

Chapter 3

WATER QUALITY

3.1 INTRODUCTION

Lake Tahoe is one of the deepest and clearest lakes in the world. As such, it is a highly sought out destination for recreation, tourism and home ownership. Clarity and exceptional water quality are the basis of Lake Tahoe water quality goals. These important features give Lake Tahoe important designations. Both the federal government and California government have designated Lake Tahoe an “Outstanding National Resource Water”. Nevada has designated Lake Tahoe a “Water of Extraordinary Ecological or Aesthetic Value”. In addition to aesthetic enjoyment, the exceptional quality of water in the Lake Tahoe Basin supports a number of beneficial uses related to human and environmental health, including drinking water supply, water contact recreation, wildlife habitat, and aquatic life and habitat.

The aquatic system of the Tahoe Basin can be separated into five major components: 1) Lake Tahoe pelagic (open) waters and littoral (nearshore) waters; 2) tributary or stream flows; 3) surface runoff or stormwater; 4) groundwater; and 5) lakes in the Tahoe Basin other than Lake Tahoe. A sixth non-aquatic component that affects Lake clarity is air quality as it relates to atmospheric deposition of nitrogen, phosphorus, and fine particles. The Lake is affected by loading of nutrients and sediment, and the tributary streams, stormwater, groundwater and atmospheric deposition are sources of such pollutant loading. The components are covered separately since they are functionally different in relation to Lake Tahoe clarity and water quality in general. Separate federal, state and TRPA goals and standards have been developed for air quality, although not necessarily for atmospheric deposition and for each of the five components of the Tahoe Basin aquatic system for which there were considered to be sufficient data available to clearly define the need for and the specific characteristics of a standard. There are a number of external factors that affect the water quality of these subcomponents, such as precipitation, land use intensity and impervious cover (such as pavement and buildings), and soil disturbance. These factors have been considered in the discussion of water quality goals and standards for each subcomponent.

See the Water Quality Technical Supplement of the “Draft Pathway 2007 Evaluation Report” (January 2006) for further details on other state and federal water quality standards, laws, and interactions between these and TRPA’s Water Quality Thresholds.

(http://www.pathway2007.org/assets/EVALUATION_REPORT/TECHNICAL/WATER-jan06.pdf).

The setting consists mainly of the hydrologic Lake Tahoe Basin of California and Nevada as introduced for each of the six water quality subcomponents that follow. Many of these Lake Clarity related processes will be covered in greater detail in the TMDL Technical Report for Lake Tahoe, which is expected to be released in

August 2007 by the Lahontan Regional Water Quality Control Board and Nevada Division of Environmental Protection.

3.1.1 LAKE TAHOE WATER QUALITY PROCESSES

Lake Tahoe has an exceptionally long residence time, with the typical drop of water residing in the Lake for approximately 700 years (Byron and Goldman, 1986). In other words, if Lake Tahoe were drained, it has been estimated that it would take approximately 500 to 700 years to refill it (TRPA, 1982a). The result of this remarkable residence time is that discharges to the Lake remain, either in solution or mainly in the Lake's bottom sediments. In contrast, the residence time of Fallen Leaf Lake the largest "other lake" in the Lake Tahoe Basin is only eight years. Thus, Tahoe does not benefit from the flushing action of precipitation and runoff, as do other water bodies. The Lake's only natural outlet, the Truckee River located near Tahoe City, California, represents a minimal loss of nutrients and sediments in the overall nutrient budget based on outflow calculations (TRPA, 1988). The U.S. Bureau of Reclamation manages the top six feet of Lake Tahoe with the operation of the dam at Tahoe City. During drought periods the Lake often falls below the natural rim of 6223 feet. In high rainfall periods the Lake elevation can rise above the legal limit of 6229.05 feet, such as the rapid rise to 6229.4 ft. on Jan. 4, 1997 in response to the flood events of New Year's 1997.

Historically, Lake Tahoe was nitrogen limited meaning any addition of nitrogen stimulated algal growth; however, monitoring conducted by the Tahoe Research Group-U.C. Davis (TRG, now the Tahoe Environmental Research Center (TERC)) indicates that since the mid-1980s phosphorus is the more limiting nutrient. This phosphorus limitation on algal growth is thought to be the result of increased atmospheric nitrogen deposition over time leading to a surplus of nitrogen for algal growth. More than 50 percent of the total nitrogen input to the Lake has been estimated to be from atmospheric deposition (Jassby *et al*, 1994). Phosphorus in Tahoe is likely to be more tightly bound in particulate form than nitrogen and is transported downward as particles and held in the sediments with greater efficiency (Hatch, TRG, 1997). Phosphorus and nitrogen can both limit algal productivity in the Lake. Algal growth bioassay results show some variation in increased productivity with the addition of nitrogen, phosphorus, or nitrogen and phosphorus in combination (Hackley *et al*, 2004).

Lake Tahoe has been impacted by increased algal productivity and fine suspended sediment particles resulting in a greater than 30 percent loss of clarity since 1968. This response is due to accelerated input of nutrients and fine particles into the lake due to influence of urbanization. This disturbance results in imbalances in the lake's nutrient budget, accelerating increases in algal productivity. Indicators of these nutrient and fine particle effects in Lake Tahoe are phytoplankton (free-floating algae) primary productivity (PP_r), Secchi disk depth (water clarity), and periphyton (attached algae) productivity and biomass (Goldman 1981, 1985, 1986; Loeb and Reuter 1984; Loeb and Palmer 1985; Hackley *et al*, 2004).

The presence of phytoplankton in the water column reduces clarity by mainly absorbing light, and to a lesser extent scattering light. In addition to nutrient budget imbalances and resultant algal blooms, water clarity may be greatly reduced by the accumulation of small size particulate matter (< 20 μm diameter mineral

sediments) in Lake Tahoe waters. These particles efficiently scatter light, resulting in clarity loss (Geoff Schladow, The Lake Tahoe Clarity Model, 2000, Swift *et al*, 2006.) In recent research to determine the total maximum daily load (TMDL) of nutrients that can be tolerated while still maintaining the desired water quality of the Lake, these fine particles have been shown to have a dominant affect on clarity and may be responsible for 60% or more of the Secchi depth loss due to light scattering.

3.1.2 LAKE TAHOE NUTRIENT & SEDIMENT BUDGETS

When evaluating inputs, outputs, sinks, and storage of nutrients in a lake, it is useful to consider a nutrient and fine sediment budget. This is the loading estimate that determines the response of the Lake has to pollutant loading for these constituents. Lake Tahoe's loss of clarity since the 1960's is the result of changes in nutrient and perhaps fine sediment budgets (although measurements of this parameter have only recently begun so there is long-term record). When the inputs of these nutrients exceed the outputs from the Lake, the resulting increased storage of nutrients increase algal growth along and light absorption by these algae along with the suspension of fine particles in the water column reduce clarity. Nearshore clarity and periphyton biomass respond to the same excess of fine sediment and nutrients, respectively. The clarity model outputs for the TMDL for Lake Tahoe will determine the response of clarity to the nutrient and fine sediment budgets affecting open water clarity relative to those reported in the 2001 Threshold Evaluation (TRPA, 2002), and predict the needed load reductions for nutrients and fine sediments in order to meet clarity goals. The 2006 loading estimates from the Watershed Model and other TMDL related research are reported in the general status section for the pollutant loading source thresholds (WQ-4 through WQ-6). The majority of nitrogen loading to Lake Tahoe appears to be from atmospheric deposition, presumably from gasoline engine exhausts, and may be difficult to control without very effective transportation management and projects to reduce emissions. The unique characteristics of phosphorus, including its lack of a gaseous phase under normal conditions, and its tendency to associate with particulate matter, suggest that management practices may more easily balance the phosphorus and fine particulate budgets combined than the nitrogen budget. The majority of the total phosphorus and fine particulate sources appear to be from upland sources of soil erosion including streams and stormwater runoff.

3.1.3 LAKE TAHOE'S STREAMS AND WATERSHED

There are sixty-three perennial streams tributary to Lake Tahoe, and fifty-four intervening areas (without stream channels) that contribute runoff directly to Lake Tahoe.

Sediment transport depends upon a stream's kinetic energy. As water moves downhill through the watershed, potential energy is converted to kinetic energy. Some kinetic energy is dissipated through friction; leftover kinetic energy is capable of transporting sediment. Kinetic energy is proportional to the volume of water in the stream, and proportional to the square of the stream's velocity. The total sediment load a stream carries is composed of two parts: the bedload component and the suspended component. Bedload is the heavier portion moved downstream along the stream's bottom. Suspended sediments are lifted off the bottom and travel longer distances supported by the water. A recent study has

suggested that stream channel erosion may be a major source of sediment loading to Lake Tahoe, and fine sediment in particular (Simon *et al*, 2003). Strecker and Reininga (1999) reported that increasing impervious cover in a watershed is known to increase stream flows, and lead to downcutting of the channel and the related increase in stream bank erosion. It is expected that there would be a similar response to impervious cover in Tahoe watersheds, but the impervious coverage model and similar studies have not been done here to date.

3.1.4 SURFACE RUNOFF

Minimizing concentrations of sediments and nutrients in runoff depends on: (1) a healthy vegetative cover for nutrient uptake and incorporation or an adequate duff or mulch layer to assist in infiltration (Grismer and Hogan, 2004; 2005); (2) denitrification for nitrogen removal; (3) adsorptivity for phosphorus removal; and (4) filtration and settling for removal of sediment and nutrients associated with particles. Riparian and wetland areas are believed to be critical to good water quality due to their high rates of nutrient and sediment removal compared to surrounding vegetation; however, a recent literature review concludes that bioavailable nutrient removal efficiency of wetlands in Tahoe is predicted to be lower than reported because nearly all of the loading occurs during the dormant season, when biological removal processes are at a minimum (Hydroscience, 2000). In contrast, a field monitoring study of urban stormwater treatment by a constructed wetland system in Tahoe City found that bioavailable nutrients concentration were substantially reduced throughout the year, although winter efficiency appeared somewhat lower compared to summer (Heyvaert *et al*, 2004). Denitrification does not require that plants are active, only the denitrifying bacteria and availability of a carbon source in the soil and anaerobic conditions. Furthermore these wetland areas also function in flow attenuation and reduction of runoff, which is likely to yield additional benefits in water quality and flood protection.

Urbanization of a watershed increases sediment and nutrient yields by providing new sources of sediments and nutrients and interfering with removal mechanisms and water storage. Urbanization of the watershed of Lake Tahoe has led to five new direct sources of nutrients and sediment: (1) fertilizers being used largely to support non-native vegetation and not taken up by vegetation; (2) exfiltration from sewer lines and sewage spills from increased development; (3) leachate from land disposal of sewage in the past prior to state laws requiring sewage export; (4) in-Basin contributions of nitrogen and phosphorus to the atmosphere; and (5) increased erosion especially in disturbed areas and use of traction sand in the winter. A 1982 study (Glancy, U.S. Geological Survey) in the Tahoe Region found that urbanization could increase sediment yields up to 100 times that of the undeveloped areas above Incline Village.

3.1.5 GROUNDWATER

The contribution of groundwater from anthropogenic sources to water quality in Lake Tahoe is not well understood. A 1987 study (Loeb, 1987) found that groundwater concentrations of nitrate nitrogen were lowest in those areas furthest from Lake Tahoe. Concentrations increased down gradient toward the Lake, corresponding to the increasing proportion of disturbed land and urbanization, and the possibility of leaching of nutrients from land disposal of sewage in the 1950s

and 1960s. The TMDL Technical Report is expected to address this issue in greater detail.

A recent study based on analysis of existing data indicates that groundwater may contribute substantial loads of both nitrogen and phosphorus to Lake Tahoe. An in-depth review of existing reports and data collected by the Army Corps of Engineers estimates total dissolved nutrient loadings to Lake Tahoe to be 50,000 and 6,800 kg/yr respectively for nitrogen and phosphorous, or approximately 13% and 14% of the total annual loading budget. Moreover, 56% of the nitrogen and 39% of the phosphorous groundwater loadings may be the result of anthropogenic sources. The areas of greatest nutrient loadings from groundwater are believed to be in the Tahoe City / West shore and Tahoe Vista / Kings Beach areas. Fertilized areas, residual contamination from septic tanks and treated sewage infiltration areas, engineered infiltration basins, and urban infiltration could be significant sources of nutrients to the groundwater (USACE Lake Tahoe Basin Framework Study, 2003b). Some results of this review were similar to those reported by Thodal (1997).

Although the USGS has maintained a network of groundwater monitoring stations, the report above indicates that a comprehensive management strategy to obtain consistent groundwater data and uniform reporting is not currently in place. The Army Corps' report calls for a more rigorous monitoring program to provide significantly better data for the quantification of regional and basin-wide nutrient loading, the evaluation of sources, and understanding the interaction of groundwater with streams.

3.1.6 OTHER LAKES IN THE LAKE TAHOE BASIN

The lakes in the Tahoe Basin other than Lake Tahoe have been a focus for their own specific water quality and ecology. Only a few of these lakes have any significant development (e.g. Echo Lakes, and Fallen Leaf Lake). Development impacts, where they occur, would be similar to other parts of the Tahoe Basin watershed. Non-development impacts to the water quality of these undeveloped other lakes would be largely due to land management activities, or recreation and general watershed impacts such as atmospheric deposition below. A recent study was completed on five of these other lakes to monitor most of the same parameters previously monitored on them by U.C. Davis in the early 1990's (Lico, 2004).

3.1.7 LAKE TAHOE'S AIRSHED AND ATMOSPHERIC DEPOSITION

The atmosphere acts as a source of nutrients to Lake Tahoe and its watershed (Jassby *et al*, 1994). Vegetation and water surfaces scavenge gaseous compounds once NO_x reacts in the atmosphere (e.g., nitrogen dioxide, NO_2 on vegetation, and NO_3 to water) from the air. Liquid and solid particles (e.g., ammonium nitrate, NH_4NO_3) settle on vegetation, land, and the Lake. Deposition in the absence of precipitation is referred to as "dry deposition". Snow and rain scavenge gaseous and particulate forms from the air, depositing them on land and the Lake, in the process known as "wet deposition."

Since gaseous forms (e.g., NO_2 and NO_3) are relatively short-lived and are quickly absorbed from the air to vegetation and water respectively, local emission sources

are dominant over distant sources (LTADS Technical Memo, CARB, 2005), although fine particulates (e.g., NH_4NO_3) take time to form, travel long distances, and settle very slowly. Thus, emission ammonium nitrate sources upwind of the Tahoe Region dominate local sources, and ventilation of the Region by wind action minimizes deposition of particulates. Local sources are the dominant sources of fine particulate matter overall. Since the concentration of gaseous nitric acid (HNO_3) and ammonia (NH_3) were the most elevated forms of nitrogen at Tahoe sites, it appears that some transport from out of the Tahoe Basin but may be included in the atmospheric deposition of nitrogen to the Lake and watersheds (Tarnay *et al.*, 2001). However, the Lake Tahoe Atmospheric Deposition Study concludes that most atmospheric deposition sources are within the Tahoe Basin (CARB, 2005).

3.2 BACKGROUND

The recent substantial use of models for Lake Tahoe are the Clarity and Watershed models that are being developed for the TMDL, or pollutant loading capacity, for the fine particulate, nitrogen and phosphorus that effect the clarity of Lake Tahoe.

The Tahoe Regional Planning Compact (Public Law 96-551 – Dec. 19, 1980) amendment required that TRPA adopt Environmental Threshold Carrying Capacities (ETCCs, or Thresholds), and the amendment of TRPA's Regional Plan in order to achieve and maintain such thresholds. The Compact found that among other things that the waters of Lake Tahoe and other resources of the Lake Tahoe Region are threatened with deterioration or degeneration. The Compact defines these ETCCs or thresholds as an environmental standard necessary to maintain a significant scenic, recreational, educational, scientific or natural value or the region or to maintain public health and safety within the region. Article II (I) of the Compact states that Environmental Threshold Carrying capacities are to include, but not be limited to, standards for air quality, water quality, soil conservation, vegetation preservation and noise, thus permitting, if not requiring, the adoption of standards for other elements necessary to maintain a significant scenic, recreational, educational, scientific or natural value of the Lake Tahoe Region or to maintain public health and safety within the region. The Compact Article V (d) requires that TRPA's regional plan provide for attaining and maintaining Federal, State, or local air and water quality standards, whichever are strictest, in the respective portions of the region for which the standards are applicable. Article V (d) further states that "Each element of the regional plan, where applicable shall, by ordinance, identify the means and time schedule by which air and water quality standards will be attained."

The value statements used in setting the targets for water quality thresholds in the Threshold Study Report (1982) were: 1) Attain levels of water quality in the lakes and streams within the Basin suitable to maintain the identified beneficial uses of Lake Tahoe. 2) Restrict algal productivity (rate of growth) to levels that do not impair beneficial uses or deteriorate existing water quality conditions in the Lake Tahoe Basin. 3) Prevent degradation of the water quality of Lake Tahoe and its tributaries to preserve the lake for future generations. 4) Restore all watersheds in the Basin so that they respond to runoff in a natural hydrologic function.

Resolution 82-11 sets out numeric, policy and management standards for ETCCs starting with water quality. Some of these threshold standards are referenced to state standards, or the 1982 Threshold Study Report, rather than being explicitly stated. TRPA's Goals and Policies, Land Use Element, Water Quality subelement, restates the compact requirements for water quality, the state and federal standard references, and the water quality threshold standards. There are currently two water quality goals in the Goals and Policies: Goal #1 covers Lake Tahoe clarity goals; Goal #2 covers other pollutants which may affect water quality in the Tahoe Basin. The latter presumably covers the Federal, State, and local standards other than those for the water quality Lake Tahoe clarity related thresholds. Code of Ordinances, Chapter 81 lists specific discharge standards that are only referenced in 82-11, and the Goals and Policies water quality threshold statements. Code of Ordinances, Chapter 32, Section 32.3, requires TRPA to keep a list of indicators to be monitored for evaluating the attainment status of thresholds. These are referred to below as the compliance indicators, and are the main tracking for threshold attainment in the water quality threshold compliance forms.

The TRPA water quality thresholds are focused on environmental goals (similar to desired conditions) for Lake Tahoe clarity or the pollutant loading effects and pollutant loading sources. The Tahoe Regional Planning Compact defines these ETCCs as environmental standards necessary to maintain significant water quality value or public health and safety within the region. The indicators are parameters that are used to measure attainment or status of these goals, and specific standards are the particular numeric or narrative target for those indicators to indicate attainment (see Lake Tahoe standards comparison Table 3-1 in the Water Quality Appendix). TRPA has selected seven compliance indicators to track attainment for the water quality thresholds below.

3.2.1 MEASUREMENT AND MONITORING OF INDICATORS AND STANDARDS FOR POLLUTANT LOADING EFFECTS THRESHOLDS

WQ-1 Littoral Lake Tahoe

Indicator

The compliance indicator for this threshold is turbidity. Since 1991 this turbidity indicator has been measured offshore at the 25 meter contour at the following locations in littoral Lake Tahoe: 1) mouth of Upper Truckee River and Trout Creek; 2) El Dorado Beach; 3) mouth of Edgewood Creek; 4) Nevada Beach; 5) mouth of Incline Creek; 6) Burnt Cedar Beach; 7) mouth of Ward Creek; and 8) Tahoe State Recreation Area. A site was added at the mouth of Blackwood Creek in 1999.

Standard

Decrease sediment load as required to attain turbidity values not to exceed 3 nephelometric turbidity units (NTU) in littoral Lake Tahoe. In addition, turbidity shall not exceed 1 NTU in shallow waters of Lake Tahoe not directly influenced by stream discharges.

WQ-2 Pelagic Lake Tahoe, deep water clarity

Indicator

Winter average Secchi depth measured at the Lake Tahoe Index Station, in meters is the compliance indicator for this threshold.

Standard

TRPA: Average Secchi depth, December – March, shall not be less than 33.4 meters.

WQ-3 Pelagic Lake Tahoe, phytoplankton primary productivity

Indicator

Phytoplankton primary productivity (PPr) is the compliance indicator for this threshold, annual average, measured at the Lake Tahoe Index Station (gC/m²/yr).

Standard

TRPA: Annual mean PPr shall not exceed 52 gmC/m²/.

3.2.2 MEASUREMENT AND MONITORING OF INDICATORS AND STANDARDS FOR POLLUTANT LOADING SOURCE THRESHOLDS

WQ-4 Tributaries

Indicators

Compliance indicators have been interpreted to include annual average concentrations per California total nutrient constituent and Nevada soluble Lake Tahoe nutrient standards for nitrogen, phosphorus, and iron, and 60 mg/l at 90th percentile for suspended sediment (Tables 3-2 and 3-3 in the Water Quality Appendix).

Standards

TRPA threshold numeric standard: Attain applicable state standards for concentrations of dissolved inorganic Nitrogen (DIN), dissolved phosphorous (DP), and dissolved iron. Attain a 90th percentile value for suspended sediment concentration of 60 mg/L. Interpreted state standards: California: total nitrogen (0.15-0.22 mg/l), total phosphorus (0.010-0.030 mg/l), and total iron (0.015-0.03 mg/l), (annual average.); Nevada: Lake Tahoe standards for soluble phosphorus not to exceed 0.007 mg/l (annual average.); soluble inorganic nitrogen not to exceed 0.025 mg/l (annual average.).

WQ-5 Stormwater runoff, surface water

Indicators

Compliance indicators include DIN, DP and iron, grease and oil and suspended sediment for TRPA surface water discharge standards (Table 3-2 in the Water Quality Appendix).

Standards

Achieve 90th percentile concentration value for DIN of 0.5 mg/L, for DP of 0.1 mg/L, and for dissolved iron of 0.5 mg/L in surface runoff directly discharged to a surface

water body in the Basin. Achieve 90th percentile concentration value for suspended sediment of 250 mg/L.

WQ-6 Stormwater runoff, land infiltration to protect groundwater

Indicators

The compliance indicators are total nitrogen, phosphorus, and iron; along with turbidity, grease and oil. TRPA discharge standards for infiltration to protect groundwater, take into consideration the filtering effect of the soil profile (Table 3-2 in the Water Quality Appendix).

Standards

Surface runoff infiltration into the groundwater shall comply with the uniform Regional Runoff Quality Guidelines as set forth in Table 4-12 of the Draft Environmental Threshold Carrying Capacity Study report, May, 1982. Which reads: Waters infiltrated into soils should not contain excessive concentrations of nutrients which may not be effectively filtered out by soil vegetation. Maximum concentrations for constituents are: Total nitrogen (N) 5 mg/L, Total phosphate 1 mg/L, Iron 4 mg/L, Turbidity 200 NTU, Grease and oil 40 mg/L. Where there is a direct and immediate hydraulic connection between ground and surface waters, discharges to groundwater shall meet the guidelines for surface discharges, and the Uniform Regional Runoff Quality Guidelines shall be amended accordingly.

3.2.3 MEASUREMENT AND MONITORING OF INDICATORS AND STANDARDS FOR NON-LAKE TAHOE CLARITY OR ENVIRONMENTAL HEALTH THRESHOLD

WQ-7 Other lakes

Indicators

Compliance indicators include water quality parameters and standards established by California and Nevada. Since the water quality of other lakes of the Region affect the general water quality of the Lake Tahoe Basin, rather than Lake Tahoe's clarity directly, standards for 'Other Lakes' have been established mainly for Fallen Leaf Lake (Table 3-2 in the Water Quality Appendix).

Standards

Attain existing water quality standards.

All of the Lake Tahoe Clarity water quality thresholds include numerical standards, most of which were established by review of monitoring data during the 1967 – 1971 period in comparison with similar data from the 1977 – 1981 period. These standards are based on the assumption that Lake Tahoe conditions during this earlier time period are the end-goal, and that they should be attainable through implementation of compliance measures. In addition to these standards, specific indicator units introduced above, and interim targets have also been established.

3.2.4 ADDITIONAL FACTORS TRACKED FOR WATER QUALITY THRESHOLDS

WQ-2A Degree of EIP implementation for erosion and runoff control

Indicators

For each local unit of government, Caltrans, NDOT, and the US Forest Service: 1) total expenditures on WQEIP projects, including operations and maintenance; 2) miles of road shoulder treated with runoff and erosion control practices; and 3) area of public right-of-way treated with erosion and runoff control practices (acres). Interim targets are set annually for new development allocations linkage, and every five years.

WQ-2B Degree of BMP retrofit compliance for past development

Indicators

For local jurisdictions, El Dorado, Placer, Douglas, and Washoe Counties, the City of South Lake Tahoe: 1) BMPs in place on a developed parcel basis; 2) revegetation of areas disturbed as of July 1, 1989. Interim targets are set for site evaluations and BMP implementation on an annual basis for development allocations, and every five years for the threshold evaluation.

3.3 THRESHOLD STATUS

The contribution of compliance measures to threshold attainment and the achievement of interim targets are summarized in the Compliance Forms (for this 5 year review) at the end of this chapter, and the water quality Appendix. Table 3-4 in the Water Quality Appendix lists an evaluation of the effectiveness of these compliance measures for reaching water quality and soil conservation threshold attainment. Proposed threshold changes are discussed in the Introduction to this threshold evaluation, and in particular Figure 1.7 and Table 1.1.

3.3.1 WQ-1 LITTORAL LAKE TAHOE – TURBIDITY

Status of Indicators

Attainment

Turbidity Threshold is in attainment based on traditional 25 meter depth contour turbidity monitoring (9 sites), and based on the Desert Research Institute's (DRI) Nearshore Turbidity Study (Taylor *et al*, 2004) at depths as shallow as 2 meters. Turbidity was < 1 NTU in non-stream impacted areas, and < 3 NTU in stream impacted areas.

2006 Status Relative to Threshold Attainment Schedules

Threshold interim target status

Since this threshold was in attainment, no interim targets were assigned, and there was no target date.

Threshold target dates

For the purposes of this evaluation there are no recommendations, since the threshold is nominally in attainment. There is a Pathway proposal to develop a

more appropriate indicator and or standard after 2008 to more effectively represent the desired conditions for nearshore transparency (e.g. 1 NTU equates to 4 ft. transparency which is not considered to be publicly acceptable), and perhaps algal productivity goals.

3.3.2 WQ-2 PELAGIC LAKE TAHOE, DEEP WATER CLARITY

Status of Indicators

Non-Attainment

Winter Average Secchi depth threshold is in non-attainment, based on 2002-2006 data for Winter Average Secchi depth at the Index Station which averaged 23.9 meters compared to the standard of 33.4 meters. The range for winter average was from 23.9 m in 2002 to a maximum of 25.4 m for December 2003 through March 2004. The annual average Secchi depth transparency of Lake Tahoe for the calendar year 2006 was 20.6 meters. The California Standard annual average Secchi depth for the 1967-71 periods was 29.7 meters (Fig. 1, and Table 3-1 in Water Quality appendix).

Status of Additional Factors

WQ-2A Degree of EIP implementation for erosion and runoff control

Status of Indicators

Water Quality EIP projects completed since 2001 have been added to the list in the Cumulative Accounts, Section III. Table of Erosion & Runoff Control Projects Constructed Since 1988.

The table of Erosion Control Projects, and added water quality EIP projects is in the Cumulative Accounts section in Appendix B. The interim target set in 2001 is very difficult to interpret as “no less than 50% WQ EIP implementation for each jurisdiction for the next evaluation period”. The 2006 EIP Accomplishments Report is in draft stage, and at this time does not have reports for Caltrans and the City of South Lake Tahoe. None of what are referred to in the EIP as measures of performance (MOPS) have been reported at this point.

WQ-2B Degree of BMP retrofit compliance for past development

Status of Indicators

BMP retrofit of previously developed parcels appears to be behind schedule, Douglas County BMP certificates suggest that attainment is ahead of schedule for the target from 2001, and the only other jurisdiction that is close to the target for the target date at the end of 2006 is Washoe County.

One of the problems with BMP retrofit of past development is the large number of properties, and the relatively small number of staff of Partners in Conservation to carry out site inspections before and after BMPs are installed (Tahoe Resource Conservation District, Nevada Tahoe Conservation District, NRCS, TRPA, and UNR Extension). It appears from comparison of inspections with certificates that Douglas County interim targets have been met, Washoe County targets are close to being met by the end of December 2006, but the California jurisdiction targets are woefully below the mark. Perhaps this is due to too much focus on past due priority 1 watershed properties for implementation when they are in violation. This

uses resources that would be more beneficial if applied to priority 2 and 3 watersheds if violation enforcement was in place at least as a demonstration.

2006 Status Relative to Threshold Attainment Schedules

Threshold interim target status

The winter average Secchi depth interim target of 24.0 meters was met only in 2004 (Dec. 2003 – March 2004), and the annual average Secchi depth interim target of 23.0 meters was met and exceeded for 2002 (23.78 meters). No target date has been set for threshold attainment.

Threshold target dates

Any interim targets need to be tied to the output of the clarity model for Lake Tahoe, which are not fully complete at this time. A few of the load reduction scenarios that have been run through the clarity model suggest that the Secchi depth standard could be met within twenty years with a combination of load reduction strategies. However, there is significant inter-annual variability in Secchi depth readings as a consequence of meteorology and there amount of precipitation and therefore runoff (3 meters), and therefore, interim targets and target dates for attainment estimated without the benefit of the clarity model predictions based on a variety of scenarios would not be meaningful. The setting of an interim target would have to take into account the load reduction potential of EIP projects being completed during that evaluation period. Phase 2 of the Lake Tahoe TMDL is focused on development of pollutant load reduction targets, which can be modeled to provide a basis for prediction of and setting interim targets for Secchi depth. If such targets are not met, then a well-defined adaptive management must respond to increase pollutant load reductions.

3.3.3 WQ-3 PELAGIC LAKE TAHOE, PHYTOPLANKTON PRIMARY PRODUCTIVITY

Status of Indicators

Non-Attainment

Annual mean Phytoplankton primary productivity (PPr) threshold is in non-attainment as of 2006 based on PPr of 205.5 gmC/m²/yr for 2006; this is nearly four times the standard of 52 gmC/m²/yr (Table 3-6 in Water Quality Appendix).

2006 Status Relative to Threshold Attainment Schedules

Threshold interim target status

The interim target for PPr was not met during the evaluation period. PPr had decreased between 2001 and 2002 (193.9 down to 177.0 g C/m²/yr), however PPr increased again for 2003 through 2006. Since the late 1960's the population dominance in Lake Tahoe has shifted from larger, non-motile species of phytoplankton to smaller motile (flagellated) species. There is a question on the attainability of this threshold that remains to be addressed. There is no positive trend for reduction for PPr, therefore no basis for setting an interim target towards threshold attainment. No target date has been set for threshold attainment.

Threshold target dates

The chlorophyll concentration profiles in Lake Tahoe are a direct measure of the light absorption reduction of transparency, and are more directly linked to the clarity model than PPr, which is based on a bioassay used to determine nutrient limitations to algal productivity. It appears that a significant reduction in nutrient availability would have to occur prior to any reduction in PPr. There has not been a decreasing trend in PPr since 2002, and it is not possible to suggest a target date for PPr standard attainment, in fact attainment may not be possible. This issue warrants further discussion with researchers to determine any inherent value in retaining PPr as a threshold standard.

3.3.4 WQ-4 TRIBUTARIES

Status of Indicators

Non-Attainment

Annual mean nutrient concentration thresholds for tributary streams were generally in non-attainment based on Water Year Lake Tahoe Interagency Monitoring Program (LTIMP) 2001-2006 data for ten tributary streams (Table 3-7 in Water Quality Appendix). Most if not all ten tributaries had appeared to be in attainment for suspended sediment concentration based on monthlies through 2005 water year, except for exceedance of the concentration standard in May and June of 2005 for Blackwood, Ward, and Incline Creeks representing more than 10% of the monthlies for 2005. Thus the SSC concentration 90%tile standard was not met. None of the California streams are in attainment for total N or total P. On the Nevada side, previous Threshold Evaluations have interpreted Lake Tahoe standards for soluble phosphorus and soluble or dissolved inorganic nitrogen as being applicable to tributary streams. Only Logan House Creek consistently meets the previously interpreted Lake Tahoe soluble reactive phosphorus and soluble inorganic nitrogen standards (except for nitrogen in 2001). There do not appear to be Lake Clarity related standards in place for soluble phosphorus and soluble or dissolved inorganic nitrogen on Nevada tributaries in the Tahoe Basin. There are total phosphates and total nitrogen standards for these Nevada streams which are considerably higher than California tributary standards (up to three times California total P standards, and up to twice or in one case six times greater than California total N standards, Table 3-3 in the Water Quality Appendix). Nevada streams are in attainment for the higher total phosphates and total nitrogen standards. Since tributary iron standards are considered to be too low for the iron background in Lake Tahoe watersheds, and iron concentrations have consistently exceeded the existing standards, the iron analysis was dropped from the LTIMP stream sample analysis in 2002 due to budget constraints.

2006 Status Relative to Threshold Attainment Schedules

Threshold interim target status

The interim target for tributary annual average concentrations of N, P, and attainment of the suspended sediment concentration 90%tile standard was set for the target date of the Regional Plan Update for 2007, but is not likely to be met. The Regional Plan Update Target date is now fall of 2008. The target for setting uniform standards between the two states and TRPA for the above parameters will have to wait until after 2008, the anticipated completion of the Final TMDL for Lake

Tahoe. There is no basis for setting interim targets for tributary stream nutrient and sediment concentration standards at this time.

Threshold target dates

The load reduction targets from the TMDL, and target load reductions from tributary loading should become the focus for this threshold over time. Stream channel erosion is a major source of fine particulate especially in some tributaries, such as the Upper Truckee River. There have been suggestions that the nutrient concentration standards are in some cases not attainable even in the upper portions of watersheds with little or no development and long recovery time from historic disturbance. There is no substantial concentration trend for constituents on which to base a target date for threshold attainment. There is a concern that tributary water quality may suffer if the concentration standards are dropped as a threshold. However, to the extent that state standards for tributaries are focused on protecting the water quality of those streams *per se* those state standards will remain in place independent of water quality thresholds. Several tributaries in both states are listed as impaired water bodies, and will be the subject of TMDLs focused on the individual streams.

3.3.5 WQ-5 STORMWATER RUNOFF, SURFACE WATER

Status of Indicators

Non-Attainment

The status for this threshold standard is non-attainment, based on a 2005 TMDL Stormwater BMP Evaluation and Feasibility Study (Strecker and Howell, 2005). It is not possible to evaluate trends due to lack of sufficient data, but the finding of non-attainment is based on some sites not meeting discharge standards. As in the 2001 Threshold Evaluation the data available for this report showed that there was > 50% attainment of TRPA's total suspended sediment (or suspended sediment concentration), soluble phosphorus, and all reported samples from BMP discharges met the soluble nitrogen standard. The most comprehensive collection of this stormwater data has been associated with the TMDL development and TRPA has only had access to some of the more recent data at this time.

2006 Status Relative to Threshold Attainment Schedules

Threshold interim target status

TRPA has targeted source control and runoff treatment to meet phosphorus and fine sediment discharge standards by encouraging and permitting pilot basin and active treatment sites particularly for Caltrans (Airport basin on Highway 50, and Brockway Summit SR 267). No specific target date has been set for meeting surface water discharge standards, and the TMDL will focus on pollutant load reductions rather than meeting concentration standards. There is no trend in the available data to provide the basis for setting interim targets for meeting stormwater discharge standards.

Threshold target dates

This stormwater discharge thresholds needs to shift to pollutant load reductions based on the TMDL, and load reduction targets for stormwater for fine sediment,

nitrogen and phosphorus. No target date for attainment can be reasonably set under these circumstances.

3.3.6 WQ-6 STORMWATER RUNOFF, LAND INFILTRATION TO PROTECT GROUND WATER

Status of Indicators

Non-Attainment

The status for this threshold standard is non-attainment, based on a 2005 TMDL Stormwater BMP Evaluation and Feasibility Study (Strecker and Howell, 2005). The data for untreated stormwater runoff samples indicate the majority of samples would meet groundwater (or land treatment) infiltration standards. There is no realistic evaluation of trends due to lack of sufficient data. The most comprehensive collection of such data has been associated with the TMDL development and some of the more recent data has not been provided to TRPA.

2006 Status Relative to Threshold Attainment Schedules

Threshold interim target status

Source control and runoff treatment have been targeted at reducing loads of phosphorus and nitrogen to groundwater. The Improved Fertilizer Management Plan amendments completed in December 2002 have discouraged the use of phosphorus fertilizer unless there is a demonstrated need from soil P-availability tests. Limited groundwater studies in association with infiltration basin have not demonstrated an impact of phosphorus infiltration on groundwater. There is no trend in the available data to provide the basis for setting interim targets for meeting stormwater discharge standards.

Threshold target dates

The stormwater discharge thresholds needs to shift to pollutant load reductions based on the TMDL, and load reduction targets for stormwater for fine sediment, nitrogen and phosphorus. No target date for attainment can be reasonably set under these circumstances; at least until load reduction targets can be set from the TMDL process.

3.3.7 WQ-7 OTHER LAKES THRESHOLD

Status of Indicators

Non-Attainment

The other Lakes Threshold is in non-attainment for Fallen Leaf Lake, due to Secchi depth and other indicators not meeting California standards. The four additional lakes monitored in 2002 and 2003 do not appear to have had significant change in their water quality in comparison to the monitoring from the early 1990's (Lico, 2004a). Since these four lakes do not have specific objectives, the basis for the evaluation of their condition is the degree of change from any established baseline monitoring.

2006 Status Relative to Threshold Attainment Schedules

Threshold interim target status

As part of the Pathway 2007 Indicator and Standard development, it has been determined that the Outstanding National Resource Water designation does not apply to other lakes in the Tahoe Basin. Monitoring by USGS of the five largest other lakes in 2002 and 2003 determined that tributary standards are not appropriate for evaluating the water quality condition of these other lakes as was suggested in an earlier evaluation as an interim target. The other lakes are all ecologically different from each other, and it appears that there is no single or adequately documented set of indicators that can be recommended indicators for these other lakes, nor is there sufficient data to recommend standards.

Threshold target dates

Previously established interim targets for Fallen Leaf Lake are unrealistic, since there is insufficient data to establish a trend line for any or all of the indicators with standards for that lake. The frequency of the data at Fallen Leaf is such that it is difficult to establish a trend even for Secchi depth, which is consistently below the California standard. The proposal from the Pathway process is to use Indexes of Biological Integrity to evaluate the water quality – environmental health conditions of the other lakes in the Tahoe Basin. Any significant focus on these other lakes is dependent on desired conditions and the social willingness to support these goals.

3.4 EIP IMPLEMENTATION STATUS

3.4.1 COMPLETED EIP PROJECTS AND CONTRIBUTION TO THRESHOLDS

The EIP project implementation and units of benefit process is not complete, and has been identified as a task for the 2007 EIP update. The units are now referred to as Measures of Progress and Accomplishment Units depending on the level of detail and ties to either programmatic goals or management approaches. There is an ongoing effort to increase the frequency and efficiency of roadway sweeping and other BMP maintenance to reduce the impacts of fine sediment. An LTIMP subcommittee is working with state transportation departments and local jurisdiction maintenance on an alternative deicer and road sand abrasive monitoring program. The sewer exfiltration, reduction, and infrastructure operation and maintenance feasibility study was completed under U.S. Army Corps funded Tahoe Framework study in association with the Tahoe TMDL development (2003a, EIP #638). The urban runoff characterization studies and coordinated monitoring are underway as part of the TMDL development process. Additional funding has been requested to continue this type of storm water monitoring (EIP #628, 10110, and 10111). TRPA and USGS have completed a two-year Other Lakes threshold standard study (including discharge tributary sampling) (USGS 2004: EIP # 10117). The EIP operations and maintenance program has not been developed, largely due to the lack of establishment of a local revenue source to fund operation and maintenance (EIP # 430, and program). BMP pilot projects and other research are underway with a focus on removal of bioavailable phosphorus and fine sediment from stormwater runoff (EIP # 10107, 10108). See the concurrent EIP Update process for a full discussion of the process including who or what agencies and entities are involved, technical approaches to project

implementation, tools and techniques that will link completion of EIP projects to pollutant load reduction (such as the EIP Water Quality Sub-theme prototype for the Adaptive Management System), and how these projects have contributed towards threshold attainment.

Available data and watershed models being used in the Tahoe TMDL will be the basis of support for any tributary standard proposals (EIP # 626, 627, 628). LTIMP watersheds are providing the key data components for the watershed model, needed load reductions, and restoration goals for these watersheds. Statistical analysis carried out under the TMDL, as well as past LTIMP analysis, are the bases for an ongoing reevaluation of tributary sampling protocols and additional funding has been requested through Lahontan and USGS to enhance the LTIMP network. Several of the tributary streams in both states have been listed on the 303(d) list, requiring future TMDL development on those streams.

Table 3-1: Status of EIP Projects from 2001 - 2006 Threshold Evaluation

EIP Number	Title	Project Description	Status
24	Ward Creek SEZ Restoration	USFS and CTC will restore naturally functioning SEZ, stabilize stream channel, and control gullies which provides water quality, scenic, and wildlife benefits.	Partially complete.
27	Blackwood Creek SEZ/Fishery Restoration	The USFS will restore naturally functioning SEZ and stream channel which provides water quality, scenic and wildlife benefits. Approximately 45 acres.	Partially complete.
250	Edgewood Creek Restoration	Restore Edgewood Creek through National Forest lands.	Edgewood Watershed Assessment completed 2004.

EIP Number	Title	Project Description	Status
427	Clarity Model Research	In cooperation with other research agencies, develop a clarity model for Lake Tahoe which links management practices to lake clarity. EPA has provided funding to TERC to complete the foundation for this model, which includes three linked sub-models intended to predict clarity responses to fine sediment, nitrogen and phosphorus loads.	Much of this work is completed under TMDL development. Numerous runs needed to model load reduction and climate scenarios.
429	Amend WQ-1 and WQ-4 Indicator Units	Amend compliance form indicator units for WQ-1 (turbidity monitoring), and WQ-4 (tributary monitoring). Precursor tasks include completion of a Turbidity Data Analysis (started April, 2000), and the LTIMP Data Analysis (started July, 1999). (See 626 for Stream Monitoring)	In progress, will modify for WQ-1 on nearshore clarity only.
430	BMP / WQ Maintenance Program for Large Projects	TRPA staff will assist owners of large water quality facilities to develop maintenance programs with funding options. This program is intended for large projects and not single family residences. This project may serve as a pilot program for the larger project maintenance.	Inactive due to lack of funding for project.
431	Dissolved Oxygen as a Water Quality Indicator	Develop a bioassessment program for selected stream tributaries as a threshold indicator of stream integrity. Annual assessments can be used to monitor improvements from restoration projects or as to establish reference conditions for degradation of the aquatic ecology.	Involved with development of an index of biological integrity (IBI) under Fisheries Resource. Would only apply to relatively disturbed water bodies.

EIP Number	Title	Project Description	Status
560	Upper Truckee – Cove East SEZ Restoration	CTC will restore the mouth of the upper Truckee River and floodplain adjacent to the Tahoe Keys from Hwy 50 to the Lake. Will possibly include the mouth of Trout Creek. CTC has broken this project into two phases: 560.1 (Cove East/ Lower West Side) and 560.2 (Upper Truckee – Barton Meadows Restoration)	Lower West Side, original Cove East is complete. Acquisition of Barton Meadow by CTC complete. Planning and Environmental Analysis underway for this restoration.
562	Third Creek – Lower Reach SEZ Restoration	From SR 28 to Lakeshore Blvd the creek needs to be brought out of its incised channel and the floodplain restored where possible.	Geomorphic analysis and design completed under US Army Corps 206 program.
626	Refine Tributary Monitoring Program	TRPA, in consultation with LTIMP, shall refine the current tributary monitoring program to evaluate the effectiveness of each station and to consider adding elements to the program. A critical study to be completed as part of this decision making process.	Ongoing. AMS monitoring, and TMDL load reduction monitoring are likely to lead to modifications of this monitoring program.
627	Clarity Model Research	In cooperation with other research agencies, develop a clarity model for Lake Tahoe which links management practices to lake clarity. EPA has provided funding to TERC to complete the foundation for this model, which includes three linked sub-models intended to predict Lake Tahoe clarity response to fine sediment, N and P loads.	Ongoing as part of the Lake Tahoe TMDL development.

EIP Number	Title	Project Description	Status
628	Urban Runoff Model	Develop an urban runoff model to quantify impacts of urban runoff for intervening zones, estimating phosphorus and sediment transport and to facilitate prioritization of future projects. First phases to this program include completion of wetland efficiency study under EIP # 10071, and the Intervening Area Study completed by UCD 2002.	Ongoing under TMDL research, and watershed model.
629	208 Plan Update	The 208 Plan will be updated which incorporates several amendments crossing over several thresholds. It also includes updates to project descriptions which will update the EIP. The update needs to coordinate with USFS Watershed Assessment and Forest Plan Update, and TMDL.	Inactive, pending 2007 TRPA scoping and Final TMDL Implementation Plan, which may obviate the need for an Updated 208 Plan.
630	Upper Truckee Focused Watershed Group	The Upper Truckee Focused Watershed Group coordinates agency activities occurring or planned in the watershed. A major objective is to complete a Watershed Plan with assistance from the US Army Corps of Engineers. Knowledge gained from this group will be important for restoration of the Upper Truckee River Watershed.	Ongoing. Bureau of Reclamation is funding some portion of the restoration studies and effort.

EIP Number	Title	Project Description	Status
638	Shorezone Sewer Line Replacement/Relocation	Sewer line replacement and/or relocation is necessary to reduce the threat of water quality impacts due to natural shoreline erosion and beach recession. A risk assessment made to determine solution and cost for the areas near shore and SEZ. Assessment report was completed by U.S. Army Corps in 2003.	Ongoing, Portions of the defined priority replacement / relocation project are now being funded with Federal monies made available through the Southern Nevada Public Lands Management Act (SNPLMA).
661	Focused Research on Impacts of Motorized Watercraft	Research has related to the occurrence, concentrations, and persistence of fuels and emissions by-products associated with the use of motorized watercraft on Lake Tahoe. Substantial progress has been made related to benzene, ethylbenzene, toluene, and orthoxylene (BTEX), methyl <i>tert</i> -butyl ether MTBE, and other hydrocarbon compounds common to watercraft emissions.	Complete. The great decrease in MTBE was demonstrated post-carbureted 2 cycle engine ban, and the polycyclic aromatic hydrocarbon (PAH) study was completed in 2002.
704	Fallen Leaf Lake Area BMP	TRPA has identified conveyance and treatment needs at Fallen Leaf Lake, including re-vegetation, curbs, gutter, ret walls, and rock slope protection. Cathedral Road and Fallen Leaf Road are located within this project area.	Not completed. Start date unknown.

EIP Number	Title	Project Description	Status
948; 951	Upper Truckee River Elks Club to Airport SEZ Restoration; Geomorphic Analysis/Monitoring	Restore to SEZ 1.5 miles of road and 4 miles of trails. Restore 2 acres of disturbed SEZ and 13 acres of uplands. Stabilize 600 feet of stream bank. Total project area including former Sunset Stables, (189 acres) is about 250 acres, including portions of USFS parcel to SE.	Planning for restoration is ongoing. Geomorphic Analysis complete. Pre-project Monitoring is continuing.
954	HWY 50 from Cave Rock to Glenbrook	NDOT will install erosion control and runoff treatment improvements along the stretch of Hwy 50 from Douglas mile post 8.00 Cave Rock Tunnel, to Douglas mile post 10.00.	Under construction 2006 season, should be complete by Dec. 2006.
994	HWY 50 South Tahoe 'Y' to Stateline, Phase I	Install road runoff treatment facilities along 5 miles of Hwy 50. Project will likely be completed in phases with sidewalks, redevelopment and community plan projects. Phase I and II are estimated at \$12,000,000 each. Phase III is from Ski Run Blvd to Stateline has had several redevelopments and the Tahoe Meadows linear parkway project completed.	Most planning and design work done on Phase I from Trout Creek to Ski Run. Unknown construction start.
10071	Wetland Treatment Effectiveness	EPA and NDSL funding relating to wetland treatment efficiency currently approximated at \$300K. This project will provide data on pre-restoration conditions to evaluate future project success and information relating to the ability of SEZ to treat urban runoff.	Complete under funding mentioned, however Village Green Wetland monitoring continues under other funding and further research and monitoring is needed.

EIP Number	Title	Project Description	Status
10107	Biologically-available Phosphorus Research	Identify and quantify the biologically-available forms of phosphorus and assess fate, transport, and bio-availability issues for both Lake and streams. Use sequence stratigraphy to investigate pre-historic and historic sedimentation and Phosphorus accumulation.	Completed under TMDL research, except for stratigraphy and accumulation aspects.
10108	Fine-grained Sediment and Nutrient Research	Project will: - Quantify sources and loading rates of fine-grained sediments and nutrients discharged from Tahoe streams to Lake Tahoe. - Determine chemical constituents found in traction sand and collected sediment - Quantify fine sediment loading	Portions complete under TMDL research for first and third goals of project. Other portions ongoing.
10109	BMP Effectiveness	Project will assess the most effective methods to reduce sediments and nutrients discharged from Lake Tahoe watersheds.	Ongoing under TMDL Phase II research.
10110	Direct Loading from Urbanized and Non-urbanized Areas	Project will identify sources and quantify rates of direct loading to the Lake from urbanized and non-urbanized intervening areas.	Partially complete under former Intervening Area Study, and TMDL Watershed Model.
10111	Loading Rates from Stormwater Runoff	Characterization of urban stormwater runoff. Samples from intervening data of Lake Tahoe Basin Stormwater Studies will be statistically analyzed to determine loading rates based on land use.	Partially complete from TMDL stormwater research and monitoring, and Watershed Model loading runs.

EIP Number	Title	Project Description	Status
10117	Other Lakes Monitoring	Thorough analysis of existing data to initiate feasibility study on the need to establish water quality standards for other lakes in the Region. Determine nutrient concentrations of Upper and Lower Echo, Spooner, Fallen Leaf and Marlette Lakes and tributary streams.	Complete, 2004 USGS Report.
10118	Shoreline Erosion Study	Study to assess impacts of shoreline erosion on the shorezone and water quality of Lake Tahoe.	Complete. 2004 DRI Final Report.

3.5 THRESHOLD NEED FOR CHANGE

A major conclusion of this evaluation is that many of the water quality threshold standards, management standards and policies require extensive re-evaluations for either recalibration or amendment. These changes also relate to updating the management system itself and coordination with other agencies. It is the recommendation of this report that TRPA should pursue the amendments to the environmental threshold carrying capacities developed and recommended as part of the Pathway 2007 process. The sections below summarize the proposed amendments. As noted amendments are scheduled for action with adoption of the Regional Plan package in 2008, while others will require further development and analysis by TRPA. The proposed changes include replacing the current value statements with the statement of an all encompassing vision for water quality, and more specific desired conditions for lake clarity thresholds, and human and environmental health.

The following proposed Vision Statement and Threshold Goal / Value Statements reflect the recommended basis for changing the existing threshold standard.

Water Quality Vision: Exceptional water quality provides restored clarity, environmental and human health, and human enjoyment of Lake Tahoe waters.

Threshold Goal 1. Lake Clarity: Restore, and then maintain the waters of Lake Tahoe for the purposes of human enjoyment and preservation of its ecological status as one of the few large, deepwater, ultraoligotrophic lakes in the world with unique transparency, color and clarity.

The pollutant loading effects thresholds (WQ-1, 2, and 3) fall under this threshold goal, as well as the Lake Clarity related pollutant loading source threshold standards (WQ-4, 5, and 6).

Threshold Goal 2. Human & Environmental Health: Water quality conditions in the Lake Tahoe Basin protect human and environmental health.

The proposed threshold standards for human health, and environmental health fisheries threshold standards for an indices of biological integrity (IBIs), and the existing other lakes threshold standard (WQ-7) fall under this threshold goal.

3.5.1 WQ-1 LITTORAL LAKE TAHOE

Threshold Recommended Changes

Indicator and Standard: Continue using the existing turbidity standards, but monitor in shallower nearshore zone up to 2 meters depth, rather than the current 25 meter contour. Add a focus on a research program to recommend new indicators and or standards for nearshore clarity, and aesthetics after 2008. The management standards and other standards would likely need to reflect those changes, the TMDL load reduction approaches once they are developed, and EIP implementation.

Rationale for Change

The current turbidity and periphyton standards are not considered to be adequately descriptive of the desired conditions or sufficient for protection of nearshore transparency and aesthetics. For example, turbidity of 1 NTU equates to a transparency (~Secchi depth) of only 4 feet, which does not seem to be good enough to be publicly acceptable (Taylor *et al*, 2004). The existing periphyton standards were based on an artificial plate colonization method, which has not been used since the 1967 – 1971 period, when published articles had already described the periphyton biomass as being a nuisance (Goldman, 1967). Establishing numeric “not-to-exceed” values for turbidity and periphyton biomass will be difficult because of the high variability of the nearshore conditions. The Pathway target date for this evaluation and proposed changes is after the Regional Plan Adoption in 2008. In addition, the location of turbidity monitoring at the 25 meter contour does not reflect the experience of most visitors and residents of Lake Tahoe where the perceived problems with nearshore are observed. The DRI nearshore turbidity study (Taylor *et al*, 2004) demonstrated that even elevated turbidity in the nearshore as shallow as 2 meters depth decreased to background levels near the 25 meter contour. Thus monitoring at the 25 meter contour is insufficient to evaluate nearshore clarity conditions.

3.5.2 WQ-2 PELAGIC LAKE TAHOE, DEEP WATER CLARITY

Threshold Recommended Changes

The only need for change with respect to this threshold is for consistency with California standards of the Annual Average Secchi depth, based on the same data and timeframe of the current winter average Secchi depth standard. This would ensure continuing collection and evaluation of all seasonal and annual data and the clarity modeling function which is the basis of the TMDL. This change would go into effect with adoption of a new regional plan. Once the TMDL load reduction

targets and source allocations are developed around the time of regional plan adoption, these can serve as management targets (possible standards) in an adaptive management framework.

Rationale for Change

There is concern that continued focus on the winter average Secchi depth might suggest threshold improvement on a seasonal basis, while not taking the data for the whole year and the annual average Secchi depth into account. Additionally the Lake Tahoe Clarity Model is based on using data over the entire year and across years to provide predictions on an annual average Secchi depth basis.

3.5.3 WQ-3 PELAGIC LAKE TAHOE, PHYTOPLANKTON PRIMARY PRODUCTIVITY

Threshold Recommendation Changes

The recommendation is to update the phytoplankton primary productivity threshold although the state standards will remain in place, and refocus on the transparency threshold for Secchi depth. The TMDL load reduction management standards will include the reduction of algal nutrient (nitrogen and phosphorus) loading to Lake Tahoe, which will be projected to result in the reduction of algal productivity to reach the Secchi depth standard. However, concerns in dropping this threshold, and its value in relation to other indicators of algal water quality impacts need to be more fully discussed with researchers and experts on algal productivity before incorporation into the regional plan.

Rationale for Change

The PPr standard may not be directly related to clarity or attainable due to demonstrated shifts in the population dominance in Lake Tahoe from large non-motile phytoplankton species in the late 1960's to smaller motile (flagellated) species in more recent years (Hunter *et al*, 1990). These flagellated species can move along nutrient concentration gradients, and therefore have a higher rate of productivity. The Lake Tahoe clarity model, which is the basis of predicting transparency response to nutrient and fine sediment loading is more closely linked to concentrations gradients of chlorophyll-a as a direct measure of the light absorption reduction of transparency (Secchi depth).

3.5.4 WQ-4 TRIBUTARIES

Threshold Recommended Changes

The recommendation is to update the Lake Clarity related tributary threshold standards with uniform concentration standards following the completion of the TMDL. Load reduction management standards to be developed from the Lake Tahoe TMDL for fine sediment, nitrogen, and phosphorus will be used for programmatic management in order to focus on reaching the Lake Tahoe Clarity goal. Other water quality aspects are covered under human and environmental health threshold recommendations below and may be incorporated after further analysis by TRPA. These changes would go into effect with adoption of a new regional plan. It should be noted that in addition to being retained in the Regional Plan as standards for threshold indicators the federal and state tributary standards would remain in effect as federal and state water quality standards that TRPA is required to achieve.

Rationale for Change

There is a current disparity between TRPA's and the two state's water quality constituent standards for tributaries to Lake Tahoe. California has total nitrogen and total phosphorus standards, which do not appear to be attainable in the upper undeveloped portions of some watersheds. Nevada has Lake Tahoe soluble standards for these constituents, and total phosphates and nitrogen standards for tributaries, which are two or more times the concentrations of the California standards. Since loading management standards for tributaries will be dependent on the outcome of the TMDL load allocation process, it is likely that tributary concentration standards may be affected as well and state Lake Tahoe clarity related standards may be changed after the final TMDL (> 2008). There is also a major difference in the availability for algal growth between total and soluble loads for nitrogen and phosphorus, thus these tributary concentration standards are insufficient to attain or protect the Lake Tahoe clarity resource in the long run.

3.5.5 WQ-5 STORM WATER RUNOFF, SURFACE WATER

Threshold Proposed Changes

The recommendation is to replace the Lake Clarity related surface water discharge threshold standards with the load reduction management standards to be developed from the Lake Tahoe TMDL for fine sediment, nitrogen, and phosphorus in order to reach the Lake Tahoe Clarity goal. These changes would likely go into effect after further analysis by TRPA.. TRPA will implement the TMDL pollutant load reduction targets on a programmatic basis and still retain revised discharge standards as management standards for projects.

Rationale for Change

The current surface water discharge standards were set approximately between the constituent concentrations typical of untreated developed areas and highway runoff and that of undeveloped areas. These concentrations were assumed to be protective of Lake Tahoe clarity in that they would tend to lead to decreased nutrient and sediment loading if in attainment, but it is not known if either the existing discharge standards or management standards are sufficient to reach the Lake Tahoe Clarity goals. There is a discrepancy in that TRPA's surface discharge standards are for soluble nutrients, while Lahontan's are for total nutrients at the same concentrations. There is a large difference in immediate availability for algal growth between total and soluble nutrient concentrations. The TMDL load reduction targets based on the clarity model should provide a more suitable and perhaps attainable programmatic management standards for stormwater discharge to surface water.

3.5.6 WQ-6 STORM WATER RUNOFF, LAND INFILTRATION TO PROTECT GROUND WATER

Threshold Recommended Changes

The recommendation is to retain the Lake Clarity related groundwater infiltration or land treatment discharge threshold standards (intended to protect groundwater and thus reduce loading to Lake Tahoe) as part of the Regional Plan Update, along with the programmatic load reduction management standards for stormwater runoff and treatment to be developed from the Lake Tahoe TMDL for fine sediment, nitrogen, and phosphorus in order to reach the Lake Tahoe Clarity goal. The retention of the existing threshold standards and changes to programmatic management for pollutant load reduction would go into effect with adoption of a

new regional plan. TRPA will still retain revised discharge standards as management standards for projects.

Rationale for Change

Unlike the surface discharge standards, TRPA and Lahontan have exactly the same total nutrient and turbidity standards for what is essentially a land treatment standard. These standards assume a soil or other treatment path for nutrient and sediment removal before runoff reaches groundwater. If the removal of pollutants can not be assumed due to direct hydrologic connection, then the surface water discharge standards apply. The TMDL load reduction targets based on the clarity model should provide a more suitable and perhaps attainable management standard for stormwater treatment effectiveness. There is a need to further evaluate groundwater nutrient loading to Lake Tahoe, and the potential for sources of those nutrients to be reduced in order to reduce nutrient loading to the lake. There are also concerns that the current discharge standards do not sufficiently protect groundwater and do not lead to reduction in pollutant loading to Lake Tahoe.

3.5.7 WQ-7 NON LAKE CLARITY – OTHER LAKES, AND PROPOSED ENVIRONMENTAL HEALTH THRESHOLD

Threshold Recommended Changes

The recommendation is to move the “Other Lakes” threshold to the Human and Environmental Health Threshold Goal, and incorporate consideration of the ecological quality of these other lakes in the Lake Tahoe basin under that threshold goal described below. TRPA’s Compact requires the attainment of Federal, State, and local water quality standards, and those that are not directly related to Lake Tahoe clarity would fall under that threshold goal. The Pathway proposal for these other lakes is that their water quality be evaluated in terms of environmental health for water quality with indices of biological integrity (IBI) suitable to their individual ecology after further analysis. Some changes would go into effect with adoption of a new regional plan.

Rationale for Change

As stated in the 1982 Threshold Study Report, there was very little and likely insufficient data to establish an “other lakes” threshold standard. The statement of the threshold standard in Resolution 82-11 simply states “attain state water quality standards for these other lakes”. There still remains insufficient evidence to provide the basis for an “other lakes” threshold. Since there have only been limited and sporadic resources to even monitor a few of these other lakes as a threshold the concerns that the water quality of these other lakes may decline does not seem to be a significant deterrent to removing them from threshold status. Focused interest in the water quality of particular other lakes needs to be supported by informed self-interest of stakeholders directly involved in those lakes. This latter, approach can be carried out within the Human and Environmental Health and state standards context.

3.5.8 OTHER

Proposed Addition of a Human and Environmental Health Threshold

This threshold goal is proposed to solidify the desired condition that water quality conditions in the Lake Tahoe Basin (other than those for Lake Tahoe clarity)

protect human and environmental health. The human health aspect involves two beneficial uses in particular, drinking water supply and water contact recreation. There are two proposed indicators for this threshold: 1) A periodic Water Quality Health Conditions Report as a summary of health-based water quality information and data from Tahoe Region ground and surface water; and 2) Indices of Biological Integrity being developed for the aquatic system (lakes and streams) by the Fisheries Resource Group. The standard for the Health Conditions Report would be compliance with established federal, state, and local health-based and environmentally based (other than Lake Tahoe clarity) water quality standards, and regulations. The IBIs would be an integrated indicator, rather than a water quality indicator *per se*. The standards would be developed for specific stream segments and other water bodies, and types or classes of these in the future.

Rationale for Change

The Compact already requires TRPA to plan for attainment and maintenance of federal, state, and local water quality standards. The Compact also requires TRPA to establish threshold standards “...*necessary to maintain a significant scenic, recreational, educational, scientific or natural value of the region or to maintain public health and safety within the region*”. The current Goals and Policies, Water Quality sub-element of the Land Use element contains Goal # 2 for other pollutants. Establishing the Human and Environmental Health threshold goal will underscore the need for a periodic regional perspective to protect human health in particular along with evaluating compliance with water quality standards that focus more on environmental health of the aquatic systems in the Lake Tahoe Basin. Existing water quality Lake Tahoe clarity thresholds are not sufficient to maintain the significant values for human and environmental health on a regional basis and this additional threshold standard is required to maintain those.

3.6 RECOMMENDATIONS

3.6.1 ALL THRESHOLDS

Progress Towards Achieving Threshold

The main focus of the Water Quality Management Plan for the Lake Tahoe Region, and many other programs and regulations of the Regional Plan has been the attainment of the water quality thresholds, in particular as they relate to Lake Tahoe Clarity. The continuing focus of the Water Quality EIP projects is to attain the water quality thresholds. These projects focus on the mitigation of water quality impacts of prior developed roadways and highways, and developed parcels in the BMP retrofit program. Attainment of the Lake Tahoe Clarity related thresholds was thought to be a long-term prospect at the time of their adoption in 1982, due to the relatively long period of unmitigated impacts on the lake during the development boom of the 1960's and 1970's. The clarity of Lake Tahoe has not yet demonstrated a definite response to all efforts for threshold attainment to date, and it will take effort and patience to restore these impacts while maintaining a healthy economy. Programs like the EIP, TMDL and others involved in the Pathway process are attempting to go down this path in an organized, science-based, responsible manner.

Status of 2001 Threshold Recommendations

Since the adoption of the 2001 Threshold Evaluation in July 2002, research efforts have focused on supporting the clarity and watershed modeling efforts associated with the development of the Tahoe TMDL. In addition, there has been continued research and monitoring associated with other water quality thresholds (e.g. Other Lakes, stormwater runoff treatment effectiveness, watercraft emissions, and groundwater nutrient loading). See Appendix B of the 2001 Threshold Evaluation (TRPA, July 2002) for additional information (recommendation titles are listed chronologically by expected completion date).

All recommended TRPA Regional Plan amendments were completed by December 2002. However, the Fertilizer Management Program has not been fully implemented for large users (maintenance of one acre or more cumulative turf area, plant nurseries in particular). The delay in implementing this recommendation is due to lack of TRPA resources and poor response of large users in submitting their management plans and reporting on fertilizer use and monitoring. Further near shore turbidity studies (Phase III) were completed in March of 2004 (under the TMDL research), but no collection of continuous turbidity data from Lake intakes for trend analysis has occurred due to questions regarding the utility of these data for monitoring littoral water quality in general.

A new database for tracking BMP retrofit and compliance with priority watershed deadlines as well as an amended BMP review process and new seller disclosure requirements have been in place since 2002. The BMP enforcement program has been implemented for priority 1 watersheds and consists of dedicated TRPA staffing, notification of fines, and submission of retrofit plans for non-compliant parcel owners. Although the short-term staff position has expired, the TRPA Erosion Control Team continues to manage and implement the BMP enforcement program. TRPA's large project maintenance program has not been implemented due to lack of funding. BMP effectiveness studies are included in Phase II of the Tahoe TMDL development. Effectiveness of BMPs in load reduction for fine sediment, nitrogen, and phosphorus will be incorporated into the load reduction matrix to help inform the crediting and load allocation / project benefit aspects of TMDL implementation and the EIP update.

Water quality EIP project risk assessment priorities developed by the former Water Quality Working Group were turned over to the EIP division. Caltrans runoff treatment pilot studies, including the U.S. 50 near South Lake Tahoe Airport area project, the SR 267 – Brockway Summit media filter basins and flocculant treatment pilots, and other USFS funded research are evaluating the use of filter media and chemical treatment effectiveness for stormwater runoff treatment. The Incline Lake Corporation has not expressed interest in applying for EIP funds to retrofit the dam discharging to Third Creek to reduce the downstream impact of sudden discharges. However, there is funding in for the USFS purchase of Incline Lake and the restoration of the dam in the Round 7, Southern Nevada Public Lands Management Act grants.

TRPA cooperated with Lahontan and DRI to collect samples during and after the 2001 and 2002 July 4th fireworks shows. There was no detection of elevation in nitrate or potassium (from black powder which is still the main ingredient in fireworks). Some short- term elevations in perchlorate were detected during the

2001 fireworks. Water suppliers with lake intakes in the area were also asked to test for perchlorate and detected none. There was no indication of significant water quality impacts or the need to continue monitoring

Recommended Changes for 2006

The Lake Tahoe clarity focus has been entirely on the TMDL and pollutant load reduction targets for fine sediment, nitrogen and phosphorus since the 2001 Threshold Evaluation.

The recommendations for changes to water quality thresholds are described in section 3.5 and also included in the Draft Pathway 2007 Evaluation Report (Version 1.1, 2006) and Technical Supplement. Some of the recommended changes will be addressed in the 2008 Regional Plan Update. The specific changes to be brought forth in the update will be evaluated in an Environmental Impact Statement to be completed before public hearings and requests for Governing Board action. The Compliance Measure updates listed in this document are intended to provide new information on monitoring, interim targets and to correct previous grammatical and factual errors. Potential changes to threshold standards and indicators will be addressed in the Threshold Update portion of the EIS for the Regional Plan Update. The basic proposals include:

- Adoption of the Annual Average Secchi Depth and standard of 29.7 meters as the key assessment indicator and standard for Lake Tahoe Clarity.
- Replace reliance with current Management Standards for nitrogen, phosphorus (algal nutrients), and sediment with programmatic TMDL pollutant load reduction targets for fine particulate, nitrogen and phosphorus.
- Programmatic Load reduction targets will be assigned by 2008 to tributary streams, stormwater runoff, groundwater, and atmospheric deposition for fine sediment, nitrogen and phosphorus load reductions to meet the overall targets for Lake Tahoe clarity.
- A human and environmental health threshold goal has been proposed for water quality. A periodic Human Health Conditions Report will be the indicator used for a regional evaluation of drinking water standards, water quality for water contact recreation (pathogens), filtration avoidance for surface water intakes, and toxic spills and remediation. Existing federal and state standards apply, and no threshold standard is proposed. Environmental health for aquatic organisms will rely on wildlife and fisheries developed Indices of Biological Integrity as an indicator with associated standards sometime after this fall's proposal. Other federal and state standards for aquatic toxicity will remain in force as with the human health standards above.

Implementation of Supplemental Compliance Measures

No additional supplemental compliance measures are recommended for implementation in the interim period until adoption of the revised regional Plan.

Modifications of Deletions of Past Compliance Measures

No modifications or deletion of past compliance measure are recommended for implementation in the interim period until adoption of the revised regional Plan.

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Category: water quality**Parameter: turbidity, shallow waters of Lake Tahoe**

1. STANDARD: TRPA: Decrease sediment load as required to attain turbidity values not to exceed 3 NTU in littoral Lake Tahoe. In addition, turbidity shall not exceed 1 NTU in shallow waters of Lake Tahoe not directly influenced by stream discharges.
2. INDICATOR (UNITS): Turbidity offshore at the 25-meter depth contour at the following locations in littoral Lake Tahoe (NTU): (1) mouth of Upper Truck River and Trout Creek; (2) El Dorado Beach; (3) mouth of Edgewood Creek; (4) Nevada Beach; (5) mouth of Incline Creek; (6) Burnt Cedar Beach; (7) mouth of Ward Creek; and (8) Tahoe State Recreation area.
3. MONITORING SUMMARY: Turbidity has been measured at various times since 1965, with ranges from 0.10 to 1.60. TRPA initiated monitoring of turbidity at the above locations in the littoral zone in 1991. Desert Research Institute (DRI) began spatial and temporal study of turbidity in 2000, and comparison of TRPA samples to continuous records of water purveyors. The recommendations from the water purveyor study were not implemented due to questions on the desirability of using the intake data for representing littoral or nearshore clarity. Additional nearshore turbidity studies have been completed in shallow waters around with lake with a flow through system (Taylor et al, 2004). For more details, see the 1996 Evaluation, the 1999 Annual Water Quality Report, the 2001 Evaluation, and the Draft Pathway 2007 Evaluation Report and Technical Supplement.
4. ATTAINMENT STATUS: Attainment.
5. TARGET DATE: Not applicable.
6. EVALUATION INTERVAL: TRPA should ~~evaluate the adequacy of~~ discontinue the current 25-meter sampling depth in favor of shallower and more frequent nearshore turbidity sampling using the recent trend analysis and methods comparison ~~in progress~~ completed by the Desert Research Institute. The areas of increased turbidity show a decrease near the 25 meter contour. Recommendations for changing the turbidity standards or using light transmission including seasonal continuous monitoring will be thoroughly evaluated for indicator and standard changes during of the Regional Plan Update.
7. INTERIM TARGETS: Not applicable.
8. COMPLIANCE MEASURES: The Compliance Measures have been reworked, for a complete listing, see Appendix A.
 - a. MEASURES IN PLACE: 1-18, 48, 49, 53, 54, 57-61, 214.
 - b. EFFECTIVENESS OF MEASURES IN PLACE: See Appendix A.
 - c. SUPPLEMENTAL MEASURES: 53, 54, 57, 58, 59, 60, and 61.
9. ADEQUACY OF COMPLIANCE MEASURES: Compliance measures in place appear to be adequate to attain and maintain the threshold. Supplemental measures may be implemented in the future if necessary.

Category: water quality**Parameter: clarity, winter, pelagic Lake Tahoe**

1. STANDARD: TRPA: average Secchi depth, December-March, shall not be less than 33.4 meters. California: Secchi disk transparency shall not be decreased below levels recorded in 1967-71 based on a comparison of seasonal and annual mean values.
2. INDICATOR (UNITS): Secchi depth, winter average; at the Tahoe Research Group (TRG) index station (meters).
3. MONITORING SUMMARY: The Tahoe Research Group conducts regular monitoring of Secchi depth at the TRG index station, approximately once every ~~ten~~ 12 days, and at the mid-lake station approximately every 21 days.
4. ATTAINMENT STATUS: Non-attainment. Secchi depths have shown a gradually decreasing trend over the period of record. However, the mid-winter average shows a distinct slowing in the decreasing trend since 1988, as compared with that for 1968 to 1987. Winter average Secchi was at its worst in 1997 (20 meters), which includes the impact of the New Year's 1997 flood. Winter average Secchi depth recovered somewhat in 1998 and 1999 to 24.7 meters, and was at 23.7 meters for 2001. The winter average Secchi depths for 2002 – 2004 were 23.9, 21.62, and 25.38 meters, respectively.
5. TARGET DATE: ~~After~~ Likely after 2020 2026, pending output from the clarity model included in the TMDL for fine particulate, nitrogen and phosphorus.
6. EVALUATION INTERVAL: Annual December – March.
7. INTERIM TARGETS: Annual average Secchi depth at the TRG index station was not to shall not be less than 22.7 meters in WY 2000. This interim target was not met by the winter average for 1998, 1999, and 2001. A target for the next evaluation period is 24.0 m, winter average, and 23.0_m for the annual average (Also see WQ-2-A and WQ-2-B compliance forms for additional mitigation interim targets for this threshold

indicator). The interim target of 24 meters was met in 2002 and 2004, and the annual average interim target was only met in 2002. Since nearly all the winter and annual average Secchi depths have varied by the inter-annual variation of 3 meters (controlled by runoff volume), the clarity model output is required to suggest a reasonable interim target for the next evaluation period. The interim target shall be 26 meters + or – 3 meters.

8. COMPLIANCE MEASURES: Compliance Measures ~~been~~ were reworked for the 2001 Evaluation, for a complete listing see Appendix A.
 - a. MEASURES IN PLACE: 1-20, 26-30, 43-46, 56-59,78-81, 93,129, 214.
 - b. EFFECTIVENESS OF MEASURES IN PLACE: The compliance measures in place include the main water quality compliance measures of the Regional Plan. The implementation of the EIP and the increased pace of water quality projects should accelerate improvement in this threshold. See Appendix A for details.
 - c. SUPPLEMENTAL MEASURES: It is unknown if any of the Supplemental Compliance Measures would add significantly to attainment.
9. ADEQUACY OF COMPLIANCE MEASURES: Compliance measures in-place contributed to ~~an~~ unknown degree to the attainment of the interim performance target. However, Lake Tahoe remains in non-attainment of the underlying threshold, and will not be in attainment for many years.

Category: water quality

Parameter: clarity, winter, pelagic Lake Tahoe

1. STANDARD: TRPA: average Secchi depth, December-March, shall not be less than 33.4 meters. California: Secchi disk transparency shall not be decreased below levels recorded in 1967-71 based on a comparison of seasonal and annual mean values.
2. INDICATOR (UNITS): As a related factor, progress on the Capital Improvements Program for Erosion and Runoff Control (now Water Quality EIP, WQEIP). For each local unit of government, Caltrans, NDOT, and the U.S. Forest Service: (1) total expenditures on WQEIP projects, including operations and maintenance; (2) miles of road shoulder treated with erosion and runoff control practices; and (3) area of public right-of-way treated with erosion and runoff control practices (acres).
3. MONITORING SUMMARY: TRPA monitors implementation of the GIP WQ EIP through project planning, funding, design, permitting, inspection, and coordination; and will now request ~~units-of-benefit~~ MOPs data on miles and acres of treatment applied to projects. The completion of the EIP update will allow this information to be linked to the GIS database to provide a tracking /reporting system for project benefits. The figures below will adjust with an update of ~~the 208 Plan~~ and development of the Environmental Improvement Program and finance plan.
4. ATTAINMENT STATUS:
Non-attainment for 2001, although five out of eight jurisdictions have met target expenditures, see Table 5 in the 2001 water quality appendix for details. Caltrans has recently finished a master plan for project implementation. The USFS erosion controls grants are distributed through the counties, and it is difficult to extract only the water quality projects. The soil conservation threshold does not track project expenditures outside of SEZ, so the USFS projects related to water quality are included here. The interim target ~~should-be~~ was revised to reflect the completion of the EIP update and associated database for tracking of ~~benefit-units~~ Measures of Performance (MOPs). New interim target ~~will-focus-on specific-units-for-WQ-2A thru F, (see Section VI table-of-Benefit-Units).~~ was focused on completion of MOPs representing prior indicators except for total expenditures. Attainment status for 2006 cannot be evaluated, since there were no specific target set, although the MOPs are being tracked in EIP Accomplishment reporting.
5. INTERIM TARGET DATE: For indicator (1), by December 31, ~~2006~~ 2011 is difficult to set due to other program elements incorporated into Water Quality Threshold EIP projects. Although EIP implementation is expected to accelerate project the pace of project completion, there are gaps in project funding and breakout of project elements for water quality benefit *per se*. Project applications will include the ~~units-of-benefit~~ measures of performance identified for EIP, and will be evaluated on a yearly basis as part of the water quality scores update process. There will be no less than 50% WQ EIP implementation in each jurisdiction for the next evaluation period. It is difficult to interpret this 50% target, since it includes all project phases. Based on EIP compliance for allocations for the five IPES related jurisdictions (40% of EIP targets) only Douglas County appears to not have met the above target. It appears that NDOT and the USFS may have exceeded the target above, but not Caltrans.
6. EVALUATION INTERVAL: Annual, in conjunction with IPES and water quality scores update. ~~By 2002, a~~ Additional tracking will be formulated to address-is included in the EIP Accomplishment for those projects not tied to IPES scoring, specifically, CALTRANS, NDOT, and the USFS.
7. EFFECTIVENESS OF MEASURES: The tracking of expenditures on projects ~~does~~ did not provide sufficient information related to the ~~units-of~~ water quality benefits per project completion. The addition and expansion of WQ-2 for ~~such-units~~ MOPs, and the inclusion to the EIP database ~~will~~ provides a better measure of the performance, and the future accomplishment units on effectiveness for this element to the threshold. The focus will change with the completion of the TMDL to

[accomplishment units based on pollutant
load reduction targets.](#)

Category: water quality**Parameter: clarity, winter, pelagic Lake Tahoe**

1. STANDARD: TRPA: average Secchi depth, December-March, shall not be less than 33.4 meters. California: Secchi disk transparency shall not be decreased below levels recorded in 1967-71 based on a comparison of seasonal and annual mean values.
2. INDICATOR (UNITS): As a related factor, progress on implementation of Best Management Practices (BMPs). Based on a stratified random survey of residential, commercial, public service, and recreation properties, the percentage of properties with: (1) BMPs in place in accordance with the Handbook of Best Management Practices, and (2) revegetation of areas disturbed (e.g., denuded or compacted without structures) as of July 1, 1989.
3. MONITORING SUMMARY: Previous surveys were conducted in 1989, 1990, 1993, 1995, and 1999. TRPA has redesigned the tracking system for implementation of BMPs to using statistical data generated through the Erosion Control Team. Data in excel sheets are linked to the TEGIS system and parcel and other databases for region wide retrofit status.
4. ATTAINMENT STATUS: 2006 Non-Attainment using statistical data indicates 25% BMP Installation in El Dorado and Placer counties, 65% for Washoe, and 20% in Douglas County. Basin wide BMP implementation is 30%. It appears from the BMP database that the 2006 target has not been met in any jurisdiction, and that Washoe County certificates since December 31, 2001 will be closest to meeting the target. The targets are not close to being met in the other jurisdictions.
5. INTERIM TARGET DATE: The interim target from the 1996 Evaluation had set a goal of 35% revegetation of disturbed areas and 40% for developed properties. Continued tracking should provide additional data to be reviewed yearly, and complied with water quality scores update in January- of each year. ~~---~~ By December 31, 2006 projected for 80% of developed parcels in priority 1 and priority 2 watersheds that need site

evaluations and potentially BMP implementation (based on known developed parcels, security returns, and known BMP implementation): 1) BMP site evaluations / implementation targets are as follows: Douglas County 156 parcels; Washoe County 2694 parcels; Placer County 2796 parcels; City of South Lake Tahoe 7679 parcels; and El Dorado County 4291 parcels; 2) Revegetation of disturbed areas has not been tracked, but is a component of each BMP retrofit assessment/implementation, erosion control CIP, and restoration project. Thus the target for revegetation will be set the same as for implementation of BMPs. Since there have been no enforcement fines for non-implementation of BMPs to date, it is difficult to determine if this has been the reason that progress in BMP implementation is slower than anticipated. Extra effort with the priority 1 watersheds is likely to have reduced the focus of BMP retrofit efforts in priority 2 and 3 watersheds. BMP implementation targets after December 31, 2006 are as follows: Violation enforcement only in priority 1 and later priority 2 watersheds; fee for service site inspections / implementation targets for priority 2 and 3 watersheds. Jurisdiction targets for priority 2 and 3 watersheds BMP targets for the next five years California based on grant projections are: 5000 single family residential, 500 multi-family parcels, and 250 commercial properties. There are no specific targets for Nevada at this time. are: Douglas County ...

6. EVALUATION INTERVAL: Annual
7. EFFECTIVENESS OF MEASURES IN PLACE: The BMP Retrofit Program has greatly accelerated the pace of BMP installations, in some areas of the basin, and in non point source pollution prevention through increased community involvement and awareness of runoff to on the ground water quality improvements. If the interim targets above can be implemented and met, the program will demonstrate a needed gain in effectiveness.

Category: water quality**Parameter: phytoplankton primary productivity (PPR), pelagic Lake Tahoe.**

1. STANDARD: TRPA: annual mean phytoplankton primary productivity shall not exceed 52 gC/m²/yr. California: algal productivity shall not be increased beyond levels recorded in 1967-1971, based on a statistical comparison of seasonal and annual mean values.
2. INDICATOR (UNITS): Phytoplankton primary productivity, annual average, measured at the [Tahoe Research Group \(TRG\)](#) index station (gC/m²/yr).
3. MONITORING SUMMARY: The Tahoe Research Group conducts regular [bioassay](#) monitoring of ~~PPR~~ PPr at the index station approximately every [twelve](#) days.
4. ATTAINMENT STATUS: Non-attainment. ~~PPR~~ PPr at the index station has been steadily increasing over the period of record. Attainment will be difficult due to the complexity of lake chemistry, and the slow response time of the Lake. [There has been a change in phytoplankton population dominance in Lake Tahoe from larger non-motile cells to smaller motile cells that can move along nutrient concentration gradients. This threshold does not appear to be attainable under the circumstances, without a significant reduction in nutrient availability in Lake Tahoe. No target date has been should be set at this time for threshold attainment. If clarity model load reduction targets can be met, then there is a possibility that the model can predict a target date for Secchi depth, which would have to include decreased PPr.](#)
5. TARGET DATE: ~~Likely A after 2024~~ There is no basis for prediction of a PPr attainment date, if attainment is possible. [Secchi depth and the Clarity Model predictions are based on the interaction of light absorption by phytoplankton and light scattering from fine particles.](#)
6. EVALUATION INTERVAL: Annual
7. INTERIM TARGETS: Pending completion of a water clarity model for Lake Tahoe,

currently the subject of research and development, a realistic, measurable interim goal is a reduction in the rate of increase in pelagic zone primary productivity, based on diminishing nutrient loads from tributary streams, groundwater, and atmospheric sources.

The proposed interim target ~~is~~ [was](#) 170 gm C/m²/yr. This is a more realistic and achievable target until the completion of the clarity model. This target was met in 1994-1997. [The interim target was not met during the most recent evaluation period \(2002 – 2005\). Phytoplankton primary productivity is approximately four times the standard based on the 1967-1971 annual average.](#)

8. COMPLIANCE MEASURES: The compliance measures ~~have been were~~ reworked [in 2001](#), for a complete listing see [Table 3](#), ~~in 2004~~ [Appendix A](#).
 - a. MEASURES IN PLACE: Same as WQ-2 with: 48 and 49.
 - b. EFFECTIVENESS OF MEASURES IN PLACE: The compliance measures in place include the main water quality compliance measures of the Regional Plan. Algal productivity exceeded the short-term forecast line every year since 1984.
 - c. [SUMPLEMENTAL MEASURES:](#)
9. ADEQUACY OF COMPLIANCE MEASURES: Compliance measures in-place did not attain the interim performance target. Lake Tahoe remains in non-attainment of the underlying threshold, and will not be in attainment for many years. The 1996 Evaluation recommended implementation of supplemental measures as a high priority. Long-term monitoring will be necessary to determine the adequacy of the combined compliance measures. [The nitrogen and phosphorus load reduction targets, if met could slow the PPr over time.](#)

Category: water quality**Parameter: tributary water quality**

1. STANDARD: California: total nitrogen (0.15-0.22 mg/l), total phosphorus (0.010-0.030 mg/l), and total iron (0.015-0.03 mg/l), (annual average). Nevada: Lake Tahoe standards for soluble phosphorus not to exceed 0.007 mg/l (annual average.); soluble inorganic nitrogen not to exceed 0.025 mg/l (annual average.). TRPA: attain a 90th percentile value for suspended sediment of 60 mg/l.

2. INDICATOR (UNITS): Annual average concentrations of appropriate constituents in any tributary stream for which states have established standards (mg/l); 90th percentile value for suspended sediment of 60 mg/l.

3. MONITORING SUMMARY: The USGS and the Tahoe Research Group currently monitor tributary water quality at 31 stations on 14 tributary streams. For details, see USGS Fact Sheet 138-00, October 2000. The period of record varies from stream to stream, but generally ranges from seven to 16 years of data.

4. ATTAINMENT STATUS: Non-attainment. ~~Depending on the water year, some tributaries are in attainment of the constituents listed above. The recent trend analysis for the long-term tributary data shows some improvement in loading for many of the larger tributaries. Load reductions (available for the ten at lake tributaries) for total nitrogen and phosphorus clearly show improvement in the long-term trend, sediment reductions were mixed. See the figures in section 3.9, 3.10, 3.11. in section III.F of this 2001 Threshold Evaluation and the appendix for details. The suspended sediment standard appears to be in attainment for the 2006 Evaluation period, except for Blackwood, Ward, and Incline Creeks for May and June 2005. California streams are not in attainment for N and P. Nevada streams are in non-attainment for the applied Lake Tahoe soluble N standard, Logan House Creek exceeded this only in 2001. Only Logan House Creek on in Nevada meets the soluble reactive phosphorus standard.~~

~~a. California Tributary Standards: Total Nitrogen: Non-attainment, total load reductions were seen in the Upper Truckee River. Total Phosphorus: Non-attainment, although load reductions were observed in 100% of the California monitored tributaries. Total Iron: All of the annual average values~~

~~for monitored streams in California from WY 1989 through WY 2000 exceeded the applicable California standard. The background levels in the Tahoe region far exceed the standard of 0.03 mg/l. There is sufficient data to revise to a more realistic value, which should coincide with establishment of TMDL's for major basin tributaries. b. Nevada Lake Tahoe standards used for tributary Standards: Soluble Phosphorus: Nevada tributaries typically do not attain state standards. Only one of the Nevada streams was in attainment for soluble Phosphorous. Logan House Creek, being the background and 'undeveloped' watershed has historically met the standard. Total Soluble Inorganic Nitrogen: Nevada tributaries typically do not attain state standards. Three of the five Nevada monitored streams are in attainment for soluble nitrogen. c. TRPA Suspended Sediment Threshold: Trends are evident for decreasing sediment loading in 60% of Nevada monitored streams, in particular Logan House Creek, Edgewood, and Third Creek.~~

5. TARGET DATE: Until completion of the TMDL, there is no basis for setting target dates for meeting total nutrient concentration standards.
 a. Total Nitrogen: 2006
 b. Total Phosphorus: 2006
 c. Total Iron: 202106 (pending review of California iron standards). The previous 2006 target dates were not met. The TMDL for Lake Tahoe will change the focus to reductions of fine particulate, nitrogen and phosphorus loads.

6. EVALUATION INTERVAL: annual

7. INTERIM TARGETS: Meet tributary average standards for N, P, and set uniform standards for these and suspended sediment with the Lahontan RWQCB and Nevada Division of Environment Protection. By the update of the Regional Plan in 2008, TRPA should prepare a report and a recommendation to include any TMDL's established for the Tahoe Region.

By, September, ~~2002~~2008, TRPA shall implement the BMP maintenance program for large projects as part of the Capital Improvements EIP Program.

8. COMPLIANCE MEASURES: The compliance measures ~~have been~~were reworked in 2001, for a complete listing see Appendix A.
- a. MEASURES IN PLACE: . 1-20, 26-41, 54, 127, 139, 150-152, 178.
 - b. EFFECTIVENESS OF MEASURES IN PLACE: Some measures are more effective than others, supplemental measures may have to be put in place. ~~For a complete list of 2001 recommendations see Table 3.7.~~
 - c. —
9. ADEQUACY OF COMPLIANCE MEASURES: Compliance measures in-place contributed to an unknown degree to the partial attainment of the interim performance target.

Category: water quality
Parameter: runoff water quality

1. STANDARD: TRPA threshold--discharges to surface water (90th percentile):
 Dissolved inorganic nitrogen: 0.5 mg/l
 Dissolved phosphorus: 0.1 mg/l
 Dissolved iron: 0.5 mg/l
 Grease and oil: 2.0 mg/l
 Suspended sediment: 250 mg/l
 1981 208 Plan/SWRCB Water Quality Control Plan--discharges to surface water:
 Total nitrogen as N: 0.5 mg/l
 Total phosphate as P: 0.1 mg/l
 Total iron: 0.5 mg/l
 Turbidity: 20 ~~FTU~~ NTU
 Grease and oil: 2.0 mg/l
 NOTE: for discharges to groundwater, see WQ-6
2. INDICATOR (UNITS): Concentration of applicable constituent in samples of surface runoff (localized surface flow from rainfall and snowmelt draining small sub-watersheds) at point of discharge to surface waters (mg/l for chemical constituents), as related factors, progress on implementation of ~~implementation of~~ BMPs, as set forth in the 208 Plan, Volume I (November 1988), pp. 183, 184. (See SQ-2-A and B). Also, note that TRPA interprets the "Total phosphate" guideline in the 1981 208 Plan to mean "Total phosphorus."
3. MONITORING SUMMARY: A discussion of the early monitoring conducted by the Lahontan WQCB and TRPA can be found in the annual data reports. TRPA mapped the significant points of discharge to the surface waters of the Lake Tahoe shoreline area as culvert points and monitored ten of these sites periodically throughout the Region 1991-~~1995~~; this is currently being updated and was expanded under the TMDL research. ~~There are also about 10 projects in the process of monitoring for pre-project data related to stormwater runoff...~~
4. ATTAINMENT STATUS: Non-attainment. In the 1990's TRPA and Lahontan Board monitoring programs recorded that 81 to 95 percent of samples did not attain the guidelines for discharges to surface water. The more recent 2001 Evaluation data on selected erosion control projects showed 70% of the sites meet soluble N, 60% meet soluble P and 73% meet the total suspended sediment (TSS) discharge

standard. Only 25% of the few sites reporting meet the soluble iron standard.

5. TARGET DATE: ~~After 2010~~ The TMDL should shift the focus to reduction of stormwater runoff loads for fine particulate, nitrogen and phosphorus.
6. EVALUATION INTERVAL: Annual
7. INTERIM TARGETS: By December 2006 TRPA shall ~~target~~ facilitate the implementation of source control and runoff treatment at limiting Phosphorus and fine sediment sources to meet discharge standards. The monitoring focus will be on flow weighted samples and event loading from runoff, and correlate samples based on land use. As of 2006 three pilot projects have been implemented by Caltrans to focus on fine sediment and phosphorus and nitrogen removal to meet surface water discharge standards. The USFS LTBMU has also supported flocculent testing for such removal. Autosamplers are the standard means of monitoring for stormwater runoff now, for flow weighted samples and storm event mean concentrations and load reductions by treatment sites such as water quality basins.
8. COMPLIANCE MEASURES: The compliance measures ~~have been~~ were reworked in 2001, see Appendix A.
 - a. MEASURES IN PLACE: . 1-20, 21, 22, 33, 34, 52-54, 127, 215.
 - b. EFFECTIVENESS OF MEASURES IN PLACE: Many measures have not been monitored to determine their effectiveness as related to the threshold; see table 3.6 for details.
 - c. SUPPLEMENTAL MEASURES: Some supplemental measures may need to be moved to measures in place.
 - d. EFFECTIVENESS OF SUPPLEMENTAL MEASURES:
9. ADEQUACY OF COMPLIANCE MEASURES: Untreated surface runoff will generally not meet the TRPA and state guidelines for discharges to surface waters. Discharges to surface waters should either be eliminated or treated prior to discharge. Specific compliances measures for this threshold need to be developed relative to TMDLs for load reduction effectiveness.

Category: water quality**Parameter: groundwater**

1. STANDARD: TRPA: Surface water infiltration into the groundwater shall comply with the Uniform Regional Runoff Guidelines, below. Where there is a direct and immediate hydraulic connection between ground and surface waters, discharges to groundwater shall meet the guidelines for surface discharges--see WQ-5. Uniform Regional Guidelines for discharges to groundwater

Total nitrogen as N: 5 mg/l
 Total phosphate as P: 1 mg/l
 Total iron: 4 mg/
 Turbidity: 200 NTU
 Grease/Oil: 40 mg/l

2. INDICATOR (UNITS): Concentration of applicable constituent in samples of surface runoff (localized surface flow from rainfall and snowmelt draining small sub-watersheds) at point of discharge to groundwaters (mg/l for chemical constituents, NTU; as related factors, progress on implementation of the Capital Improvements Program for erosion and runoff control and implementation of BMPs, as set forth in the 208 Plan, Volume I (November 1988), pp. 183 and 184. (See WQ-2-A and B). Also, note that TRPA interprets the "Total phosphate" guidelines to mean "Total phosphorus."
3. MONITORING SUMMARY: This threshold assumes a treatment path for ~~infiltration, infiltration~~; it is not a ground water standard per se. For prior monitoring studies see the 1999, and 2004 Annual Water Quality Reports. There have been some reports on general groundwater character, but limited information exists on the threshold as it relates to infiltration of runoff. Two recent studies provide preliminary data that suggests infiltration may not be impacting groundwater in terms of phosphorus loads (Beck, 2006; and Heyvaert et al, 2005). ~~TRPA has mapped the significant points of discharge to the ground waters of the Region--~~
4. ATTAINMENT STATUS: Non-attainment. In the TRPA and Lahontan Board monitoring programs, 29 to 34 percent of samples did

not attain the guidelines for discharges to ground water. The more recent 2001 Evaluation data on selected erosion control projects show 62.5% of the sites meet total N, 78.6% meet total P and 75% reporting meet the total iron standard. There is limited amount of data on total suspended sediment (TSS) but no data on turbidity, and there is not an established correlation between TSS and turbidity.

5. TARGET DATE: ~~After 2010--~~There is no basis for setting a target date for meeting infiltration site discharge standards. It appears that the majority of discharges to these sites meet these standards. Pre-project monitoring can ensure appropriate pre-treatment of runoff prior to discharge to infiltration sites.
6. EVALUATION INTERVAL: Annual
7. INTERIM TARGETS: ~~By December 2004~~ TRPA ~~shall target~~ has facilitated and permitted source control and runoff treatment focused at limiting Phosphorus and Nitrogen loading reductions to groundwater and Lake Tahoe in order to meet discharge standards. Limited studies completed in 2006, have not demonstrated groundwater impact from infiltration sites for phosphorus. The current monitoring for project effectiveness, the results from the above studies, and the TMDL BMP effectiveness research shall be evaluated to include in the design of new projects.
8. COMPLIANCE MEASURES: The compliance measures have been reworked, for a complete description, see Appendix A.
- a. MEASURES IN PLACE: . Same as WQ-5 with 19-22, 42-50, 60, 135, 140.
- b. EFFECTIVENESS OF MEASURES IN PLACE: There has been little monitoring of this threshold as it relates to infiltration, some inferences can be made of SEZ treatment to runoff. New measures related to the near shore have been added to the current measures in place.
- c. SUPPLEMENTAL MEASURES: Specific study of current measures in place are required before supplemental measures are enacted.

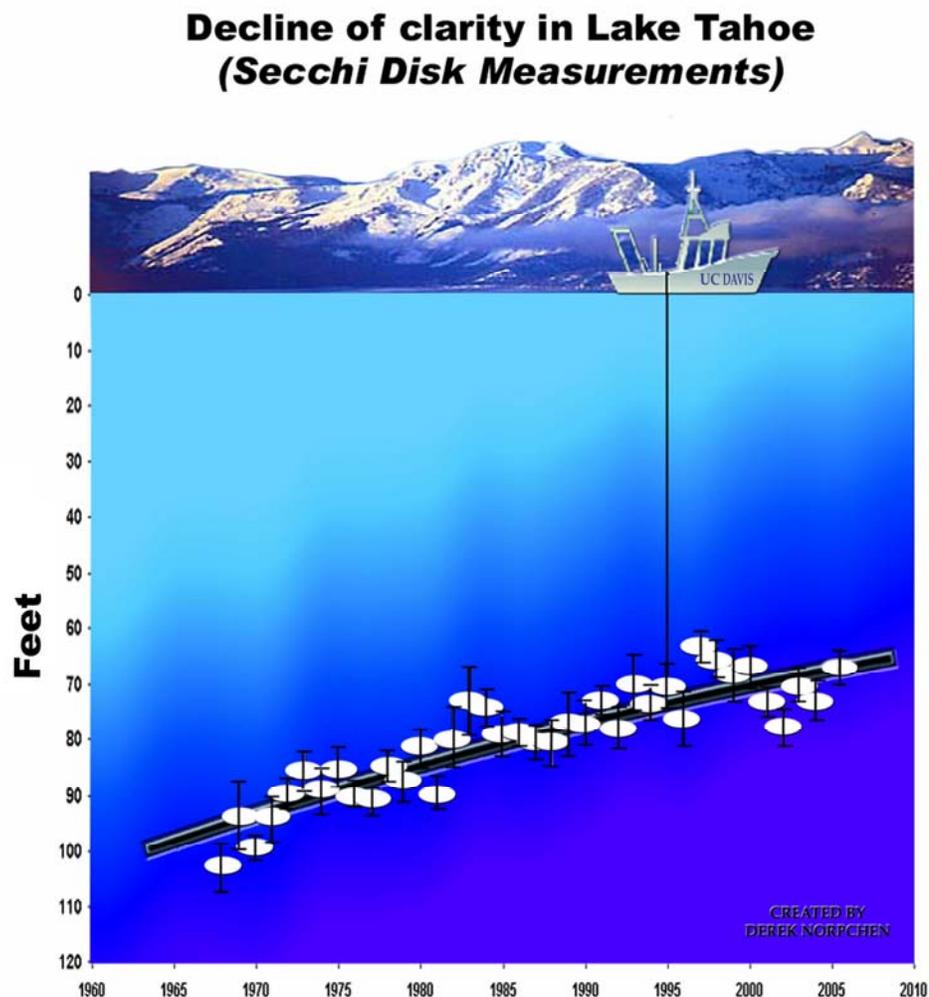
- d. EFFECTIVENESS OF SUPPLEMENTAL MEASURES: Not applicable.
9. ADEQUACY OF COMPLIANCE MEASURES: Discharges of surface runoff to land treatment sites are intended to protect groundwater. With application of BMPs and limits on impervious coverage these measures, will generally meet the TRPA and state guidelines for discharges to treatment sites which protect groundwater, although runoff from heavily urbanized areas of the Region should be pretreated prior to infiltration. More study is needed for the influence of infiltration on ground water, ~~infiltration~~ and nutrient loading at the lake-groundwater interface.

Category: water quality
Parameter: other lakes

Marlette, and Spooner Lakes during the 2002 and 2003 seasons.

1. STANDARD: Numerical standards are set for Fallen Leaf Lake, including total nitrogen (0.20 mg/l ann. avg.) and total phosphorus (0.005 mg/l ann. avg./ 0.010 mg/l 90th percentile). No other lake in California, other than Lake Tahoe, is assigned numerical standards. The tributary standards for tributaries draining those lakes therefore apply.
2. INDICATOR (UNITS): Annual average or 90th percentile concentrations of applicable constituents (WQ-4 Tributary Standards California: Ann. Avg. Total nitrogen, phosphorus, iron, Secchi depth or turbidity specific to each lake. Nevada: Ann. Avg. soluble inorganic nitrogen, soluble phosphorus, Secchi depth or turbidity specific to each lake, or Fallen Leaf Lake) from samples of the other lakes in the Tahoe Region for which the states have established numerical standards (normally mg/l); as related factors, progress on implementation of the capital improvements program for erosion and runoff control and implementation of BMPs, as set forth in the 208 Plan, Volume I (Nov. 1988), pp. 183 and 184. (See WQ-2-A and B).
3. MONITORING SUMMARY: From 1974 to 1976, EPA and USGS conducted limited monitoring of Fallen Leaf, Lilly, and Gilmore Lakes. Fallen Leaf Lake easily met the total nitrogen standard. The Forest Service has monitored Lake LeConte, in the Desolation Wilderness, since 1983. Since From 1991 to 1994, TRPA has collected data on total nitrogen, total phosphorus, total iron, and turbidity at Cascade, Upper and Lower Echo, Marlette, Spooner, and Fallen Leaf Lakes. In 1992, TRPA and NDEP initiated additional monitoring of other lakes in Nevada, and in 1993, federal grant assistance was obtained to evaluate California. These studies should provide some baseline data for the lakes included, namely Fallen Leaf, Spooner, Marlette, and both Echos. In August 1998 Lower Echo, Upper Angora, and Fallen Leaf lakes were in attainment for N and Iron standards (tributary or specific respectively). Fallen Leaf was also in attainment for dissolved oxygen and iron specific standards. The USGS monitored Fallen Leaf, Echo Lakes,
4. ATTAINMENT STATUS: ~~Unknown-Non-attainment.~~ Generally in attainment for nitrogen and phosphorus. ~~TRPA shall determine the status of establishing water quality standards by the 2006 Threshold Evaluation.~~ Fallen Leaf was in non-attainment for Secchi depth and near surface water temperature. The four other lakes do not appear to have had any decline in water quality in comparison with the monitoring from the early 1990's.
5. TARGET DATE: There are no specific indicator standards for other than Fallen Leaf Lake, and there is insufficient data from that lake to establish trends. By December 2004 TRPA shall complete the other lakes feasibility study, in order to set appropriate indicator standards for other lakes. The study was completed, but there are not obvious indicator standards that could be set with such insufficient data.
6. EVALUATION INTERVAL: Every ~~2-35~~ year, if retained as a threshold for 2008 Regional Plan Update.
7. INTERIM TARGETS: ~~Under direction of Lake Tahoe as a Outstanding Natural Resource Waters, other lakes should allow no further degradation of water quality. By December 2004, TRPA shall apply tributary standards to other lakes if appropriate (based on the other lakes monitoring study) and study feasibility of establishing other water quality standards.~~ There was insufficient data for the establishment of this threshold in 1982. Without sufficient data to establish trends, TRPA shall can not establish interim targets, and shall or identify compliance measures necessary and sufficient to attain and maintain the appropriate standards for other lakes.
8. COMPLIANCE MEASURES: The Compliance Measures ~~have-been~~ were reworked in 2001, see Appendix A for details.
 - a. MEASURES IN PLACE: . 1-5, 8, 11, 13, 14, 21, 22, 26-31, 35-42, 55-59, 102, 129, 140, 152, 155, 178, 194.
 - b. EFFECTIVENESS OF MEASURES IN PLACE: Pending further data collection and analysis, the effectiveness of measures in place is not known.

- c. SUPPLEMENTAL MEASURES:
Pending further data and analysis, the need for and effectiveness of supplemental measures is not known.
 - d. EFFECTIVENESS OF SUPPLEMENTAL MEASURES: ~~Pending further data and analysis, the need for and effectiveness of supplemental measures is not known.~~
Not applicable.
9. ADEQUACY OF COMPLIANCE MEASURES: The limited data set ~~indicates~~ limits the ability to determine the adequacy of these measures. The restriction of development and BMP implementation ~~has~~ is believed to have been effective for this threshold. Many of the new measures in place are related to other thresholds such as fisheries, and effectiveness is not easily determined.



Appendix Figure 3-1. Annual Average Secchi Depth 1968 to 2006.

Water Quality Appendix.

Appendix Table 3-1. Comparison of State of Nevada Water Quality Standards, State of California Water Quality Objectives and TRPA Thresholds for Lake Tahoe¹.			
Parameter	Nevada	California	TRPA
pH	S.V. = 7.0 – 8.4	7.0 – 8.4	
DO - % of Saturation	S.V. ≥ 90%	≥ 90% Minimum ≥ 80%	
DO (mg/l)		30-Day Mean > 6.5	
		7-Day Mean > 6.5	
		7-Day Mean Minimum > 5.0	
		1-Day Minimum > 4.0	
Chlorides, mg/l	A.A. ≤ 3.0	A.A. < 3.0	
	S.V. ≤ 5.0	90 th Percentile ≤ 4.0	
Soluble Phosphorus, mg/l	A.A. ≤ 0.007		
Total Phosphorus		A.A. < 0.008	
Total Nitrogen (as N), mg/l	A.A. ≤ 0.25	A.A. ≤ 0.15	
	S.V. ≤ 0.32		
Total Soluble Inorganic Nitrogen, mg/l	A.A. ≤ 0.025		
Algal Growth Potential	A.A. < 2 x AGP at limnetic reference station	A.A. < 2 x AGP at limnetic reference station	
Plankton Count – No./ml	Jun – Sep Average ≤ 100	Mean seasonal ≤ 100	
	S.V. ≤ 500	Maximum < 500	
Specific Electrical Conductance, □mhos/cm at 20° C	A.A. ≤ 95	A.A. ≤ 95	
	S.V. ≤ 105		
Total Dissolved Solids, mg/l	A.A. ≤ 60	A.A. ≤ 60	
	S.V. ≤ 70	90 th percentile ≤ 65	
Sulfate, mg/l	S.V. ≤ 2.0	A.A. < 1.0	
		90 th percentile ≤ 2.0	
Clarity	Vertical Extinction Coefficient (VEC) < 0.08 per meter when measured below first meter	Vertical Extinction Coefficient (VEC) < 0.08 per meter when measured below first meter	
Transparency		Secchi disk transparency > 1967-71 seasonal and annual means (29.7 m)	Secchi disk transparency Dec-Mar 67-71 W.A. > 33.4 m WQ-2
Turbidity	S.V. < 3 NTU at any point of the lake too shallow to determine a reliable VEC	S.V. < 3 NTU at any point of the lake too shallow to determine a reliable VEC	S.V. < 3 NTU in littoral Lake Tahoe WQ-1 influenced by stream discharge
		S.V. < 1 NTU in shallow waters not directly influenced by stream discharges	S.V. < 1 NTU in WQ-1, shallow waters not directly influenced by stream discharges

Water Quality Appendix.

Appendix Table 3-1. Comparison of State of Nevada Water Quality Standards, State of California Water Quality Objectives and TRPA Thresholds for Lake Tahoe¹.			
Parameter	Nevada	California	TRPA
Management Standards			DIN, DP, Fe load reduction for 1967-71 phytoplankton primary productivity (PPr) and periphyton biomass
			Reduce DIN loads from Surface Runoff by 50%, GW by 30%, Atmospheric Sources by 20% from 1973-81 Annual Avg.
			Reduce DP, Fe load from all sources as required to achieve Clarity and PPr
Biological Indicators		Algal productivity & phytoplankton, zooplankton, & periphyton biomass < 1967-71 seasonal and annual means	WQ-3 Phytoplankton Primary Productivity (PPr) A.A. < 52 gC/M ² /yr, periphyton biomass < 1967-71 mean values

¹Blank cell indicate that the standard has not been adopted by the agency. However, TRPA's Compact requires that the regional plan provide for attainment of State and Federal water quality standards, and local air and water quality standards, whichever are strictest in that portion of the region where they apply Article V (5)(d). The U.S. Forest Service, Lake Tahoe Basin Management Unit (**LTBMU**) has committed to attain all these applicable standards.

Water Quality Appendix.

Appendix Table 3-2. Water Quality Thresholds, Standards, Objectives by Agency for the Lake Tahoe Basin¹				
Category and Standards	LRWQCB adopted standard = X	NDEP standard = X	TRPA TH = X	USFS
Thresholds & Pollutant Source			X	Incorporated in Forest Plan Goals
Threshold WQ-1 through 3 are covered in Lake Tahoe Standards (Table 3-2)			X	
WQ-4: Tributaries: 90 th percentile SSC 60 mg/l	X Tahoe Basin WQ Objective, TDS for individual streams A.A. 30-90 mg/l, 90 th percentile on some 60-90 mg/l	TSS SV not more than 25 mg/l, TDS A.A. not more than 500 mg/l	X	Stream BMPs and Restoration
Attain State STDs for DIN, DP, DFe was interpreted as Sol P A.A. 0.007 mg/l Lake Tahoe STD in NV	NH ₃ formula, TN range 0.15 – 0.23 mg/l TP range 0.005 – 0.030 mg/l TFe range 0.010 – 0.070 mg/l	NH ₃ S.V. 0.004 mg/l, S.V. NO ₃ 10.0 mg/l, S.V. Nitrite 0.06 mg/l, TP A.A. not more than 0.05 mg/l, TFe S.V. not more than 1.0 mg/l	X	Stream BMPs and Restoration
Management Standard: Reduce Ann Nutrient and SSC loads to achieve Lake Tahoe loading thresholds			X	Management goals (LMP)
WQ-5: Stormwater: Surface Discharge Stormwater Runoff 90 th percentile DIN 0.5 mg/l	90 th percentile TN 0.5 mg/l maximum value		X	LMP
90 th percentile DP 0.1 mg/l	90 th percentile TP 0.1 mg/l maximum value		X	LMP
90 th percentile DFe 0.5 mg/l	90 th percentile TFe 0.5 mg/l maximum value		X	LMP
90 th percentile SSC 250 mg/l	Turbidity not more than 20 NTU		X	LMP

Water Quality Appendix.

Appendix Table 3-2. Water Quality Thresholds, Standards, Objectives by Agency for the Lake Tahoe Basin¹				
Category and Standards	LRWQCB adopted standard = X	NDEP standard = X	TRPA TH = X	USFS
Reduce Ann Nutrient and SSC loads to achieve Tributary and Lake Tahoe loading thresholds. Reduce DIN loads from Surface Runoff by 50%			X	LMP
Grease and Oil 2.0 mg/l	X		X	LMP
WQ-6: Stormwater: Discharges to Land Treatment for Protection of GW, a direct and immediate hydrologic GW connection requires surface discharge STDs apply	X		X	
Total Nitrogen as N 5 mg/l	X		X	LMP
Total Phosphate as P 1 mg/l	X		X	LMP
Total Iron as Fe 4 mg/l	X		X	LMP
Turbidity 200 NTU	X		X	LMP
Grease and Oil 40 mg/l	X		X	LMP
Reduce Ann Nutrient and SSC loads to achieve Lake Tahoe loading thresholds. Reduce DIN loads from GW by 30%			X	LMP goal in general terms
WQ-7: Human & Environmental Health: Other Lakes – attain existing water quality STDs (see Fallen Leaf Water Quality Objectives below)	X Fallen Leaf Lake (see Table 3-, in Section III for details on parameters)		X	Goals LMP and Sierra Nevada Framework

Water Quality Appendix.

Appendix Table 3-2. Water Quality Thresholds, Standards, Objectives by Agency for the Lake Tahoe Basin¹

Category and Standards	LRWQCB adopted standard = X	NDEP standard = X	TRPA TH = X	USFS
State Standards (other than Threshold parameters)				
pH for Tributary Streams	General WQO: Changes in normal ambient pH shall not exceed 0.5 pH units	SV within range 6.5-9.0		
Dissolved Oxygen (DO) for Tributary Streams	General WQO: DO as % saturation shall not be depressed by more than 10%, or no min DO < 80% saturation	SV > 6.0 mg/l		
Turbidity in Streams	General WQO: Increases in turbidity shall not exceed natural levels by more than 10%	SV < 10.0 NTU		
Color of Stream Water	General WQO: Waters shall be free of coloration that causes nuisance or adversely affects the water for beneficial uses.	SV not more than 75.0 PCU		
Chloride in Stream Water	WQO: A.A. range Cl 0.1 –1.0 mg/l, 90 th range 0.2 –5.5 mg/l	SV not more than 250 mg/l		
Sulfate in Stream Water	WQO: A.A. range 0.4 –1.4 mg/l, 90 th percentile range 0.5 –2.8 mg/l	SV not more than 250 mg/l		
Boron in Stream, or Source Water	Upper Truckee River WQO: A.A. 1.0 mg/l, 90 th percentile 2 mg/l	Toxics total Boron 0.75 mg/l for irrigation and 5.0 mg/l for livestock		
Sodium in Stream Water		AA not more than 8 SAR		
Escherichia Coli	WQO: Fecal Coliform < 20/100 ml in 10 day period, < 10% of all samples in 30 day period > 40/100 ml	SV not more than 126/100 ml	Snap Shot Day sample focus LRWQCB lab	
Stream Temperature	WQO: Non-alteration	SV (Oct 1 – May 31) < 10.0 ° C, SV (Jun 1 – Sep 30) < 20.0 ° C		

Water Quality Appendix.

Appendix Table 3-2. Water Quality Thresholds, Standards, Objectives by Agency for the Lake Tahoe Basin¹

Category and Standards	LRWQCB adopted standard = X	NDEP standard = X	TRPA TH = X	USFS
Water Quality Objectives (WQO) other than those listed above (detail in Section III Lahontan Matrix)			~ Load reduction standards	Management based standards
Biostimulatory substances < promotion of aquatic growth < affect nuisance or beneficial use	X			
Chemical Constituents MCL and SMCL	X	X		
Floating Materials alteration < 10% significance	X			
Oil and Grease concentrations shall not be altered	X			
Pesticides < detection concentrations, no detectable increase in bottom sediments or bioaccumulation	X	Toxics: Concentration limits to protect drinking water source, and aquatic life	BMP use restriction, EPA registered, alternatives 1st, non-detection In SEZ unless to attain thresholds	
Radioactivity concentrations < deleterious human, plant, animal, or aquatic life or accumulation in food web to protect same	X			
Settleable Materials increase by no more than 0.1 ml/l	X			
Toxicity concentrations < deleterious human, plant, animal, or aquatic life. Indicator organism bioassays: spp diversity, population, growth anomalies	X			

Water Quality Appendix.

Appendix Table 3-3. Nevada Division of Environmental Protection: Standards Required to Maintain Higher Water Quality (RMHQs) for Beneficial Uses.								
Control Point	pH	Total Phosphates (as P) - mg/l	Total Nitrogen (as N) - mg/l	Chloride, Dissolved, mg/l	Total Dissolved Solids, mg/l	Total Suspended Solids, mg/l	Turbidity, NTU	Color, PCU
E. Fork Incline Cr. at Ski Incline *a	SV: 7.0-7.9		SV: 1.1 AA: 0.4	SV: 4.0 AA: 2.0	SV: 70 AA: 55			No increase > 10
W. Fork Incline C. at State Hwy. 431 *b	SV: 7.0-8.0		SV: 0.9 AA: 0.5	SV: 6.0 AA: 5.0	SV: 80 AA: 80	SV: N/A AA: 8.0	SV: 3.0 AA: 20	No increase > 10
Incline Creek at Lakeshore Drive *c	SV: 7.0-8.3		SV: 1.8 AA: 1.2	SV: 8.0 AA: 6.0	SV: 85 AA: 70			No increase > 10
E. Fork Third Cr. at State Hwy. 431 *d	SV: 7.0-8.0	SV: AA: 0.045	SV: 0.5 AA: 0.3	SV: 5.0 AA: 3.0	SV: 80 AA: 65	SV: N/A AA: 20.0	SV: 3.0 AA: 2.0	No increase > 10
Third Creek at Lakeshore Drive *e	SV: 7.0-8.4		SV: 1.4 AA: 1.0	SV: 5.0 AA: 4.0	SV: 75 AA: 55			No increase > 10
Wood Creek at Lakeshore Drive *f	SV: 7.0-8.2		SV: 0.7 AA: 0.5	SV: 5.0 AA: 3.0	SV: 70 AA: 60			No increase > 10
Second Creek at Second Creek Dr. *g	SV: 7.0-8.0		SV: 0.3 AA: 0.2	SV: 5.0 AA: 3.0	SV: 70 AA: 65			No increase > 10
Second Creek at Lakeshore Drive *h	SV: 7.0-8.2		SV: 0.6 AA: 0.3	SV: 6.0 AA: 3.0	SV: 80 AA: 60			No increase > 10

Water Quality Appendix.

Appendix Table 3-3. Nevada Division of Environmental Protection: Standards Required to Maintain Higher Water Quality (RMHQs) for Beneficial Uses.								
First Creek at Dale and Knotty Pine Dr. *i	SV: 7.0-8.1	SV:	SV: 0.3	SV: 3.0	SV: 80		SV: 4.0	No increase > 10
		AA: 0.043	AA: 0.2	AA: 2.0	AA: 70		AA: 2.0	
First Creek at Lakeshore Drive *j	SV: 7.0-8.2		SV: 0.6	SV: 4.0	SV: 90		SV: 9.0	No increase > 10
			AA: 0.3	AA: 3.0	AA: 75		AA: 8.0	
Glenbrook Creek *k	SV: 7.0-8.2	SV: 0.060	SV: 0.5			SV: 22.0		No increase > 10
		AA: N/A	AA: 0.5				AA: N/A	
Logan House Creek *l	SV: 7.0-8.5	SV: 0.060	SV: 0.5			SV: 11.0		No increase > 10
		AA: N/A	AA: 0.5				AA: N/A	
Eagle Rock Creek *m	SV: 7.0-8.4	SV: 0.035	SV: 0.5			SV: 12.0		no increase > 10
		AA: 0.035	AA: 0.5				AA: 12.0	
Edgewood Ck @ Palisades *n	SV: 7.0-8.4	SV: 0.050	SV: 0.2			SV: N/A		No increase > 10
		AA: 0.045	AA: 0.3				AA: N/A	
Edgewood Ck @ Stateline *o	SV: 7.0-8.4	SV: 0.100	SV: 0.6			SV: 17.0		No increase > 10
		AA: N/A	AA: 0.6				AA: N/A	

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(1) BMP requirements, new development: For all additional development in the Tahoe Region, application of temporary and permanent BMPs are required as a condition of approval. Requirements are set forth in Chapter 25 of the TRPA Code. BMPs are described in the Handbook of Best Management Practices.	Yes, but there are elements that need to be improved.	Site-specific BMP prescriptions are based on soil, slope and topography appropriate to the project site.	Currently working on updated BMP approaches in conjunction with Partners in Conservation to implement BMPs and incorporate new technologies and information, continued enforcement of temporary and construction BMPs.
(2) BMP implementation program -- existing streets and highways: Under Chapter 25 of the TRPA Code, the implementation program includes voluntary, regulatory, and remedial aspects. BMPs are described in the Handbook of Best Management Practices.	Not to the extent desirable.	Existing roads are large contributors of sediment and various pollutants. Improved implementation of BMPs.	Enhance the existing coordination and communication with NDOT and Caltrans, and local jurisdictions to incorporate new technologies to reduce loads of fine sediment, N and P.
(3) BMP implementation program -- existing urban development: Under Chapter 25 of the TRPA Code, the implementation program includes voluntary, regulatory, and remedial aspects. BMPs are described in the Handbook of Best Management Practices.	Yes, but there are elements that need to be improved.	Actually called the BMP retrofit program. Soil conservation will continue to support the BMP retrofit program in an effort to enhance and develop the program. Priority watersheds are assigned by date. Projects within priority watersheds are put on a BMP retrofit program when remodels or additions are approved on the property. Priority One watershed properties were required to come up to BMP standards by October 15, 2000, priority 2 by October 15, 2006, and priority 3 by October 15, 2008.	Continue outreach to educate about the effectiveness of BMPs, using contractor and real estate workshops. It is the intent of the program to provide incentives for BMP retrofit for properties not coming in for project approval. Continue working on operation of the program to requiring BMP compliance disclosure upon sale of the property, between the buyer and the seller.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(4) BMP implementation program -- existing urban drainage systems: Under Chapter 25 of the TRPA Code, the implementation program includes voluntary, regulatory, and remedial aspects. BMPs are described in the Handbook of Best Management Practices.	Yes, but not entirely.	The Tahoe Basin Executive's sponsored Storm Water Quality Improvement Committee has worked to improve the delivery of these projects. As part of that effort the US Army Corps has contracted to develop methods for Pollutant Load Reduction estimation in conjunction with these projects and the TMDL. There is still a need for systematic monitoring and modeling along with the TMDL for combined BMP effectiveness.	Develop short-term watershed indicators in addition to Bio-Assessment Monitoring in an effort to respond or adjust to impacts/improvements faster than water quality indicators reveal. There is a need to develop demonstration projects to illustrate the accuracy of these short-term indicators. Evaluation of indicators should lead to the identification of problem areas in ways to adjust BMP effectiveness. Indicators will also provide quantifiable benefits at the neighborhood scale. These short-term indicators should compliment the existing long-term tributary and Lake monitoring.
(5) Capital Improvements Program for Erosion and Runoff Control: The CIP for erosion and runoff control is set forth in Volume IV of the 208 Plan. It is a critical part of the TRPA Regional Plan. The CIP applies primarily to erosion and runoff problems from public rights-of-way. It is implemented by the local jurisdictions, Caltrans, and NDOT with oversight and assistance from TRPA and other agencies.	Yes, but not entirely.	Capital Improvement Program is now part of the EIP under Water Quality and SEZ Restoration. Its implementation has and will continue to be one of TRPA's most effective actions to pursue attainment of the threshold.	Continue to support Capital Improvement Programs represented through EIP.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(6) Excess coverage mitigation program: Where projects are approved for modification or rehabilitation of facilities on parcels with existing coverage in excess of the Bailey coefficients. This mitigation program provides for a reduction of coverage in an amount proportional to the cost of the project and the extent of excess coverage that is onsite. The program is set forth in Chapter 20 of the TRPA Code of Ordinances.	Yes, but not entirely.	Temporary adjustments are proposed for this program and are intended to be adopted in June 2001. This threshold evaluation may suggest other revisions such as the type of coverage that can be transferred, adjustments in hydrologic boundaries, and the restrictive use of subsidies to support specific types of projects. However, the most critical revision that needs to be assured is that a one-to-one mitigation will be attained when this program option is exercised. Modification of the reduction formula and adjustment to the square foot coverage cost will be a part of the solution.	The cost of land coverage is annually reviewed basin wide by a licensed appraiser. The Code currently requires that mitigation fee reflect the acquisition and restoration costs of the local land bank agencies (CTC, NVSL). Transfer of coverage and hydrologic boundaries are related issues to be identified as an A, B, or C list recommendation.
(7) Effluent limitations: California (SWRCB, Lahontan Board) issues effluent standards under their statewide authorities to help control water quality problems resulting from discharges of urban drainage. TRPA may also set effluent standards for control of nonpoint sources under the provisions of Chapter 9 of the TRPA Code of Ordinances.	Yes, but not entirely.	Currently no enforcement on the Nevada side for the type of projects that Lahontan monitors on the California side. TRPA defaults as the enforcer on the Nevada side. NDEP is pursuing staff resources to coordinate with TRPA in this effort.	Improve partnership with NDEP on the Nevada side to coordinate with Lahontan on effluent standards with similar guidelines basin wide. The TMDL load reduction targets for fine particulate, N and P, and the target allocations for reductions from stormwater will likely modify this compliance measure.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(8) Limitations on new subdivisions: No new divisions of land are permitted within the Tahoe Region which would create development potential inconsistent with the Goals and Policies (See the Goals and Policies, p. 113.). TRPA's intent is to avoid the impacts of new lot and block subdivisions while allowing mechanisms such as re-subdivision to lessen the potential impacts of existing approved but unbuilt subdivisions.	Yes.	This measure is working because new subdivisions are not creating development potential as defined by the Code. All new subdivisions approved are approved consistent with the Bailey coefficients as the existed on the effective date of the Regional Plan. Concern has been expressed regarding the configuration of coverage approved as a part of multi-family projects that are subsequently subdivided.	TRPA should continue to require water quality monitoring studies for these types of two-step subdivisions to determine if impacts are similar to traditional lot and block subdivisions. These larger projects tend to require an EIS to evaluate and mitigate impacts. The effectiveness of that mitigation is critical to the effectiveness of this compliance measure.
(9) Land use planning and controls: TRPA's land use plan, set forth in the Goals and Policies and the Plan Area Statements and maps, directs development to already urbanized areas of consistent land use. Specific land use policies are implemented through the use of Plan Area Statements, specific community plans, and in some instances master plans. See the Goals and Policies (pp. II-2 through 5), and Chapters 13, 14, 15, 16, and 18 of the Code of Ordinances.	Yes.	Except for 1B lands, urban areas generally have high capability land; thus, more suitable for development. it is prudent planning to concentrate development in the Basin within the urban boundaries and Plan Areas where land coverage can be better managed and storm water treated	Continue the commitment to the strict interpretation of those chapters to honor the commitment to concentrate those activities within the urban boundaries and Plan Area Statements. This will reflect TRPA's continued commitment to reducing disturbance on raw lands.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(10) Residential development priorities (IPES): The Individual Parcel Evaluation System (IPES) evaluates parcels eligible for single-family development contingent upon their relative suitability for development. This program directs additional development first to the most suitable parcels. IPES is set forth in Goals & Policies (pp. VII-3 through 7) and Chapter 37 of the Code.	Yes.	DRI analysis suggests that there has been a decrease in sediment loads in most of the tributaries since implementation of IPES. The increase in sediments loads in other creeks may not be directly attributable to the IPES program. However, their needs to be more refined research to determine whether IPES is definitively effective as designed and intended.	A reevaluation of the environmental management strategies within those watersheds or tributaries where sediments are not going down should be undertaken. To help determine what factors may be contributing to the increase. However, their needs to be more refined research to determine whether IPES is definitively effective as designed and intended.
(11) Limits on land coverage for new development: All new development must conform to the coefficients of allowable land coverage set forth in the Bailey Report. In some instances, provisions are made to allow additional coverage on a given parcel by transfer programs. See the Goals and Policies (pp. II-12 through 15) and Chapter 20 of the Code.	Yes.	New coverage approved conforms as stipulated by permit. However, existing excess coverage is not being fully mitigated (the fee is based on the combination of excess land coverage and the project costs, so the fee is not a 1:1 mitigation).	Continue to vigorously pursue the necessary adjustment required so that the excess coverage mitigation program can function as intended. This implies a one-to-one sq. ft. mitigation (this would require a significant code revision and adoption).

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(12) Transfer of development: To provide more flexibility for planning new development and mitigating existing problems, four types of transfer programs are provided in the Regional Plan: 1) transfers of residential development rights, 2) transfers of existing development, 3) transfers of land coverage, and 4) transfer of residential allocations. See the Goals and Policies, pp. II-14 and VII-14.	Yes.	Land coverage has become short in supply and high in cost, particularly in Nevada watersheds. New multi-family residential projects must acquire development rights to facilitate increased density. Rights (such as potential coverage) are typically transferred from environmentally sensitive parcels, which are permanently retired as a consequence of the transfer. A new program allows for the assignment of residential allocations to buildable parcels in-lieu of retiring a sensitive parcel, an alternative to obtaining allocations through local jurisdictions. Limited availability of new commercial floor area (CFA) and tourist accommodation units (TAUs) requires project proponents to acquire and transfer existing development to facilitate new construction.	Continue to support residential development rights as well as the allocation and transfer of existing development rights program. Continue to provide support to CTC and Nevada Division of State Lands in the management of their land bank program. This can be accomplished and refined through the MOU process.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(13) Restrictions on SEZ encroachment and vegetation alteration: No new land coverage or other permanent disturbance is permitted in SEZs, except for certain public outdoor recreation facilities, public service facilities, projects which require access across SEZs. New development in man-modified SEZs, and SEZ restoration and erosion control projects have an exception with conditions, too. This will continue provided that the TRPA makes the required findings and that offsetting restoration is secured. See Chapter 20 of the Code.	Yes, but with additional with future refinements	SEZ encroachment and disturbance, no net disturbance is happening as a consequence of the SEZ encroachment regulations. There are specific historical disturbances of SEZs where restoration is possible. This suggests that there is a need for further programmatic resources to provide restoration incentives.	Whether through resource/ cost sharing with partner agencies, or through BCP requests or grant funding, the SEZ management will benefit from increased funding and addition of physical, chemical and biological indicators. There is also a need to specify the kinds of activities are appropriate within SEZ's to preserve and/or enhance their functions. Some MOUs may need to be modified.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(14) SEZ restoration program: The SEZ restoration program is set forth in Volume III of the 208 Plan and Volume's I-IV of the updated Environmental Improvement Program.	Yes, but not entirely.	SEZ restoration typically reverses the effects of historical disturbances, including ditching, filling, diversions, draining and urban encroachment.	For the next regional plan, SEZ restoration should focus on re-establishing functional attributes within the constraints of the watershed, as well as prioritizing restoration projects in close proximity to Lake Tahoe and major tributaries. Acres of SEZ restoration should be adjusted every five years, based upon available resources, opportunities, feasibility and effectiveness to restore SEZ functions. Such SEZ restoration continue happening within programs executed by US Forest Service, California Tahoe Conservancy, and Nevada Division of State Lands. Also, an inventory of SEZ lands in and near urban areas is needed to determine the restoration potential and Outside of urban areas, SEZ restoration should first quantify the change in functional attributes prior to implementation. project-need descriptions and locations for the SEZ portion of the EIP should be updated based on evaluation criteria derived from the classification system; TRPA will continue to advocate implementation and financing of the SEZ portion of the EIP.
(15) SEZ setbacks: All new development must be setback from the defined extent of the SEZs to preserve their integrity. There are important values of the edge zone created by the SEZ and surrounding vegetation types. Required setbacks are identified in Chapter 37 of the Code.	Yes.	SEZ setbacks provide transition zones (buffers) between urban needs and riparian zones. Setbacks reduce degradation of SEZ resources. No new disturbance of SEZs are happening as a consequence of existing regulations.	A more rigorous application and updated scientific basis for SEZ setbacks is needed. Clarification of the SEZ definition is needed, including exempt features. Revisions to the SEZ identification criteria are also needed to accurately reflect field conditions. Continued commitment to enforce SEZ setbacks will be vigilantly enforced.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(16) Fertilizer reporting requirements: TRPA may request practices that require regular fertilizer maintenance (e.g., golf courses, parks, cemeteries, ball fields, and residential yards) need to submit fertilizer management plans for review and approval. Large users of fertilizer shall initiate a tracking program for lands under their control and present annual reports to TRPA. See Chapter 81 of the Code. Additional restrictions on fertilizer use could include bans on fertilizer applications in some situations, such as golf courses in SEZs, or lake front properties, or requirements to use only slow-release fertilizers.	Yes, but There needs to be more compliance from large user in the basin, recreational turf managers other than golf courses in particular. Also there is no plan and reporting compliance from commercial turf managers.	Explanation adequately addressed in Control measure narrative.	TRPA should develop a mechanism where reports are routed to the appropriate staff person for interpretation and possible action. An effort needs to be made to encourage other large turf areas users to develop plans for review. This will need to happen in cooperation with Lahontan and NDEP, perhaps on an NPDES permit or a TRPA BMP Plan. Code Section 81.7 was amended in December 2002, requiring fertilizer management plans and annual reporting for defined "large users". This amendment also discourages the use of phosphorus fertilizers unless a soil P availability test demonstrated the need for P.
(17) Water quality mitigation: All projects and activities which result in the creation of additional land coverage must offset their potential water quality impacts through one, or a combination of the following methods: 1) implementation of offsite water quality control projects as a condition of project approval or 2) contribution to a water quality mitigation fund. See Chapter 82 of the Code.	Yes	Should be contingent upon demonstrated effectiveness of the BMPs that are part of the erosion control projects. There is a BMP effectiveness component in the TMDL Phase II research that will effect the selection and focus of BMPs over time. Runoff control is expected to remain as a key BMP approach.	Continue to be vigilant about updating our methods. Monitor to quantify as well as qualify the effectiveness of the BMPs we use. Re-evaluate the mitigation fund so allocation may more specifically benefit the project area. The allocation of fees to local jurisdictions does not focus their use on areas of new development, but on offsite projects jurisdiction wide. Load reductions for fine particulate, N and P from the TMDL will influence BMP application focus.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(18) Restrictions on rate and/or amount of additional development: Such restrictions could include restrictions on additional development in all categories or certain categories, including residential, commercial, recreational, and public service. Restrictions could be applied Region-wide, by jurisdiction, by watershed, or by some other appropriate sub-unit. Restrictions could be placed on public service uses not currently covered by allocations by establishing allocation limits, setting priorities, or prohibiting certain uses in the Region.	Yes, but there is no direct link to assessment standards for water quality or soil conservation.	Continuing to see a mix of new and redeveloped properties. This measure is closely tied to attainment and maintenance of all thresholds. If measure were not working there would be only projects proposed on raw land. New public service facilities continue to be approved on an “as needed” basis as the finding that there is a need for the project needs to be made. New public service projects are prohibited from providing additional service capacity /infrastructure for unplanned development.	Continue to enforce the applicable Code provisions. These measures need to be evaluated on the basis of the intent behind them (e.g. reduce and mitigated the impacts of development). If that intent is being met, then they are presumed to be effective.
(19) Improved BMP implementation/enforcement program: An improved program could include subsidized BMP applications from grants, annual budgets, or fees; or mandatory compliance with BMPs upon sale of property.	Yes, but some elements need to be improved.	BMP compliance disclosure upon sale of property added as a Chapter 25 Code amendment on in cooperation with Basin –wide realtors, and other stakeholders in December 2002.	Continue to develop a public outreach and education program related to BMPs and watershed improvements as part of the Environmental Improvement Program (EIP). Compliance with residential BMPs is based on watershed priority are as follows: Priority 1=2001; Priority 2=2006, Priority 3=2011. TRPA should continue (and expand) BMP workshops with the Partners in Conservation for contractors, homeowners, and landscape architects.
(20) Increased funding for WQ EIP for erosion and runoff control: Increased funding could come from grants, annual budgets, bonding, or fees. This measure is consistent with the CIP Volume IV of the 208 Plan, which has been incorporated in the EIP.	Yes, but not entirely.	Funding sources are emerging and are expected to be in place. This will be captured under EIP’s future funding	Continue to participate and identify priority projects that deserve the funding sources available through EIP, including options for private homeowners and small business. This should be targeted toward projects that will result in the greatest benefit to runoff and pollutant source control as well as treatment and interdiction of known fine sediment, N and P producing areas.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(21) Artificial wetlands/runoff treatment program: This compliance measure would include a more active program to identify major discharge points of surface runoff and provide treatment through the installation and maintenance of artificial wetlands. The program should involve pilot projects prior to full-scale implementation. This program is consistent with the spirit and intent of the 208 plan.	Not at present, since only a few sites have been used to approach this type of treatment.	Funding sources are emerging to include monitoring for projects related to urban runoff. Efforts are underway to coordinate the ongoing monitoring efforts to maximize the exchange of information and provide feedback for project design.	Utilize the results of EPA and other studies on the wetlands efficiency in runoff treatment to evaluate the use of these wetlands Consider use of artificial wetlands for water quality treatment and SEZ restoration credit which has been applied locally, but is an unresolved national issue.
(22) Transfer of development from SEZs: Removal of existing structures from SEZs could be accomplished by establishment of a specific transfer program, with appropriate incentives.	Yes.	Bonus units can be given to projects that transfer development out of a SEZ. This is the only incentive specific to SEZs. There are prohibitions against additional land coverage and development within SEZs. This encourages development outside SEZs and promotes removing existing development from SEZs.	Continue to promote program as it functions presently. This measure may provide some of the most significant incentives for redevelopment on over-covered areas with SEZ that leads to reduction of coverage and restoration of SEZ with appropriate setbacks.
(23) Combustion heater rules, stationary source controls, and related rules: Rules regarding emissions from combustion heaters and stationary sources set forth in Chapter 91 of the TRPA Code.	Yes	To the extent that heaters and stationary sources are sources of atmospheric of fine particulate and phosphorus, these rules can be effective.	See the final Technical Memorandum of the Lake Tahoe Atmospheric Deposition Study for further evaluation of the potential effectiveness of this measure.
(24) Redevelopment and redirection of land use: Certain plan area statements are designated for redirection of development to improve environmental quality, community character, and efficiency of transportation systems. See the Goals and Policies, pp. II-2, II-4, and II-12, and Chapter 15 of the Code of Ordinances.	Yes.	Explanation adequately addressed in Control measure narrative.	Continue to concentrate development within urban areas. Look to Pathway and the Regional Plan Update to increase incentives for this program in meeting Place-Based concepts and ETCC desired conditions.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(26) Elimination of accidental sewage releases: The discharge of wastewater to the surface or groundwaters of the Tahoe Region is prohibited, except for existing development operating under approved plans for wastewater disposal. Sewage collections, conveyance, the treatment districts shall have approved spill contingency, prevention, and detection plans. (See the Goals and Policies, pp. II-41 and 43).	Yes, but needs further development.	On the ground evaluation of sewage disposal sites is evaluated by the geologists of the BMP retrofit program. Contingency plans for overflow emergencies are prescribed through this program. This may include interception basins to capture run-off in times of facility failure.	Continued effort of vigilant re-evaluation of these facilities and the interception measures that have been installed will be updated as new methods and technology allow. Army Corps completed a pheasability study of needed sewer system infrastructure replacement in 2003. Implement the EIP project improvements indicated by that study. The study indicated the risk of exfiltration from collection lines is minimal, export line replacement is underway including relocation from SEZs where possible.
(27) Reduction of sewer line exfiltration: All agencies which collect or transport sewage should have plans for detecting and correcting exfiltration problems, and shall be required to implement such plans as a condition of TRPA project approvals. (See Goals & Policies,p.II-45).	No	Only certain ground water well monitoring stations can detect these subterranean sewage pipe exfiltration failures. Plans submitted to identify exfiltration problems are limited in there ability to detect these system failures. Collection lines are more likely to take in groundwater.	The ability to monitor and detect sewage exfiltration failures is limited by funding, technology and human resources. See Army Corps study note above. The ability to address actual exfiltration problems when detected is the responsibility of Sewer Districts in consultation with Lahontan, NDEP, and TRPA.
(28) Effluent limitations: State agencies issue limitations under their existing authorities to entities collecting and treating wastewaters. All existing sewage collection and treatment entities in the Tahoe Region are covered NDEP permits or California Waste Discharge Requirements (WDRs).	Yes	The explanation is adequately captured in the control measure narrative.	To continue to support and work in partnership with the authorities who monitor and regulate the collection and treatment of sewage waste waters.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(29) Regulation of wastewater disposal at sites not connected to sewers: Wastewater discharge prohibitions apply equally to discharges in rural or remote areas. TRPA may approve holding tanks or other no-discharge systems in some situations where they would not create adverse impacts. See Chapter 81 of the Code.	Yes	The explanation is adequately captured in the control measure narrative.	Continue to enforce.
(30) Prohibition on solid waste disposal: Disposal of solid wastes in or on land within the Tahoe Region is prohibited. See p.II-45 of Goals & Policies.	Yes	The explanation is adequately captured in the control measure narrative.	Continue to enforce.
(31) Mandatory garbage pick-up: Garbage pick-up is mandatory in the Tahoe Region and should be structured to encourage clean-ups and recycling. See p. VI-3 of the Goals and Policies.	Yes	This measure seems more aimed at human pathogens and toxics from garbage accumulation.	California's strict rules for recycling should continue to be applied basin wide

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(32) Hazardous material/wastes programs: Underground storage tanks for sewage, fuel, or other potentially harmful substances shall meet TRPA standards and shall be installed, maintained, and monitored in accordance with the BMP Handbook. TRPA will cooperate with other agencies on preparation, evaluation, and implementation of toxic and hazardous spill control plans. All persons handling, transporting, using, or storing toxic or hazardous substances shall comply with applicable state and federal laws. See pp. II-44 and 45 of the Goals and Policies and Chapter 81 of the Code.	Yes	The explanation is adequately captured in the control measure narrative.	Continue to enforce and continue to pursue new technology that will allow for the rapid detection of these system failures when they occur. Encourage construction of above ground fuel tanks, especially in sensitive areas, (marinas and SEZ's). The Lahontan / TRPA MOU delegates underground tank and contaminated groundwater sites and related issues to Lahontan on the California side of the Basin.
(33) BMP implementation program: Snow and ice control practices: Chapter 81 regulates snow removal and snow disposal locations for all public and private snow removal operations. The BMP Handbook addresses snow disposal practices. The implementation program is set forth in Chapter 25 of the Code and involves voluntary, regulatory, and remedial aspects. Snow removal is limited to structures, paved areas, and areas necessary for parking or safe pedestrian access. Snow removal from dirt roads is subject to TRPA regulation.	No	Enforcement issue that is not being addressed. New projects are required to show snow storage areas, however it is existing commercial properties that are the problem. Active BMP retrofit of paved driveways will aid in residential properties.	Incorporate snow and ice reports to identify specific areas of high deicer use as potential pilot projects for BMP effectiveness relative to snow removal practices. Public education program (perhaps through LTEEC) for landowners. Require snow removal plans that include barriers, snow disposal sites in appropriate locations and other BMPs for commercial properties and large developments such as condominium complexes.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality and Soil Conservation Thresholds			
Compliance Measure	Effectiveness	Explanation	Recommendation
(34) Reporting requirements, highway abrasives and deicers: Institutional users of road salt shall keep records on salt application. Major users of salt and abrasives shall initiate a tracking program and present annual reports to TRPA. (See Goals and Policies, p.II-44 and Chapter 81 of the Code).	Yes, but not entirely.	Currently TRPA is receiving reports from some of the large users (Caltrans and NDOT). There is no staff time devoted to interpretation of these reports and follow up monitoring	Prioritize projects and/or additional urban runoff treatment in areas of high use. Continue with interagency working groups related to maintenance and development of basin-wide standards. These issues need to be resolved as part of Pathway, and include post snow street sweeping for reduction of fine particulate which reduces Lake Tahoe Clarity.
(35) BMP implementation program--roads, trails, skidding, logging practices: The BMP Handbook and Chapter 71 of the TRPA Code identify the required BMPs for roads, trails, skidding, and logging. The program of implementation is set forth in Chapter 25 of the Code	Yes	TRPA's Registered Professional Forester will vigilantly monitor activities associated with logging activities and recommend appropriate adjustment of permits and prescriptions to enforce the most current and appropriate BMPs.	Continue to enforce and expand knowledge base to incorporate and minimize the deleterious consequences associated with logging activities. LTBMU has implemented a program to reduce the water quality risk from these activities through the application of BMPs.
(36) BMP implementation program--outdoor recreation: Outdoors recreation uses are subject to the BMP requirements of Chapter 25 of the TRPA Code of Ordinances. The required practices are described in the BMP Handbook.	Yes, but not entirely	Bike trails, ski areas, shore zone use, and other concentrated recreational use requires a specific suite of on-the-ground mitigation to minimize the aggravation to the landscape that is often associated we these types of concentrated activities.	The appropriate installation of BMPs that are tailored to minimize the accelerated erosion often associated with concentrated recreational use needs further development. Some of these impacts are addressed under Master Plans.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality Threshold			
Compliance Measure	Effectiveness	Explanation	Recommendation
(37) BMP implementation program--livestock confinement and grazing: Farm and ranch structures, grazing, range pasture management, and range improvement are primary resource management uses and are permissible as set forth in the Plan Area Statements (Code, Chapter 18). TRPA approval is required for a new grazing or confinement project. (See Code, Chapter 73). Application of BMPs is required of owners and operators of livestock confinement (corrals) and grazing. The implementation program is set forth in Chapter 25 of the Code. The required practices are described in the BMP Handbook and the Landscape Guide.	Yes, but not entirely	The explanation is adequately captured in the control measure narrative.	TRPA has not completed the process of bringing livestock containment facilities into compliance with the established and new technologies that will help mitigate the consequences of concentrated livestock containment (nutrient and human pathogen contamination, and impacts to SEZ vegetation and soils. TRPA should evaluate the effectiveness of grazing BMPs on protection of stream channels and water quality.
(38) BMP implementation program--pesticides: The use and storage of insecticides, fungicides, and herbicides must be consistent with the BMP Handbook. See also in-place water quality compliance measure (47).	Yes but could use further development.	The States regulate the handling and storage of these types of chemicals through licensed applicators because there misuse is difficult if not impossible to mitigate. Lahontan and TRPA prohibit the use of pesticides in SEZs, or where aquatic systems are at risk, unless for example TRPA finds that the pest problem threatens threshold attainment, or is required for that attainment.	TRPA should amend the Regional Plan to incorporate specific guidelines related to pesticide use. Currently very little information exists in the BMP Handbook. TRPA should develop BMPs related to the use and disposal of pesticide products and provide outreach and education through landscape companies and nurseries. These products should only be allowed if other methods are ineffective, TRPA encourages integrated pest management as an alternative

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality Threshold			
Compliance Measure	Effectiveness	Explanation	Recommendation
(39) Land use planning and controls -- timber harvesting: Reforestation, regeneration harvest, sanitation salvage cut, selection cut, special cut, thinning, timber stand improvement, tree farms, early successional stage management, fire detection and suppression, fuels treatment and management, insect and disease suppression, and prescribed fire management are primary resource management uses and are permissible as set forth in the TRPA Plan Area Statements (Code of Ordinances, Chapter 18).	Yes	The explanation is adequately captured in the control measure narrative.	Continue to enforce the provisions of the TRPA Code. Increase programmatic participation and support for compliance in the accurate interpretation and application of the Code.
(40) Land use planning and controls - outdoor recreation: Beach recreation, boat launching facilities, cross-country skiing courses, developed campgrounds, golf courses, group facilities, off-road vehicle courses, outdoor recreation concessions, marinas, RV parks, riding and hiking trails, rural sports, skiing facilities, snow mobile courses, undeveloped campgrounds, and visitor information centers are primary recreational uses and are permissible uses as set forth in the Plan Area Statements (Code, Chapter 18). Expansion of existing ski facilities must be based on approved master plan.	Yes, but not entirely	The explanation is adequately captured in the control measure narrative.	TRPA will continue the commitment to update and implement those Code chapters that address those activities within the urban boundaries and Plan Area Statements which reflects our commitment to reducing disturbance on undisturbed lands.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality Threshold			
Compliance Measure	Effectiveness	Explanation	Recommendation
(41) Land use planning and controls-- OHV use: Off Highway Vehicle use is prohibited in the Region except on specified trails, roads, or designated areas where impacts can be mitigated. (See Goals and Policies, p. V-3).	Yes, but not entirely.	The explanation is adequately captured in the control measure narrative.	This control measure warrants additional review to evaluate these types of recreational activities within the Lake Tahoe Basin. The intent is to assure that these types of activities are appropriately matched to the types of soils that are most resilient to these impacts. Also appropriate BMPs need to be in place.
(42) Control of encroachment and coverage in sensitive areas: Public outdoor recreation facilities may encroach into sensitive lands provided TRPA makes required findings designed to protect water quality and ensure mitigation of impacts. Projects that, by their nature, need not be located in sensitive lands are identified in the 208 plans, Table 16.	Yes, but not entirely.	The explanation is adequately captured in the control measure narrative.	Increase vigilant enforcement and a re-affirmation of TRPA's historical interpretation of Table 16 in the 208 Water Quality Management Plan. Proposals for SEZ, Wildlife and Fisheries, and Vegetation under Pathway recommend that certain designated aquatic sites be protected from these exceptions and set aside from any such coverage or impacts.
(43) Control of shorezone encroachment and vegetation alteration: All vegetation at the interface between the backshore and foreshore shall be undisturbed. The use of lawns or ornamental vegetation in the shorezone is discouraged in the Goals and Policies, and the Code of Ordinances. There are eight shorezone tolerance districts along the shoreline of Lake Tahoe, Fallen Leaf Lake, and Cascade Lake. Specific rules apply to each district. (See Chapter 53 of the Code of Ordinances).	Yes.	The installation lawns and/or ornamental vegetation should be discouraged and in most cases prohibited. Code Section 81.7 was amended toward these ends in December 2002.	Continue to enforce the conditions outlined in Section 55.6 and 81.7 of the TRPA Code that sets forth standards for vegetation alteration in the backshore area, and fertilizer management. This requires that plants used for revegetation within the backshore be from the TRPA-approved list of backshore plants.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality Threshold			
Compliance Measure	Effectiveness	Explanation	Recommendation
(44) BMP implementation program--shorezone areas: The BMP handbook includes special BMPs for the shorezone. The program of implementation is set forth in Chapter 25 of the Code. The earlier Shorezone EIS was completed in 1999 and the 2004 EIS and Alternative 6 Supplements will have potential impact to this measure.	Yes, but not entirely.	TRPA has hired Shorezone Compliance Staff to address these issues.	Develop action plans for implementation of dynamic shoreline BMPs and protective structures (i.e. appropriately designed revetments). Utilize DRI's Shoreline Erosion Study to help focus TRPA's activities to the types of Shorezone revetments, erosion prone areas of the shoreline, and methods of shoreline stabilization that are most effective.
(45) BMP implementation program--dredging and construction in Lake Tahoe: The BMP Handbook includes BMPs for construction and dredging in Lake Tahoe. The program implementation is set forth in Chapter 25 of the Code.	Yes, but with the need to incorporate new technologies	This is a compliance measure not a BMP measure. Dredging is a permitted activity and is subject to fairly strict control, illegal activities may have a larger impact. The 2003 Lahontan / TRPA MOU delegates primary dredging permitting on the California side to Lahontan.	TRPA will continue to monitor this activity. This agency will also concurrently seek out new technologies that may allow for this activity while minimizing the associated impacts such as suction dredging.
(46) Restrictions and conditions on filling and dredging: Filling and dredging are subject to TRPA ordinance provisions to protect water quality and the natural function and dynamics of the shorelines and lakebeds. See Chapter 54 of the Code.	Yes, , but with the need to incorporate new technologies	This is a compliance measure not a BMP measure. Same as above.	TRPA will continue to monitor and enforce the applicable provisions in the TRPA Code. This agency will also concurrently seek out new technologies that may allow for this activity while minimizing the associated impacts (see above).
(47) Protection of stream deltas: Stream deltas shall be protected from encroachment and disturbance as described under SEZ protection provisions, in-place water quality compliance measure (13).	Yes, but not entirely	Protection of 100 year floodplain, although not a threshold is a primary responsibility of the Soil Conservation/SEZ program. Restricted activities as a consequence of floodplain management and SEZ protection provisions that are already in place will continue to allow TRPA to manage stream deltas in a effort to encourage proper ecological function.	TRPA has reviewed and updated both the demarcation of the 100 year floodplain and SEZs. TRPA should pursue formation of Shorezone SEZ identification criteria, which differs from alluvial (typical) SEZs.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality Threshold			
Compliance Measure	Effectiveness	Explanation	Recommendation
(48) Marina master plans: Expansion of marinas is limited until TRPA adopts a master plan for the marina (see Chapter 16 of the Code of Ordinances).	Yes.	Marina Master Plans are an effective means for consistent and regulated expansion of such facilities.	Strict enforcement and monitoring of permit requirements. Apply Shorezone Ordinances when adopted.+
(49) Additional pump-out facilities: Liquid and solid wastes from boats shall be discharged at approved pump-out facilities. Pump-out facilities shall be provided by marinas and launching facilities as required by Chapter 25 of the Code and the BMP Handbook.	Yes, but not entirely	Existing pump out facilities at marinas require maintenance and are not subject to regular inspections. Not all launching facilities have provisions. The explanation is adequately captured in the control measure narrative.	TRPA will continue to review improved compliance procedures as well as advanced technologies to deal with marine generated wastes. See above.
(50) Controls on anti-fouling coatings: The BMP Handbook incorporates California and federal restrictions on the use of paints containing tributyltin (TBT). The program of implementation is set forth in Chapter 25 of the Code. The Lahontan Board also enforces the California restrictions.	Yes, but not entirely.	The explanation is adequately captured in the control measure narrative.	Continue to enforce the applicable measures outlined in the BMP Handbook.
(51) Modifications to list of exempt activities: This is a contingency measure not presently enacted by TRPA. Activities presently exempt from requirements for TRPA permits, but which are found to have adverse impacts, may be removed from the list of exempt or qualified exempt activities.	Yes, but not entirely.	These types of activities are covered under existing Code Chapter 4 lists, and MOUs with the local jurisdictions and other responsible entities.	Suggest that this be converted to supplemental measure in place. Review current MOUs with local jurisdictions for completeness and updates relative to recent compliance violations.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality Threshold			
Compliance Measure	Effectiveness	Explanation	Recommendation
(Supplemental Measure 52) More stringent SEZ encroachment rules: More stringent SEZ encroachment rules could include reducing or eliminating the exceptions to the prohibitions on SEZ encroachment.	Not in place	There is a need to review the activities that are presently allowed within SEZ's. Pathway proposal are suggesting that specific aquatic sites be additionally protected as the measure suggests.	TRPA feels there is a need to review the SEZ rules. There is also a need to reevaluate the qualified exempt activities that are currently allowed under the existing code of ordinances.
(Supplemental Measure 53) More stringent coverage transfer requirements: This is a contingency measure not presently enacted by TRPA. More stringent requirements could include: elimination of transfers of potential coverage; elimination of transfers of soft coverage; increased coverage transfer ratios; or restriction on TRPA's ability to substitute transfers of soft or potential coverage for hard coverage in commercial transfers.	Not in place	The explanation is adequately captured in the control measure narrative. Pathway proposals will include coverage transfer rules and the amount of coverage in sub watersheds and other area basis approaches.	TRPA in 2001 reaffirmed the interpretation of the language of chapters 20 and 38. This recent review has clarified that hard, soft and potential coverage can be used to mitigate excess coverage for residential, recreation, and public service projects however; only hard coverage can be used to mitigate excess coverage for commercial and tourist projects. Pathway proposals for land capability are likely to suggest changes in the management approaches.
(Supplemental Measure 54) Modifications to IPES: This is a contingency measure not presently enacted by TRPA. The Goals and Policies contemplate adjustments in IPES based on results of a special component of the TRPA monitoring program to evaluate IPES. Modifications to IPES could include further restrictions or safeguards on movement of the IPES line.	Not in place	Recommend as a measure in place. Confirmation of certain limitations on how extensively the K-factor of the REH portion of IPES can be manipulated. The IPES patch is being implemented as part of pathway to accommodate the new soil map units and other new data on the characteristics and sensitivity of soils to disturbance and coverage.	A performance audit of the IPES program was completed in July, 2000 with limited conclusions. Data sets could be used to further investigate the relationships and performance of IPES in sediment reduction to lake tributaries.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality Threshold			
Compliance Measure	Effectiveness	Explanation	Recommendation
(Supplemental Measure 56) Control of upwind pollutants: Future compliance measures implemented by upwind jurisdictions will have a beneficial effect on transport of nitrogen compounds to the Tahoe Region. The 208 plan contains a strategy for encouraging controls to upwind NOx emissions.	Not in place	The 2006 Lake Tahoe Atmospheric Deposition study results and technical memo (CARB), have demonstrated that the majority of atmospheric deposition, for NOx is from within basin sources.	Delete this Supplemental Measure and focus on reduction of NOx emissions with transportation projects within the Tahoe Basin.
(Supplemental Measure 57) Additional controls on combustion heaters. This compliance measure could include requirements to install certified combustion heaters upon sale of a home, or sooner.	Not in place	This measure needs to be evaluated as to the significance of atmospheric deposition from these sources.	Implement Pathway recommendations on this issue.
(Supplemental Measure 58) Improved exfiltration control program. An improved program could include monitoring and reporting requirements and compliance schedules for correction of problems.	Not in place	The Army Corps Feasibility Study published in 2003, suggest that exfiltration is not as significant a source as previously thought.	Continue to leave as supplemental and provide for research direction to demonstrate need and effectiveness.
(Supplemental Measure 59) Improved infiltration control program: An improved program could include monitoring and reporting requirements and compliance schedules for correction of problems.	Not in place	A couple of recent studies have not substantiated impacts to groundwater for infiltration of hydrocarbons or phosphorus.	Continue to leave as supplemental and provide for research direction to demonstrate need and effectiveness. More research is needed on potential groundwater impacts, and sources of nutrient loading from groundwater to Lake Tahoe.

Water Quality Appendix.

Appendix Table 3-4. Effectiveness of Measures in Place for the Water Quality Threshold			
Compliance Measure	Effectiveness	Explanation	Recommendation
(Supplemental Measure 60) Water conservation/ flow reduction program: Such a program could include problem identification, strategy development, improvement recommendations, and implementation effectiveness.	Not in place	Periodic drought invariably leads to reduced water table levels and aquifer storage. As a consequence there is generally an increase in Total Dissolved Solids (TDS) as well as an increase in the concentration of undesirable pollutants.	Encourage and promote an educational outreach program that provides incentives for water conservation at both the residential and commercial level. Delete this measure, since it does not consider nutrient loading to Lake Tahoe, which is the focus for Lake Tahoe Clarity, and does not threaten human or environmental health.
(Supplemental Measure 61) Additional land use controls: It could include amendments to the Plan Area Statements to restrict areas in which certain or special uses are allowed.	Not in place	This measure could be applied to Source Water Protection, and other sensitive areas that could impact Lake Tahoe Clarity.	Implement Pathway recommendations in these matters.

Water Quality Appendix.

Appendix Table 3-5. Lake Tahoe Annual Average Secchi Depth (m) at Index Station

Year	Annual Avg. Secchi Depth (m)	min	max	1 s.d.	n	Winter	Summer	Annual
						(Dec-Mar) Secchi Depth (m)	(Jun-Sep) Secchi Depth (m)	Avg. Secchi Depth (ft)
1968	31.22	24.000	43.250	4.713	31	33.39	28.69	102.4
1969	28.57	15.500	40.500	5.354	31	36.26	22.81	93.7
1970	30.21	25.500	35.000	2.503	30	30.30	28.50	99.1
1971	28.74	21.000	35.250	4.280	24	33.55	26.27	94.3
1972	27.41	22.500	37.750	3.606	28	26.14	27.75	89.9
1973	26.08	19.500	33.000	3.532	28	29.54	22.95	85.5
1974	27.21	16.500	41.250	4.451	33	29.74	25.32	89.3
1975	26.11	20.000	34.000	3.867	28	28.79	23.72	85.7
1976	27.38	22.500	37.500	3.088	36	27.63	25.85	89.8
1977	27.75	23.000	33.500	2.575	32	27.81	28.26	91.1
1978	25.95	19.500	33.000	3.219	27	26.72	24.95	85.1
1979	26.72	20.000	37.750	3.957	35	28.98	24.89	87.7
1980	24.82	19.500	33.500	3.609	32	27.67	22.83	81.4
1981	27.39	20.500	34.000	3.557	36	24.88	29.81	89.9
1982	24.31	14.500	35.500	5.568	28	27.57	19.75	79.8
1983	22.38	8.500	38.500	6.879	33	29.05	17.41	73.4
1984	22.79	14.500	30.000	3.830	32	21.97	22.73	74.8
1985	24.20	15.750	32.500	4.342	37	27.34	22.07	79.4
1986	24.08	18.500	29.500	2.984	34	26.87	22.64	79.0
1987	24.65	19.500	31.750	3.475	33	23.20	26.14	80.9
1988	24.66	15.000	35.500	4.803	32	23.61	27.97	80.9
1989	23.64	14.500	41.000	5.883	34	26.65	22.96	77.6
1990	23.64	15.000	36.500	4.391	33	25.80	23.01	77.6
1991	22.43	15.750	27.500	2.724	34	21.64	22.22	73.6
1992	23.89	15.500	30.500	3.955	34	22.12	25.20	78.4
1993	21.47	10.000	40.000	5.771	35	25.81	19.95	70.5
1994	22.57	16.500	28.500	2.815	33	21.82	23.71	74.1

Water Quality Appendix.

Appendix Table 3-5. Lake Tahoe Annual Average Secchi Depth (m) at Index Station								
Year	Annual Avg. Secchi Depth (m)	min	max	1 s.d.	n	Winter (Dec-Mar) Secchi Depth (m)	Summer (Jun-Sep) Secchi Depth (m)	Annual Avg. Secchi Depth (ft)
1995	21.47	11.250	29.750	4.421	32	22.86	17.67	70.4
1996	23.45	15.750	41.000	5.389	34	26.88	21.05	76.9
1997	19.53	13.000	25.500	3.123	34	19.97	19.12	64.1
1998	20.14	14.500	32.750	3.684	31	23.15	18.24	66.1
1999	21.04	13.250	32.500	5.368	34	24.72	19.25	69.0
2000	20.53	14.500	33.000	4.008	33	21.51	19.54	67.4
2001	22.44	17.500	30.500	3.055	32	23.70	22.24	73.6
2002	23.78	18.250	41.000	4.013	34	23.91	24.66	78.0
2003	21.62	13.500	25.500	2.358	35	21.62	21.12	71.0
2004	22.42	15.000	31.750	3.478	33	25.38	22.25	73.6
2005	22.05	18.500	29.500	2.694	30	24.51	20.40	72.3
2006	20.63	14.500	25.500	3.929	18	23.43	17.48	67.7

Water Quality Appendix.

Appendix Table 3-6. Lake Tahoe Annual Primary Productivity at Index Station	
Year	Primary Productivity (g C m⁻² y⁻¹)
1959.5	39.0
1968	46.9
1969	50.5
1970	52.5
1971	58.7
1972	59.1
1973	61.1
1974	65.8
1975	78.9
1976	76.1
1977	74.5
1978	79.9
1979	80.7
1980	95.9
1981	88.0
1982	86.5
1983	114.2
1984	107.5
1985	119.8
1986	118.2
1987	124.2
1988	117.7
1989	148.0
1990	133.8
1991	149.2
1992	149.6
1993	182.6
1994	153.7
1995	164.4
1996	154.8
1997	168.9
1998	194.3
1999	190.4
2000	189.1
2001	193.9
2002	177.1
2003	183.5
2004	190.4
2005	203.0
2006	205.5

Water Quality Appendix.

Appendix Table 3-7. California and Nevada Tributary Water Quality Data- Annual Average 2000-2005 Water Years							
CALIFORNIA		2000	2001	2002	2003	2004	2005
Total P (mg/l)	Trout Creek	0.042	0.023	0.025	0.040	0.030	0.046
	Upper Truckee	0.081	0.024	0.026	0.046	0.025	0.040
	Blackwood Creek	0.075	0.028	0.032	0.078	0.030	0.086
	Ward Creek	0.079	0.034	0.026	0.034	0.025	0.082
	General Creek	0.023	0.017	0.017	0.024	0.018	0.024
Total N (mg/l)	Trout Creek	0.154	0.139	0.255	0.519	0.216	0.263
	Upper Truckee	0.255	0.166	0.309	0.228	0.214	0.230
	Blackwood Creek	0.191	0.144	0.354	0.078	0.188	0.329
	Ward Creek	0.169	0.150	0.259	0.225	0.166	0.313
	General Creek	0.156	0.145	0.286	0.232	0.166	0.172
Total Fe (mg/l)	Trout Creek	0.75	0.408	0.407	N/A		
	Upper Truckee	1.11	0.334	0.468			
	Blackwood Creek	1.18	0.209	0.461			
	Ward Creek	0.805	0.209	0.214			
	General Creek	0.301	0.142	0.205			
Suspended Sediment Concentration (mg/l)	Trout Creek	18	7	6	17	9	33
	Upper Truckee	73	12	14	36	14	38
	Blackwood Creek	91	25	21	45	21	139
	Ward Creek	56	16	12	18	12	118
	General Creek	18	7	7	9	11	56

Water Quality Appendix.

Appendix Table 3-7. California and Nevada Tributary Water Quality Data- Annual Average 2000-2005							
NEVADA		2000	2001	2002	2003	2004	2005
Soluble Reactive Phosphorus (mg/l)	Third Creek	0.008	0.008	0.007	0.0078	0.008	0.006
	Incline Creek	0.010	0.010	0.010	0.0099	0.010	0.009
	Logan House Creek	0.002	0.003	0.003	0.0023	0.002	0.003
	Glenbrook Creek	0.016	0.012	0.008	0.0099	0.010	0.014
	Edgewood Creek	0.009	0.009	0.014	0.0123	0.011	0.009
Total Soluble Inorganic Nitrogen (mg/l)	Third Creek	0.014	0.006	0.011	0.078	0.010	0.006
	Incline Creek	0.032	0.033	0.033	0.0286	0.035	0.027
	Logan House Creek	0.019	0.032	0.014	0.0121	0.014	0.008
	Glenbrook Creek	0.022	0.012	0.006	0.0260	0.019	0.036
	Edgewood Creek	0.03	0.019	0.011	0.0258	0.038	0.028
Suspended Sediment Concentration (mg/l)	Third Creek	83	9	32	34	12	34
	Incline Creek	18	13	19	46	14	41
	Logan House Creek	10	6	6	6	4	14
	Glenbrook Creek	14	7	10	7	5	13
	Edgewood Creek	7.5	20	5	9	5	4
Source: TRPA, 2000+							