findings for public recreation projects can be made. (Modern construction techniques permit ski lift construction without road construction.) These provisions will limit the extent of disturbance of sensitive lands for the expansion of ski areas, and will thus protect water quality.

In 1980, the State Board provided the following additional direction for ski area maintenance activities:

"Ski run and trail maintenance vehicles and equipment must not be operated in a manner that disturbs the soil. Snow moving, packing, and grooming must not be conducted when the snow cover is insufficient to protect the underlying soil from disruption."

The Regional Board has adopted waste discharge requirements for all ski areas in the California portion of the Lake Tahoe Basin. These requirements address stormwater control (especially for large parking lots), and ongoing operation, maintenance, and remedial watershed restoration activities. They are periodically updated to reflect proposed new projects and activities within the ski area. Stormwater NPDES permits may be necessary for future ski area construction projects. Local governments in the Lake Tahoe Basin must address the stormwater impacts of ski facilities on private lands under their municipal stormwater NPDES permits.

Regional Board staff should continue to participate in interagency review of proposed ski area master plans, and should update waste discharge permits as necessary for new projects carried out under master plans.

Golf Courses

Many of the existing golf courses in the Lake Tahoe Basin were constructed in Stream Environment Zones, and have thus disrupted the natural capability of these areas to provide treatment for nutrients in stormwater. Some golf courses are located within or very near the shorezone of Lake Tahoe, or in areas with high ground water tables. Proposals have been made for expansion and/or remodeling of some Tahoe Basin golf courses. General control measures for water quality problems associated with golf courses are discussed in Chapter 4 of this Basin Plan. Existing and future golf course development in the Lake Tahoe Basin requires special control measures to prevent further eutrophication of surface waters and contamination of drinking water supplies.

Waste discharge requirements issued by the Lahontan Regional Board for golf courses in the California portion of the Lake Tahoe Basin implement policies to prevent wastes, such as fertilizer nutrients, pesticides, herbicides, and products of erosion from entering surface waters of Lake Tahoe. They also require use of BMPs for control of stormwater from parking lots, rooftops, and other impervious areas, and for prevention and control of erosion problems.

Each golf course in the Tahoe Basin should follow a control plan detailing nutrient loads, pathways, and control strategies. The control strategies for golf courses shall include:

- strict annual, monthly, and daily fertilizer limitations;
- controlled drainage, including holding ponds where necessary;
- maintenance of drainage systems; and
- surface and ground water monitoring programs.

TRPA also considers existing golf courses high priorities for retrofitting with BMPs because of their potential for significant water quality impacts from fertilizer and runoff. It encourages the states to issue waste discharge requirements or NPDES permits for these facilities.

Offroad Vehicles

Water quality impacts of offroad vehicle (ORV) use are discussed as a regionwide problem in Chapter 4 of this Basin Plan. Erosion, soil compaction and damage to vegetation from ORVs are of special concern in the Lake Tahoe Basin because of the high erodibility of many of its soils, the difficulty of revegetation, and the sensitivity of surface waters. ORV damage to SEZs disturbs their capacity to treat sediment and nutrients in stormwater.

In addition to the summer use of wheeled ORVs, snowmobile use during the winter can also affect water quality. Compacted snow on heavily traveled snowmobile routes is a good thermal conductor which can cause underlying soil to freeze readily. Rapid soil freezing and thawing loosens the soil surface and can dislodge small plants, contributing to the risk of erosion upon snowmelt.

Control Measures for ORVs

Offroad vehicle use in the Lake Tahoe Basin must be restricted to designated areas where high erosion hazard lands, stream environment zones, and sensitive vegetation are not threatened.

To ensure that vehicles stay out of areas where ORV use is not permitted, some old roads must be closed or blocked off. The USFS is conducting a program of blockading roads and trails used in violation of its offroad vehicle plan. National Forest areas damaged by ORV use will be restored and revegetated as part of the ongoing USFS watershed restoration program.

To the extent that ORV use in the Lake Tahoe Basin is confined to existing dirt roads, the water quality impacts can generally be contained by the application of standard BMPs for erosion and runoff control. However, if the ORV use damages the control devices (e.g., water bars) or aggravates erosion of the road surface, additional controls may be necessary.

More vigorous enforcement of local and regional ordinances to control ORV use on private lands is necessary. Private landowners need to post land so that local law enforcement officials can enforce offroad vehicle restrictions.

The Regional Board can issue waste discharge permits to operators of commercial ORV facilities (e.g., snowmobile courses) to prevent and control water quality problems. In some cases, waste discharge requirements and cleanup orders may be issued to property owners requiring them to prevent or correct water quality problems caused by offroad vehicle use on their property.

Boating and Shorezone Recreation

The “Shorezone Protection” section of this Chapter (see Section 5.7) summarizes water quality problems related to shorezone development, TRPA's general shorezone protection programs, and guidelines for Regional Board use in evaluation of shorezone projects. Chapter 4 of this Basin Plan includes a general discussion of water quality problems and control measures related to boating and shorezone recreation activities. Problems include wastewater disposal from boats, fuel spills from boats and marinas, marina stormwater pollutants, and resuspension of sediment and associated pollutants through dredging and underwater construction. These problems are of special concern in the Lake Tahoe Basin because of the sensitivity of the Lake and the heavy recreational use it receives. The following is a summary of special control measures by problem type.

Vessel Wastes

The discharge of vessel wastes to Lake Tahoe is prohibited, but violations still occur. Many of the boats in use have built-in toilets and holding tanks or portable toilets, creating a large potential for intentional or unintentional dumping of wastewater into Lake Tahoe. Many boats are not equipped with self-contained heads, and there is no inspection program. Discharge of vessel toilet wastes introduces pollution that can affect domestic wastewater intakes from Lake Tahoe and other lakes such as Fallen Leaf and Echo Lakes. Although not in themselves a serious threat to the clarity of Lake Tahoe, vessel wastes contribute cumulatively to nutrient loading and present a public health risk.

In California, the Harbors and Navigation Code authorizes the State Board to require marinas or other marine terminals to install pumpout facilities. The State Board has adopted procedures by which the Regional Boards can determine the need for pumpout facilities, and request the State Board to require specific terminals to install them. Under these provisions, the Lahontan Regional Board shall continue to determine the need for additional pumpout facilities at Lake Tahoe, and request the State Board to require installation where such facilities are necessary. The Regional Board currently requires that all public marinas on the California side of Lake Tahoe have pumpout facilities available.

The U.S. Coast Guard is primarily responsible for enforcing prohibitions against vessel waste discharges to Lake Tahoe, and should include an inspection program as part of its enforcement effort. Other federal and state agencies should assist the Coast Guard. Permits issued by the U.S. Army Corps of Engineers, state lands agencies, and TRPA for marinas, buoys, and other facilities serving vessels on Lake Tahoe should require compliance with the prohibitions against discharge of vessel wastes. These agencies should also assist in the inspection program. The Regional Board shall assist the Coast Guard in the program to enforce the discharge prohibitions and shall bring its own enforcement actions where necessary.

The Regional Board has adopted waste discharge requirements for existing marinas at Lake Tahoe which include provisions for vessel waste pumpout facilities, and should continue to adopt waste discharge requirements for new and expanded marinas.

Dredging

Chapter 4 of this Basin Plan includes additional discussion of water quality problems related to dredging, and regionwide dredging guidelines. Construction (e.g., of piers) and dredging in Lake Tahoe can cause localized pollution problems, by disturbing sediments: this increases turbidity and reintroduces nutrients that had settled out of the water. The sediments may also be redeposited elsewhere. Construction in Lake Tahoe may also affect current flow, causing currents to disturb bottom sediments. If disposal of dredged material is done improperly, nutrients from these wastes could cause water quality problems. Dredging and disposal of marina sediments are of special concern because very high levels of tributyltin (an antifouling ingredient of boat paint) have been detected in sediments and biota of one Lake Tahoe marina.

Methods of dredging that stir up bottom sediments, as when backhoes or drag lines are used, should not be permitted. Under most circumstances, only suction dredging should be allowed. However, even with turbidity barriers, suction dredging followed by interim storage of dredged material in an "inner harbor" situation may create more problems than bucket dredging. Localized problems related to turbidity may result from repeated disturbance of stored dredged material for final disposal. Regional Board staff should evaluate proposed dredging methods based on site-specific circumstances and require the method that results in the lowest degree of threat to water quality. Disposal of dredged materials must follow practices to prevent sediments from being discharged into Lake Tahoe. The Best Management Practices Handbook includes BMPs for the dredging process and for disposal of dredged material. Consideration should be given to the use of dredged material in reclamation of abandoned mines, quarries, and borrow pits outside of the Tahoe Basin.

The Regional Board staff review all proposed dredging projects in the California portion of the Lake Tahoe Basin and should not permit the dredging unless the practices called for in this plan are followed.

Dredging and filling activities are subject to the Regional Board discharge prohibitions and exemption criteria discussed elsewhere in this Chapter.

Dredged material may be disposed of inside or outside of the Lake Tahoe Basin, but the Regional Board will set effluent limitations based on the numbers in Table 5.6-1 and on appropriate receiving water standards. Proposals for dredged material disposal in shorezones, floodplains or SEZs will be evaluated against the relevant discharge prohibitions (see the section of this Chapter on development restrictions).

TRPA's regulations on dredging techniques and discharge standards are set forth in the BMP Handbook.

Marinas

The Lahontan Regional Board has maintenance waste discharge requirements on all marinas in the California portion of the Lake Tahoe Basin which address stormwater discharges, fueling and sewage disposal operations. New or revised requirements should be adopted to address any new marina construction activity or changes in the nature of discharges or threatened discharges from existing marinas. A detailed discussion of water quality problems and control measures associated with marina discharges is provided in a regionwide context in Chapter 4 of this Basin Plan. As noted in that Chapter, some marinas may require stormwater NPDES permits.

TRPA regulates the creation, expansion, and remodeling of marinas in the Lake Tahoe Basin through its Regional Plan limits on recreation capacity (in "People at One Time," or PAOT) and through its master planning and permitting processes. Following a lengthy interagency review period, which included Regional Board staff input, TRPA adopted detailed guidelines for the preparation of marina master plans (TRPA 1990). These guidelines require each master plan to include a physical plan, an operations plan, a mitigation plan, and a monitoring plan. Water quality-related topics to be addressed include land coverage, fish habitat, shoreline stability, inspection and maintenance of boat washing and fueling facilities, wastewater pumpout facilities, stormwater control, spill prevention and response, dredging, and marina water treatment systems. The guidelines also summarize shorezone development standards for new and expanded marinas from TRPA's Code of Ordinances, and provide guidance on the design of breakwaters, jetties, and shoreline protection structures.

Although conceptual proposals have been made for marina water treatment systems, none are currently operating in the Lake Tahoe Basin. TRPA's guidelines state that, in the broad sense, "any treatment which is employed to improve and maintain water quality would be a component of the water treatment system." Possible treatment methods discussed include artificial circulation and aeration, pretreatment of stormwater discharges, and interception of stormwater constituents from driveways, launching ramps, and boat washing facilities by slotted drains directed into sumps which can be pumped and possibly equipped with absorbent material. If tributyltin

is found to be a problem, marina sediments containing it may have to be removed.

The TRPA guidelines state that commercial marinas and harbors are required to have public restrooms, fueling facilities, chemical fire retardant distribution systems, and pumpout facilities for boat sewage. Disposal facilities for portable sewage containers should also be provided. Prevention of boat sewage waste pollution will be in accordance with an enforcement program to be developed by the Marina Owners Association and approved by TRPA. Boat washing facilities, if any, must be connected to a sewer system or an acceptable alternative such as a debris trap and sump which will be emptied regularly. Connections to sewer systems may require special arrangements with the service district such as permits, pretreatment of discharges, and fees for service. Gas pumping facilities are required to have emergency and standard shut-off systems. A water treatment system for waters contained within the marina must be provided.

Fuel, sewage pumpout and portable sanitation flushing facilities at marinas need to be carefully placed. The TRPA guidelines state that they should be located in a convenient place to encourage use by all boaters (including boaters from private piers and non-commercial moorings. Emergency spill containment equipment must be at hand at such facilities, not stored ashore.

TRPA's marina master plan guidelines also provide guidance on environmental analysis, including directions for cumulative impacts analysis. In 1994, a regionwide study and environmental document were in preparation to evaluate the cumulative impacts of potential marina expansion on Lake Tahoe.

Regional Board staff should continue to participate in interagency review of proposed marina master plans and marina development projects. Proposals for “experimental” facilities such as marina water treatment systems should be carefully evaluated on a case-by-case basis.

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5.15 OTHER WATER QUALITY PROBLEMS

Fertilizer Use

Water quality problems and control measures associated with fertilizer use are discussed in the section on agriculture in Chapter 4 of this Basin Plan. However, fertilizer use on golf courses, other large turf areas, and in home landscaping is of special concern in relation to the sensitive surface waters of the Lake Tahoe Basin. Nutrients in fertilizer can reach surface waters through stormwater or by percolation through ground water, and can contribute to eutrophication. Nitrogen from fertilizer which accumulates in ground water can contribute to violation of the drinking water standard. Fertilizer impacts can occur cumulatively with nutrient loading from other sources such as urban runoff.

As noted in the section of this Chapter on golf courses, the Regional Board has placed all golf courses on the California side of the Lake Tahoe under waste discharge requirements which include conditions related to fertilizer management. Other types of projects involving significant fertilizer use should be considered for similar types of permits.

While the use of fertilizer may be necessary in some applications, such as establishing erosion control vegetation, management practices are necessary to limit the addition of fertilizer which may leach from the soil and become a component of runoff waters. The use of fertilizer in within the Tahoe Region shall be restricted to uses, areas, and practices identified in the Best Management Practices Handbook.

Fertilizer use, except as necessary to establish and maintain plants, is not recommended in the Tahoe Basin; that fertilizers shall not be used in or near stream channels and in the shorezone areas; and that fertilizer use shall be lowered in stream environment zones and eliminated if possible. This BMP includes discussion of appropriate fertilizer types and practices. It states that maintenance applications of fertilizers should be made when loss of vigor or slow growth indicates a possible nutrient deficiency. At least one additional application is required following the original grass seeding and should be applied in the spring immediately following snow melt.

According to the TRPA Code of Ordinances, projects that include landscaping or revegetation shall, as a condition of approval, be required to prepare fertilizer management plans that address: the appropriate type of fertilizer to avoid the release of excess nutrients, the rate and frequency of application, appropriate watering schedules; preferred plant materials, landscape design that minimizes the impacts of fertilizer applications, critical areas, the design and maintenance of drainage control systems, and surface and ground water monitoring programs, where appropriate.

In planning for compliance with municipal stormwater permits, local governments in the Lake Tahoe Basin should consider control of cumulative nutrient contributions from urban fertilizer use. Areawide landscape design guidelines should be revised to emphasize low maintenance plant species rather than turf and other fertilizer intensive plantings. Since they have negligible capital costs and may actually reduce operating costs, fertilizer management practices are cost-effective means of protecting water quality.

Local government ordinances requiring the use of drought-tolerant landscaping (xeriscaping) may, by encouraging the use of native plants, result in lower urban fertilizer use. Educational programs promoting xeriscaping should also emphasize BMPs for fertilizer use.

Pesticides

Although there is no agricultural use of pesticides in the Lake Tahoe Basin, potential water quality problems from pesticide use in landscaping, turf management, silviculture, and wood preservatives are of concern. High levels of tributyltin (TBT), an antifouling compound formerly used in boat paint, have been measured in and near a marina in Lake Tahoe. Rotenone has been used for fisheries management in some waters of the Tahoe Basin.

The Lahontan Regional Board's regionwide prohibition for pesticides and control measures for pesticides, discussed in Chapter 4 of this Basin Plan, are applicable in the Lake Tahoe Basin. Exemptions to this this regionwide prohibition may be granted as described in Chapter 4.1 provided the application of aquatic pesticides is proposed for the circumstances described under the section entitled “Circumstances Eligible for Prohibition Exemption” and according to the criteria under the section entitled “Exemption Criteria for Aquatic Pesticide Use.” As described in Chapter 4.1, projects proposing to use rotenone for use in waters of the Tahoe Basin must comply with the “Exemption Criteria for Fisheries Management,” which require compliance with criteria described in Chapter 3 in the section entitled “Water Quality Objectives for Fisheries Management Using the Fish Toxicant Rotenone.”

Because of its harsh climate, short growing season, and high elevation, the Lake Tahoe Basin has fewer insect and fungal pests than many other areas in

California and Nevada; however, there is some pesticide use for silviculture and turf management.

Prior to applying any pesticide, potential users shall consider integrated pest management (IPM) practices, including alternatives to chemical applications, management of forest resources in a manner less conducive to pests, and reduced reliance on potentially hazardous chemicals.

Only chemicals registered with the USEPA and the state agency of appropriate jurisdiction shall be used for pest control, and then only for their registered application. No detectable concentration of any pesticide shall be allowed to enter any SEZ unless TRPA finds that the application is necessary to attain or maintain its "environmental threshold carrying capacity" standards. Pesticide storage and use must be consistent with California and Nevada water quality standards and TRPA thresholds.

Antifouling substances painted on the hulls of boats, such as TBT, may contribute to water quality problems. California legislation in 1988 prohibited the use of TBT paints except on aluminum vessel hulls and vessels 25 meters or more in length. Vessels painted with TBT before January 1, 1988 may still be used, but may not be repainted with TBT so long as they comply with other applicable requirements. The USEPA has also banned the use of TBT on non-aluminum hulls of vessels less than 82 feet in length and has limited the release rate of TBT from other hulls to 0.4 $\mu g/cm^2$/day. [The prohibition against discharges of pesticides to surface waters in this Basin Plan is more stringent than this effluent limitation.] Controls on antifouling coatings and boat and marina maintenance practices are necessary to protect Lake Tahoe from the addition of toxic substances from this source. Antifouling coatings shall be regulated in accordance with California and federal laws, by the Lahontan Regional Board and TRPA.

Additional monitoring of water, sediment, and biota should be done at other marinas within Lake Tahoe to determine the extent of TBT problems. TBT should be considered an issue in permits for dredging at or near marinas, and for dredged material disposal.

Atmospheric Deposition

Wet and dry atmospheric deposition of nutrients, fine sediment particles, and acids onto surface waters is an issue of concern throughout the Sierra Nevada. Atmospheric nutrients and fine sediment particles 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). The Lake Tahoe TMDL concluded that atmospheric deposition contributes an estimated 63 percent of total average annual nitrogen to the lake. Atmospheric deposition also contributes an estimated 16 percent of the average annual fine sediment particle load and about 18 percent of the average annual total phosphorus load.

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 by the California Air Resources Board's (CARB) Lake Tahoe Atmospheric Deposition Study (LTADS). Studies by these groups, as reported in the Lake Tahoe TMDL Technical Report, indicate that about 69 percent of nitrogen deposition on Lake Tahoe originates locally, with the remaining 31 percent coming from regional sources. Combined, these sources contribute an estimated 218 metric tons of total nitrogen to Lake Tahoe, most of it in the form of NO_x and NH_3 (ammonia). Similarly, an estimated 71 percent of the annual total phosphorus deposition of around 6 metric tons is from local sources. Road dust is the primary contributor.

Atmospheric deposition is also a key source of fine sediment particle deposition to the lake. The Lake Tahoe TMDL Technical Report establishes that about 16 percent of Lake Tahoe's total fine sediment particle load is from atmospheric sources. Over 70 percent of this particulate deposition is from in-basin sources. The primary in-basin sources of fine sediment particles are dust from paved and unpaved roadways, dust from construction sites and other unpaved surfaces, and organic soot from residential wood burning.

The Tahoe Regional Planning Agency has adopted a regional "environmental threshold carrying capacity" standard to reduce annual "vehicle miles traveled" (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 TRPA Regional Plan 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.

Regional Board staff should continue to review reports on atmospheric deposition in the Lake Tahoe Basin, long-distance transport of airborne pollutants to the

Basin, and impacts of acid deposition on beneficial uses of Tahoe Basin waters. Where data gaps exist, additional monitoring and research should be encouraged. The results of ongoing CARB-sponsored research on acid deposition impacts elsewhere in the Sierra Nevada should be useful in evaluating data from the Lake Tahoe Basin.

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5.16 MONITORING

Monitoring of Lake Tahoe, its tributary surface and ground waters, and pollutant sources such as atmospheric deposition and stormwater is a very important part of the implementation program. Long-term monitoring of an “Index Station” in Lake Tahoe by the University of California at Davis Tahoe Environmental Research Center has documented the deep water transparency and primary productivity measurements shown in Figures 5-1 and 5-2. Further long-term monitoring is essential to document progress toward attainment of the water quality standards for these parameters, which are based on 1968-71 figures.

Monitoring and special studies have been carried out in the Tahoe Basin by a variety of agencies (including the U.S. Forest Service's Lake Tahoe Basin Management Unit, the California Department of Water Resources, the University of Nevada at Reno, and the U.S. Geological Survey). For example, the U.S. Forest Service's Lake Tahoe Basin Management Unit monitors a variety of land use activities on National Forest lands.

In response to the recommendations of the 1980 *Lake Tahoe Basin Water Quality Plan,* special studies were carried out on sewer exfiltration into ground water, nearshore phytoplankton and periphyton productivity in Lake Tahoe, and atmospheric deposition. The State Board organized the Lake Tahoe Interagency Monitoring Program (LTIMP) in 1979; annual reports of this program have been published by the University of California at Davis Tahoe Environmental Research Center. _Monitoring data from the LTIMP program was used to develop and calibrate the Watershed Model and Lake Clarity Model for the Lake Tahoe TMDL. The Lake Clarity Model bundles five models: a particle fate model, an optical model, an ecological model, a thermodynamic model, and a hydrodynamic model. These two models, coupled with targeted pollutant source analysis studies, provided the framework for the Lake Tahoe TMDL.

The TRPA currently has responsibility for coordinating the Lake Tahoe Interagency Monitoring Program, with the advice of an interagency technical advisory committee. Recent additions to the program include monitoring of “other lakes” than Lake Tahoe (including Fallen Leaf, Echo, and Cascade Lakes). TRPA has also sponsored a study on fish habitat in Lake Tahoe and the impacts of nearshore human activities on habitat quality.

The Lake Tahoe TMDL effort addressed research needs associated with Lake Tahoe's nutrient budget and the nutrient inputs and outputs of the watershed and the airshed. Ongoing research needs include, but are not limited to, better understanding of the effectiveness of SEZ restoration projects and stormwater treatment techniques, improved quantification of atmospheric deposition processes and control measures, and work to clarify the link between development, pollutant sources, and their effect on nearshore water quality.

Together with long-term continuation of the basic Lake Tahoe Interagency Monitoring Program, such special studies will enable evaluation of the adequacy of existing control programs and the need for new control measures to ensure attainment and maintenance of standards. Additional monitoring and research will also provide the basis for: (1) the establishment of numerical nutrient objectives for additional water bodies, (2) the establishment of biological, and possibly sediment quality objectives, and (3) the update of the regional runoff guidelines to include priority pollutants.

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5.17 TOTAL MAXIMUM DAILY LOAD FOR SEDIMENT AND NUTRIENTS, LAKE TAHOE, EL DORADO AND PLACER COUNTIES

Introduction: Lake Tahoe is designated an Outstanding National Resource Water by the State Water Resources Control Board and the United States Environmental Protection Agency due to its extraordinary deep water transparency. However, the lake's deep water transparency has been impaired over the past four decades by increased fine sediment particle inputs and stimulated algal growth caused by elevated nitrogen and phosphorus loading.

The Regional Water Quality Control Board, Lahontan Region (Regional Board) and the Nevada Division of Environmental Protection (NDEP) developed the bi-state Lake Tahoe Total Maximum Daily Load (TMDL) to identify the pollutants responsible for deep water transparency decline, quantify the major pollutant sources, assess the lake's assimilative capacity, and develop a plan to reduce pollutant loads and restore Lake Tahoe's deep water transparency to meet the established standard.

The NDEP is responsible for implementing the TMDL on the Nevada side of the Lake Tahoe basin. Because the Regional Board's authority lies with the state of California, there will be no further mention of Nevada's role in TMDL development and implementation in this chapter. Refer to the Lake Tahoe TMDL Report and associated documentation for additional details regarding the state of Nevada's role in the Lake Tahoe TMDL effort.

Problem Statement: Continuous, long term, deep water transparency monitoring at Lake Tahoe has documented a decline of approximately 30 feet from 1968 to 2000. The deep water transparency standard of approximately 100 feet has not been achieved since the standard was adopted in 1975. Lake Tahoe TMDL research indicates light scattering by an increase in the number of fine sediment particles in suspension and light adsorption by increased algae production has caused the deep water transparency decline. Lake Clarity Model results show that approximately two thirds of the deep water transparency condition is driven by the number of inorganic fine sediment particles less than 16 micrometers in diameter. Consequently, the Lake Tahoe TMDL effort has focused on the number of fine sediment particles as the primary pollutant causing deep water transparency decline.

Desired Conditions: The desired condition for Lake Tahoe's deep water transparency is the annual average depth recorded from 1967 to 1971, which is an annual average Secchi depth measurement of 97.4 feet (29.7 meters).

Source Assessment: The Regional Board and NDEP conducted extensive research and numeric modeling to estimate nutrient and fine sediment particle loads to Lake Tahoe. The sources contributing the largest annual pollutant loads that affect the deep water transparency are runoff from upland areas (both urbanized and undeveloped), atmospheric deposition, and stream channel erosion. Table 5.17-1 presents the pollutant load estimates for all of the identified fine sediment particle, total nitrogen, and total phosphorus sources, including groundwater and shoreline erosion inputs. Average annual nitrogen and phosphorus loads are expressed in mass units (metric tons) while average annual fine sediment particle loads are presented as the actual number of particles less than 16 micrometers in diameter.

Upland runoff: Tetra Tech, Inc. developed the Lake Tahoe Watershed Model to simulate runoff and pollutant loads from both the developed and undeveloped upland areas. Supported by a two-year Tahoe basin storm water monitoring study and validated with the long term Lake Tahoe Interagency Monitoring Program water quality dataset, the Lake Tahoe Watershed Model provides average annual, land-use based fine sediment, total nitrogen, and total phosphorus loading values. Model outputs have been divided between urban (or developed) and forest (or undeveloped) upland areas and results indicate that approximately 72 percent of the average annual fine sediment particle load, 47 percent of the average annual total phosphorus load, and 18 percent of the average annual total nitrogen load reaching Lake Tahoe is generated in the urban landscape. Undeveloped portions of the Lake Tahoe watershed are estimated to contribute approximately 9 percent, 32 percent, and 18 percent of the average annual fine sediment particle, total phosphorus, and total nitrogen loads, respectively. Details of the Lake Tahoe Watershed Model development and model results can be found in *Watershed Hydrologic Modeling and Sediment and Nutrient Loading*

Estimation for the Lake Tahoe Total Maximum Daily Load (Tetra Tech 2007).

Atmospheric Deposition: The California Air Resources Board (CARB) performed the *Lake Tahoe Atmospheric Study* to quantify the contribution of dry atmospheric deposition (i.e. non-storm event deposition) to Lake Tahoe and the UC Davis Tahoe Environmental Research Center (TERC) collected wet (i.e. storm event) and dry deposition samples. The data from these two efforts were used to estimate lake-wide atmospheric deposition of nutrients and fine sediment particles. The findings show that atmospheric deposition is the second largest source of fine sediment particles entering the lake at 16 percent of the basin-wide total load and is the dominant source of total nitrogen, contributing approximately 63 percent of the basin-wide total nitrogen load.

Stream Channel Erosion: The first estimates of stream channel erosion came from the *Lake Tahoe Framework Study: Sediment Loadings and Channel Erosion* (Simon et al. 2003). To better quantify the contributions of fine sediment from stream channel erosion in all 63 tributary stream systems, the USDA-National Sediment Laboratory completed additional work reported in *Estimates of Fine Sediment Loading to Lake Tahoe from Channel and Watershed Sources* (Simon 2006). These research efforts found that while stream channel erosion is a significant source of bulk sediment to the lake, the contribution to the fine sediment particle load is relatively small, accounting for approximately four percent of the average annual fine sediment particle load. Stream channel erosion contributes approximately two percent of the average annual total phosphorus load and less than one percent of the average annual total nitrogen load.

Groundwater: Thodal (1997) published the first basin-wide evaluation of groundwater quality and quantity from 1990-1992. The United States Army Corps of Engineers completed the *Lake Tahoe Basin Framework Study Groundwater Evaluation* (USACE 2003) as an independent assessment of Thodal's (1997) analysis to provide the primary source of groundwater nutrient loading estimates for the TMDL based on existing monitoring data. Because sediment is effectively filtered through the soil matrix, groundwater transport of fine sediment particles to the lake is assumed to be zero.

Shoreline Erosion: Shoreline erosion is the smallest source of pollutants entering Lake Tahoe. The *Historic Shoreline Change at Lake Tahoe from 1938 to 1998: Implications for Water Clarity* (Adams and Minor 2002) report estimates the volume of material eroded by wave action from aerial photographs from 1938-1994 along with grab samples to analyze the nutrient content of the lost shorezone material. The supplementary report *Particle Size Distributions of Lake Tahoe Shorezone Sediment* (Adams 2004) assesses the particle size distribution of collected shoreline sediment samples. These studies indicate shoreline erosion contributes less than one percent of the basin-wide fine sediment particle and total nitrogen loads and approximately four percent of the basin-wide total phosphorus load.

Table 5.17-1
POLLUTANT LOADING ESTIMATES BY POLLUTANT SOURCE CATEGORY

Source Category		Total Nitrogen (metric tons/year)	Total Phosphorus (metric tons/year)	Number of Fine Sediment Particles ($x10^{18}$)
Upland Runoff	Urban (Developed)	63	18	348
	Forest (Undeveloped)	62	12	41
Atmospheric Deposition	(wet + dry)	218	7	75
Stream Channel Erosion		2	<1	17
Groundwater		50	7	0
Shoreline Erosion		2	2	1
TOTAL		**397**	**46**	**481**

Loading Capacity: UC Davis developed the Lake Clarity Model to predict Secchi depth changes over time in response to fine sediment particle and nutrient load changes. The model includes hydrodynamic, plankton ecology, water quality, particle dynamics, and lake optical property sub-models. As mentioned in the problem statement, Lake Clarity Model results indicate current deep water transparency measurements are primarily driven by the concentration of suspended fine sediment particles. Based on Lake Clarity Model findings, a combined load reduction from all sources, basin-wide, of 65 percent of fine sediment particles, 35 percent of phosphorus, and 10 percent of nitrogen will be needed to meet the deep water transparency water quality standard.

TMDL and Allocations: The TMDL is the sum of wasteload allocations for point sources, load allocations for nonpoint sources, and a margin of safety. The allowable fine sediment particle and nutrient load are allocated to the major pollutant load sources: atmospheric deposition, urban (developed) upland runoff, forest (undeveloped) upland runoff, and stream channel erosion.

The basin-wide load reduction needs were determined using the Lake Clarity Model and reflect the 1967-1971 average annual Secchi depth of 29.7 meters as the loading capacity, resulting in TMDL attainment over about 65 years. Load reduction expectations for the pollutant sources are based on the Pollutant Reduction Opportunity Analysis, the Integrated Water Quality Management Strategy Project Report, and the best professional judgment of the Regional Board.

Tables 5.17-2, 5.17-3, and 5.17-4 show the respective allowable load allocations for fine sediment particles, total nitrogen, and total phosphorus by source category, listed as a percent reduction from the established baseline load. Each milestone represents five-year implementation phases. Standard attainment is expected following 65 years of implementation.

Because there are no explicit load reduction requirements assigned to groundwater and shoreline erosion sources of fine sediment particles, total nitrogen and total phosphorus, the Regional Board is implicitly allowing these sources to continue at their present baseline conditions.

Daily Load Analysis: Throughout the TMDL analysis pollutant loads have been expressed on an average annual basis. The United States Environmental Protection Agency (US EPA) requires that allowable load allocations also be expressed as daily loads.

Following EPA guidelines described in the *Options for Expressing Daily Loads in TMDLs* (US EPA 2007), the Regional Board has developed daily load estimates for the Lake Tahoe TMDL as a function of total hydraulic inflow. The Lake Tahoe Watershed Model analysis provided daily output of simulated daily loads, supplying the needed daily data sets.

Tables 5.17-5, 5.17-6, and 5.17-7 list ranges of total hydraulic inputs to Lake Tahoe, (expressed in liters per second) and an associated range of pollutant concentrations. Because the majority of the pollutant loads discharged to Lake Tahoe are carried by upland runoff, the derived daily load estimates are for upland runoff and stream channel erosion sources. The daily load estimate for the atmospheric source may be estimated by dividing the average annual pollutant loading estimate by 365 days.

Although the daily load estimates for each pollutant are required by EPA, the average annual load expression remains the basis for developing storm water permits and determining compliance for the Lake Tahoe basin. The deep water transparency standard is based on average annual conditions and the most meaningful measure of Lake Tahoe's transparency is generated by averaging the Secchi depth data collected during a given year. The modeling tools used to predict load reduction opportunity effectiveness as well as the lake's response are all driven by annual average conditions. An emphasis on average annual fine sediment particle and nutrient loads also addresses the hydrologic variability driven by inter-annual variability in precipitation amounts and types. Average annual estimates also provide a more consistent regulatory metric to assess whether urban implementation partners are meeting established load reduction goals. Finally, by emphasizing annual average conditions rather than instantaneous concentrations, implementers will have the incentive to focus action on the areas of greatest pollutant loads to cost effectively achieve required annual reduction requirements.

Table 5.17-2
FINE SEDIMENT PARTICLE LOAD ALLOCATIONS BY POLLUTANT SOURCE

	Baseline Load		Milestone Load Reductions												Standard Attainment
	Basin-Wide Load (Particles/yr)	% of Basin-Wide Load	5 yrs	10 yrs	15 yrs	20 yrs	25 yrs	30 yrs	35 yrs	40 yrs	45 yrs	50 yrs	55 yrs	60 yrs	65 yrs
Forest Upland	4.1E+19	9%	6%	9%	12%	12%	13%	14%	15%	16%	17%	18%	19%	20%	20%
Urban Upland*	3.5E+20	72%	10%	21%	34%	38%	41%	45%	48%	52%	55%	59%	62%	66%	71%
Atmosphere	7.5E+19	16%	8%	15%	30%	32%	35%	37%	40%	42%	45%	47%	50%	52%	55%
Stream Channel	1.7E+19	3%	13%	26%	53%	56%	60%	63%	67%	70%	74%	77%	81%	85%	89%
Basin Wide Total	4.8E+20	100%	10%	19%	32%	35%	38%	42%	44%	47%	51%	55%	58%	61%	65%

Table 5.17-3
TOTAL NITROGEN LOAD ALLOCATIONS BY POLLUTANT SOURCE CATEGORY

	Baseline Load		Milestone Load Reductions												Standard Attainment
	Basin-Wide Nitrogen Load (MT/yr)	% of Basin-Wide Load	5 yrs	10 yrs	15 yrs	20 yrs	25 yrs	30 yrs	35 yrs	40 yrs	45 yrs	50 yrs	55 yrs	60 yrs	65 yrs
Forest Upland	62	18%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Urban Upland*	63	18%	8%	14%	19%	22%	25%	28%	31%	34%	37%	40%	43%	46%	50%
Atmosphere	218	63%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	2%	2%	2%
Stream Channel	2	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Basin Wide Total	345	100%	2%	3%	4%	5%	6%	6%	7%	7%	8%	8%	9%	9%	10%

Table 5.17-4
TOTAL PHOSPHORUS LOAD ALLOCATIONS BY POLLUTANT SOURCE CATEGORY

	Baseline Load		Milestone Load Reductions												Standard Attainment
	Basin-Wide Phosphorus Load (MT/yr)	% of Basin-Wide Load	5 yrs	10 yrs	15 yrs	20 yrs	25 yrs	30 yrs	35 yrs	40 yrs	45 yrs	50 yrs	55 yrs	60 yrs	65 yrs
Forest Upland	12	32%	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	3%	3%
Urban Upland*	18	47%	7%	14%	21%	23%	26%	28%	31%	33%	36%	38%	41%	44%	46%
Atmosphere	7	18%	9%	17%	33%	36%	39%	42%	45%	48%	51%	53%	56%	58%	61%
Stream Channel	1	3%	8%	15%	30%	32%	34%	36%	38%	40%	42%	44%	46%	48%	51%
Basin Wide Total	38	100%	5%	10%	17%	19%	22%	24%	26%	28%	30%	32%	33%	34%	35%

Table 5.17-5
FINE SEDIMENT PARTICLE DAILY LOADING ESTIMATE

Flow Range	Associated Flow (Liters/Second)			Pollutant Concentration (Number of Particles/L)		
Percentile	Mean	Min	Max	Mean	Min	Max
0-10	1375.7	1011.6	1588.1	6.6E+07	2.1E+07	5.8E+08
10-20	1763.1	1588.7	1950.2	1.0E+08	1.7E+07	9.4E+08
20-30	2211.6	1950.5	2522.4	2.1E+08	1.9E+07	1.1E+09
30-40	2858.7	2523.8	3245.2	3.1E+08	3.1E+07	1.5E+09
40-50	3853.9	3246.4	4585.4	3.8E+08	3.1E+07	1.9E+09
50-60	5541.2	4591.3	6688.8	4.7E+08	4.2E+07	2.7E+09
60-70	8640.3	6696.0	11006.6	5.7E+08	5.3E+07	4.6E+09
70-80	14260.5	11022.9	18204.7	6.0E+08	7.2E+07	2.6E+09
80-90	24350.5	18209.9	34290.9	5.9E+08	1.2E+08	2.6E+09
90-100	60418.5	34368.2	165776.2	7.9E+08	2.7E+08	3.5E+09

Table 5.17-6
TOTAL PHOSPHORUS DAILY LOADING ESTIMATE

Flow Range	Associated Flow (Liters/Second)			Pollutant Concentration (mg/L)		
Percentile	Mean	Min	Max	Mean	Min	Max
0-10	1375.7	1011.6	1588.1	0.041	0.031	0.097
10-20	1763.1	1588.7	1950.2	0.044	0.027	0.133
20-30	2211.6	1950.5	2522.4	0.055	0.019	0.170
30-40	2858.7	2523.8	3245.2	0.064	0.023	0.214
40-50	3853.9	3246.4	4585.4	0.069	0.022	0.224
50-60	5541.2	4591.3	6688.8	0.075	0.025	0.229
60-70	8640.3	6696.0	11006.6	0.078	0.029	0.320
70-80	14260.5	11022.9	18204.7	0.073	0.034	0.202
80-90	24350.5	18209.9	34290.9	0.067	0.035	0.208
90-100	60418.5	34368.2	165776.2	0.062	0.036	0.185

Table 5.17-7
TOTAL NITROGEN DAILY LOADING ESTIMATE

Flow Range	Associated Flow (Liters/second)			Pollutant Concentration (mg/L)		
Percentile	Mean	Min	Max	Mean	Min	Max
0-10	1375.7	1011.6	1588.1	0.10	0.06	0.70
10-20	1763.1	1588.7	1950.2	0.13	0.05	1.06
20-30	2211.6	1950.5	2522.4	0.23	0.05	1.36
30-40	2858.7	2523.8	3245.2	0.32	0.05	1.58
40-50	3853.9	3246.4	4585.4	0.38	0.06	1.64
50-60	5541.2	4591.3	6688.8	0.44	0.07	1.80
60-70	8640.3	6696.0	11006.6	0.43	0.07	1.81
70-80	14260.5	11022.9	18204.7	0.36	0.08	1.85
80-90	24350.5	18209.9	34290.9	0.28	0.08	1.81
90-100	60418.5	34368.2	165776.2	0.23	0.09	1.55

Margin of Safety: A Margin of Safety is included in a TMDL to account for any lack of knowledge and uncertainties inherent to the TMDL development process. Uncertainty is an expression commonly used to evaluate the confidence associated with sets of data, approaches for data analysis, and resulting interpretations. Determining uncertainty is notably difficult in studies of complex ecosystems when data are extrapolated to larger scales or when project specific data do not exist and best professional judgment, based on findings from other systems, must be employed. The Regional Board addressed uncertainty within the Lake Tahoe TMDL by using:

1. A comprehensive science program and science-based analysis developed to (a) enhance monitoring to fill key knowledge gaps and (b) develop pollutant loading and lake response modeling tools specifically for Lake Tahoe to help reduce estimate uncertainty.

2. More than 150 conservative, implicit assumptions in the loading, load reduction, lake response, and load allocation analyses when necessary to address modeling uncertainty or limited input data.

Future Growth Potential: The potential for future growth in the Tahoe basin remains limited. As of 2009, a total of 4,841 parcels in the Tahoe basin were undeveloped and may become eligible for future development. Assuming that the 4,841 undeveloped lots have an average size of 0.25 acres and that each lot will be developed, these parcels would comprise 1210 total acres of additional developed land. Coverage on the highest capability land is limited to 30 percent (TRPA 1987, Section 20.3.A). This means that a maximum of 373 acres would be made impervious. Active conservation efforts, such as the California Tahoe Conservancy urban lot program and the Forest Service Burton-Santini acquisition program are expected to prevent a number of the lots in question from being developed by converting the private lots to public open space. Retiring these lots from development potential reduces the potential total new coverage.

Analysis conducted during Lake Tahoe TMDL development indicates that a complete, worst-case build-out scenario of remaining parcels could potentially increase fine sediment particle loading by up to two percent. Given the inherent uncertainty in the watershed modeling analysis and the conservative assumptions of the worst-case build out scenario, the potential pollutant load increase associated with future development will likely be less than the worst-case estimate.

Any activity, such as new development, re-development, or other land disturbing management actions, has the potential to increase localized (i.e. on a parcel scale) pollutant loading. To ensure that future growth does not increase pollutant loads, the City of South Lake Tahoe, El Dorado County, and Placer County must reduce fine sediment particle, total nitrogen, and total phosphorus loads as described in Tables 5.17-2, 5.17-3, and 5.17-4 from the established baseline condition. A municipality must annually demonstrate on a catchment (i.e. sub-watershed) basis that no increased loading in fine sediment particle, total nitrogen, and total phosphorus will result from any land disturbing activity permitted in the catchment. Efforts to eliminate the increased loads from these land disturbing activities will not be counted towards the annual load reduction requirements.

Implementation Plan

The Lake Tahoe TMDL Implementation Plan is a summary of programs the various funding, regulatory, and implementing agencies may take to reduce fine sediment particle, phosphorus, and nitrogen loads to Lake Tahoe to meet established load reduction milestones.

The Regional Board evaluated load reduction opportunities for all pollutant sources as part of the Pollutant Reduction Opportunity Report (Lahontan and NDEP 2008a) and found that the most cost effective and efficient load reduction options for the forested upland, stream channel erosion, and atmospheric deposition sources are consistent with existing programs. The Pollutant Reduction Opportunity Report concluded that continued implementation of measures to address disturbances in undeveloped areas, control eroding stream banks, and reduce atmospheric deposition are critical to meeting required load reductions. Therefore, a regulatory policy that maintains the current implementation approaches for these source categories is appropriate to meet TMDL load allocations.

The most significant and currently quantifiable load reduction opportunities are within the urban uplands source. Because urbanized areas discharge the overwhelming bulk of the average annual fine sediment particle load reaching Lake Tahoe, much of the load reductions must be accomplished from this source. Even if it were feasible to completely eliminate the fine sediment particle load from the other three sources, the transparency standard would never be met.

Consequently, the Lake Tahoe TMDL implementation plan emphasizes actions to reduce

fine sediment particle and associated nutrient loading from urban stormwater runoff. Due to the magnitude of both the pollutant source and related control opportunities, the Regional Board has devoted time and resources to develop detailed tools and protocols to quantify, track, and account for pollutant loads associated with urban runoff.

The following sections briefly describe the implementation approaches for each of the four major pollutant source categories. Due to the relative magnitude of the pollutant source and the importance of reducing loads from the developed upland area, the most detailed policy and regulatory changes are for managing urban stormwater.

The tools for estimating the expected average annual fine sediment particle load reduction associated with actions to address stream channel erosion, atmospheric deposition, and forest upland sources are less advanced than the methods to estimate urban upland control measure effectiveness. Acknowledging the science that indicates that stream channel erosion, atmospheric deposition, and forest upland sources contribute less fine sediments and phosphorus overall to Lake Tahoe, coupled with the high cost of developing estimation and tracking tools, the Regional Board has not developed detailed load reduction estimation, accounting, and tracking procedures for these sources. The Regional Board will, however, require responsible entities to report on load reduction activities to ensure ongoing implementation of forest, stream channel, and atmospheric load reduction efforts.

Urban Runoff: Through stormwater NPDES permits that regulate runoff discharges from the City of South Lake Tahoe, El Dorado and Placer Counties, and the California Department of Transportation, the Regional Board will specify waste load allocations and track compliance with required load reduction milestones.

The Lake Tahoe TMDL expresses waste load allocations for the urban upland source as percent reductions from a basin-wide baseline load. The baseline basin-wide pollutant loads for the TMDL reflect conditions as of water year 2003/2004 (October 1, 2003 – September 30, 2004). To translate basin-wide urban runoff waste load allocations into jurisdiction-specific waste load allocations for municipalities and state highway departments, the Regional Board will require those agencies to conduct a jurisdiction-scale baseline load analysis as the first step in the implementation process. For each five year milestone, jurisdiction-specific waste load reduction requirements will be calculated by multiplying the urban uplands basin-wide load reduction percentage by each jurisdiction's individual baseline load.

To ensure comparability between the basin-wide baseline waste load estimates and the jurisdiction-scale baseline waste load estimates for urban runoff, municipalities and the state highway department must use a set of standardized baseline condition values that are consistent with those used to estimate the 2003/2004 basin-wide pollutant loads. Specifically, baseline load estimate calculations must reflect infrastructure, land development conditions, and operations and maintenance practices representative of those implemented in October 2004.

The Lake Clarity Crediting Program provides a system of tools and methods to allow urban jurisdictions to link projects, programs, and operations and maintenance activities to estimated pollutant load reductions. In addition to providing a consistent method to track compliance with stormwater regulatory measures, the Lake Clarity Crediting Program provides specific technical guidance for calculating jurisdiction-scale baseline load estimates.

Forest Uplands: Forest uplands comprise approximately 80 percent of the land area within the Lake Tahoe basin. Fine sediment particles from this source category most often originate from discrete disturbed areas such as unpaved roads, ski runs, and recreation areas in forested uplands.

The United States Forest Service Lake Tahoe Basin Management Unit (LTBMU), California Department of Parks and Recreation, California Tahoe Conservancy (CTC), and other public land managers implement watershed management programs on their lands. As part of these watershed management programs, land managers maintain existing facilities (including unpaved roads and trails), restore disturbed lands, implement and maintain stormwater treatment facilities for all paved/impervious surfaces, prevent pollutant loading from fuels management work, and take other actions to reduce fine sediment particle, total nitrogen, and total phosphorus loads. These agencies are responsible for implementing forest fuels reduction projects to reduce the threat of wildfire in the Lake Tahoe basin. These projects must include best management practices and appropriate monitoring to ensure fuels reduction efforts do not cause this source to exceed its load allocation for fine sediment particle and nutrient loads and must comply with any applicable state or federal permits regulating stormwater discharges from roads created for silvicultural activities.

The California Department of Forestry and Fire Protection is responsible for regulating forest practices on private forest lands and works directly with Regional Board staff to minimize the water quality impacts associated with vegetation management. The Emergency California-Nevada Tahoe Basin Fire Commission Report (May 2008) provides guidance to the Regional Board and the Tahoe Regional Planning Agency to facilitate projects that address Lake Tahoe's wildfire vulnerability.

The Ninth Circuit federal Court of Appeals has found that "stormwater runoff from logging roads associated with silviculture that is collected in a system of ditches, culverts, and channels and is then discharged into streams and rivers" is not exempt from the National Pollutant Discharge Elimination System permitting process because it is considered a point source discharge of stormwater "associated with industrial activity" (Northwest Environmental Defense Center v. Brown, 2010 WL 3222105 (2010)). If, in conformance with this decision, the Water Board reclassifies a portion of the forest load allocation as a waste load allocation, such a regulatory shift would not change the implementation approach.

The forest upland load reductions are expected to be accomplished through continued implementation of existing watershed management programs described above. The Regional Board will require forest management agencies to track and report load increases and load reduction activities to assess whether required basin-wide forest load reductions are occurring. Some activities, including fuels reduction and associated administrative road construction, have the potential to increase pollutant loading at a project scale. Forest management agencies responsible for these actions must demonstrate that other project activities, including restoration efforts and temporary and/or permanent best management practices, will be implemented to compensate for any anticipated project-scale loading increase. These agencies must ensure that no increased loading occurs on a sub-watershed or catchment scale and that the basin-wide fine sediment particle, total nitrogen, and total phosphorus load from the forest uplands is reduced as required by Tables 5.17-2, 5.17-3, and 5.17-4.

Stream Channel Erosion: Fine sediment from stream channel erosion represents four percent of the total fine sediment loading to Lake Tahoe. Less than three percent of the annual total nitrogen and total phosphorus loading to the lake comes from stream channel erosion. The Upper Truckee River, Blackwood Creek, and Ward Creek contribute 96 percent of the basin-wide total for fine sediment from stream channel erosion. The LTBMU and CTC are implementing stream environment zone (SEZ) restoration projects on Blackwood Creek and Ward Creek. The CTC, City of South Lake Tahoe, CA State Parks, and the LTBMU have plans to restore reaches of the Upper Truckee River. Pollutant control opportunities for these waterways include site-specific stream bank stabilization and ecosystem restoration to prevent pollutant loading to Lake Tahoe from stream channels. These projects are expected to achieve the needed pollutant load reductions from this source category.

Atmospheric Deposition: Atmospheric deposition contributes the majority of the nitrogen and approximately 16 percent of the fine sediment particle load that reaches the lake. The TMDL implementation plan emphasizes reducing atmospheric deposition of fine sediment particles and associated phosphorus by addressing dust sources from paved and unpaved roadways and other unpaved areas within the developed and undeveloped landscape. TRPA programs for reducing emissions from residential wood burning are also expected to provide some particle reduction from this source.

Control measures for reducing dust in developed areas (such as street sweeping, and construction site good housekeeping practices) are the same as measures taken to reduce fine sediment particles in urban stormwater runoff. Similarly, some actions taken to control runoff from unpaved roadways (such as armoring unpaved roads with gravel or asphalt) within the forested uplands may reduce dust from these areas. Although allocations for atmospheric pollutant loads are independent of forest and urban upland allocations, load reduction actions taken to control surface runoff pollutants are expected to achieve the required atmospheric fine sediment particle and phosphorus load reductions. Other than supporting research to confirm that actions taken to reduce fine sediment particles in runoff effectively reduce atmospheric pollutant loads, the Regional Board does not expect to track and account for atmospheric load reductions on a jurisdiction scale.

The atmospheric deposition of total nitrogen must be reduced by two percent over 65 years to achieve the deep water transparency standard. Mobile sources (vehicle emissions) are the main source of the atmospheric nitrogen load. The Tahoe Regional Planning Agency's air quality and regional transportation plans, which contain requirements to reduce vehicle emissions and comply with health-based air quality standards, are being relied on and are expected to attain the needed two percent

nitrogen reduction within 65 years.

Future Needs: Research and monitoring efforts are underway to improve scientific understanding of pollutant loading and load reduction options. Specific projects include an effort to better quantify water quality benefits beyond reducing bed and channel erosion associated with stream restoration, a project to provide more quantitative information on the effects of various forest management actions and association mitigation measures, and ongoing atmospheric deposition monitoring. These projects and others will help determine whether more specific load and load reduction estimation efforts will be needed in the future to better quantify the benefits of air quality, stream channel, and forest management programs.

Schedule of TMDL Attainment, Data Review, and Revision: The estimated timeframe to achieve the TMDL required load reductions and meet the numeric target and is 65 years. The Lake Clarity Model showed that basin-wide loads of fine sediment particles, nitrogen, and phosphorus must be reduced by 65 percent, 10 percent, and 35 percent, respectively, to attain the numeric target of 97.4 feet average annual Secchi depth. Since the greatest reductions must occur in fine sediment particle loads, an implementation plan that achieves, on average over the entire implementation plan time frame, a one percent load reduction of fine sediment particles per year is reasonable. Though the first 20-year implementation phase is expected to achieve roughly one-half of the needed 65 percent total load reduction in fine sediment particle load, this load reduction would only improve the transparency by about ten feet, which is about one-third of the progress to the numeric target. Each successive 20-year implementation phase is expected to achieve roughly ten more feet of transparency improvement towards the numeric target, adding up to about 65 years for complete implementation to achieve the numeric target. The 65-year schedule also assumes that the rate of achieving load reductions is expected to decrease over time after the first 20-year phase as load reduction opportunities become increasingly scarce and likely more difficult to attain.

The TMDL attainment estimate considers the temporal disparities between pollutant release, sediment and nutrient delivery, and the time needed for the target indicators to respond to decreased source loading. Funding constraints may affect the pace of certain implementation actions. The Regional Board expects all implementing agencies to pursue both self-funded and external funding sources. Should funding and implementation constraints impact the ability to meet load reduction milestones the Regional Board will consider amending the implementation and load reduction schedules.

Progress toward meeting the targets will be evaluated by the Regional Board in periodic milestone reports. The implementation schedule for the Lake Tahoe TMDL to make needed changes in urban stormwater policy and implementation actions is shown in Table 5.17-8.

Table 5.17-8
LAKE TAHOE TMDL URBAN UPLAND IMPLEMENTATION/REPORTINGSCHEDULE

Action	Schedule***	Responsible Party
Submit Pollutant Load Reduction Plans or equivalent to Regional Board describing how 5-year load reduction requirements will be met	The first plan must be submitted no later than two years after TMDL approval*. Future plans must be submitted no less than six months prior to the expiration of the applicable municipal NPDES stormwater permit	El Dorado County Placer County California Department of Transportation City of South Lake Tahoe
Submit jurisdiction-specific 2004 baseline load estimates for fine sediment particles, phosphorus, and nitrogen to the Regional Board for review/approval**	No later than two years after TMDL approval*	
Reduce and maintain pollutant loads of fine sediment particles, total phosphorus, and total nitrogen as specified in Tables 5.17-2, 5.17-3, and 5.17-4	Achieve the percent reduction specified no later than each respective 5-year milestone following TMDL approval*	

*TMDL approval is the date the USEPA approves the Lake Tahoe TMDL.

**The baseline load estimates must be calculated using either the Pollutant Load Reduction Model, or an equivalent method acceptable to the Regional Board that uses a continuous hydrologic simulation process (or other modeling method that demonstrably produces similar results), incorporates stormwater discharge characteristics from established land uses, includes the effectiveness of stormwater treatment best management practices, and accounts for the changes in roadway and stormwater treatment facility condition.

***These due dates are not imposed by virtue of the Basin Plan. The due dates will be established in Regional Board orders consistent with the schedule noted herein.

The Regional Board will annually track actions taken to reduce loads from the major pollutant sources: urban uplands, forest uplands, atmospheric deposition, and stream channel erosion. If agencies responsible for implementing programs to reduce pollutant loads from the atmospheric, forest, and stream channel erosion sources fail to take needed actions to reduce loads from those three sources in accordance with the load allocation schedule, then the Regional Board will evaluate the need for more targeted regulatory action.

Adaptive Management: The Regional Board is committed to operating a TMDL Management System throughout the implementation timeframe of the TMDL. Through the Management System process, the Regional Board may evaluate information such as the relative accuracy of baseline load estimates and the efficacy of load reduction actions, and will compare the anticipated transparency response to average annual Secchi depth measurements. The Management System framework will also support regular assessments of relevant research and monitoring findings. Based on Management System findings, the Regional Board may consider reopening the TMDL to adjust load reduction milestones and/or the TMDL implementation approach if needed. Following the first fifteen year implementation period of this TMDL, the Regional Board will evaluate the status and trend of the lake's deep water transparency relative to the load reductions achieved. The Regional Board, in partnership with implementation, funding, and regulatory stakeholders, anticipates conducting this adaptive management process as needed to ensure the deep water transparency standard will be met by year 65.

The Regional Board evaluated the anticipated changes in temperature and precipitation associated with global climate change. An extensive review of available literature and climate change model results concluded that by the year 2050, Lake Tahoe basin temperatures may increase by up to two degrees Celsius and average annual precipitation may decrease by approximately ten percent. This shift may influence local stormwater hydrology and stormwater dischargers may need to adjust future stormwater practices to ensure management measures are sufficient to meet the load reduction requirements described in Tables 5.17-2, 5.17-3, and 5.17-4.

Monitoring Plan: The Regional Board expects funding, implementing, and regulatory agencies to assist in developing a comprehensive TMDL monitoring plan within the first two years following TMDL adoption by USEPA. Once developed, the monitoring program will assess progress of TMDL implementation and provide a basis for reviewing, evaluating, and revising TMDL implementation actions as needed. The following sections describe both ongoing and anticipated monitoring activities for each of the major pollutant sources and tributary and in-lake monitoring efforts.

Urban Upland

In 2007 the Tahoe Science Consortium began planning a Lake Tahoe Regional Stormwater Monitoring Program (RSWMP) to better understand local urban runoff conditions, evaluate the impact of erosion control and stormwater treatment efforts, and coordinate and consolidate an urban stormwater monitoring work. The RSWMP has been organized in three phases. The first phase, completed in 2008, focused on collaboratively framing the elements of a comprehensive stormwater monitoring program. The framework includes relevant agency, implementer and science considerations, an outline of the required elements for a monitoring program, the design for structural (administrative) elements, and goals and objectives for a sustainable program. Identified monitoring goals include (1) monitoring to quantify load reduction progress at a subwatershed scale; (2) data collection to support improvements in best management practice design, operation, and maintenance; and (3) efforts to identify and quantify specific sources of urban stormwater pollutants to refine load reduction model input parameters.

The second phase of RSWMP will build on the conceptual framework by designing a specific monitoring program that will include: a quality assurance project plan; specific monitoring goals and data quality objectives; monitoring design specifications; detailed sampling and analysis plan; stormwater database development, data management and analysis details; organizational structure of RSWMP; operational costs; funding arrangements; agency roles and responsibilities; and internal and external peer-review processes.

The last RSWMP phase will be the funding and implementation of the actual stormwater monitoring program. This phase includes selecting monitoring sites and equipment, and developing the detailed processes and protocols for reporting monitoring results. Since the RSWMP will largely provide information for the local municipal jurisdictions and state transportation agencies to meet regulatory or other monitoring needs, RSWMP participation or implementation of an equivalent monitoring program is expected to be a condition of NPDES municipal stormwater permits.

Atmospheric Deposition

UC Davis scientists regularly measure atmospheric deposition of nitrogen (nitrate, ammonium and total Kjeldahl nitrogen) and phosphorus (soluble reactive phosphorus, total dissolved phosphorus and total phosphorus). The atmospheric deposition monitoring is expected to continue and several research studies, focused on fine sediment particles, are anticipated to be completed by 2011. The results from these studies will fill knowledge and data gaps in fine sediment particle deposition on Lake Tahoe, including better estimates of loading from atmospheric deposition. To assess project effectiveness for reduction of fine sediment particles by individual atmospheric source, targeted air quality control monitoring should be conducted in association with selected project implementation.

Forest Upland

The stream monitoring network will play a key role in evaluating load reduction from these land-uses, while management practice effectiveness will be assessed on a project basis. Monitoring is needed to ensure forest management actions, including fuels reduction efforts, are evaluated at either the project and/or sub-basin level to determine whether the measures are reducing fine sediment particle and nutrient loading.

Responsible parties will be required to document and report previous year activities that may have increased or reduced pollutant loads and describe how the reported loading assessment was determined. Forest management agencies will also be required to annually submit plans for next year's management activities that are expected to influence fine sediment particle, total nitrogen, and total phosphorus loading rates. The anticipated activities are expected to include, but not be limited to: fuel reduction projects, BMPs on unpaved roads and trails, ski area revegetation, routine BMP maintenance, and effective road decommissioning.

Stream Channel Erosion

Similar to the forest upland monitoring approach, the relative impact of restoration activities will be evaluated on a project basis. Responsible agencies are encouraged to use permanent survey markers and monitor changes in stream cross-sections in relation to erosion or aggregation of sediment for stream reaches of interest.

Research projects have been funded to assess the benefits of stream restoration project components that reconnect the stream to its natural floodplain in reducing fine sediment particles and nutrients. The Water Board anticipates that these efforts will provide consistent protocols useful for quantifying the load reductions from certain streams under specified flow conditions.

Tributary Monitoring

Stream water quality monitoring and suspended sediment load calculations are regularly done as part of the Lake Tahoe Interagency Monitoring Program (LTIMP). LTIMP is a cooperative program including both state and federal partners and is operationally managed by the United States Geological Survey, UC Davis – Tahoe Environmental Research Center, and the Tahoe Regional Planning Agency. LTIMP was formed in 1978 and one of its primary objectives is to monitor discharge, nutrient load, and sediment loads from representative streams that flow into Lake Tahoe. Cumulative flow from these monitored streams comprises about 50 percent of the total discharge from all tributaries. Each stream is monitored on 30 - 40 dates each year and sampling is largely based on hydrologic events. Nitrogen and phosphorus loading calculations are performed using the LTIMP flow and nutrient concentration database. This data is stored on the USGS website at http://wdr.water.usgs.gov/.

Lake Monitoring:

Lake sampling is done routinely at two permanent stations. At the Index Station (location of the Lake Tahoe Profile or LTP), samples are collected between 0 - 105 meters in the water column at 13 discrete depths. This station is the basis of the > 40 year continuous data set and monitoring is done on a schedule of 25-30 times per year. The Mid-Lake Station has been operational since 1980 and has been valuable for comparison with the Index Station. At this location, samples are taken down a vertical profile to the bottom of the lake (0 - 450 meters) at 11 discrete depths on the order of once per month. Sampling along the complete vertical depth profile allows for the analysis of whole-lake changes. In addition, the lake monitoring program also includes phytoplankton and zooplankton taxonomy and enumeration, algal growth bioassays (using natural populations), and periphyton (attached) algae. Much of this monitoring is summarized in a report entitled, *Tahoe: State of the Lake Report* published by UC Davis (UC Davis - TERC 2009).

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