LAKE TAHOE NUTRIENT AND SEDIMENT TOTAL MAXIMUM DAILY LOAD

FALL 2002 NEWSLETTER

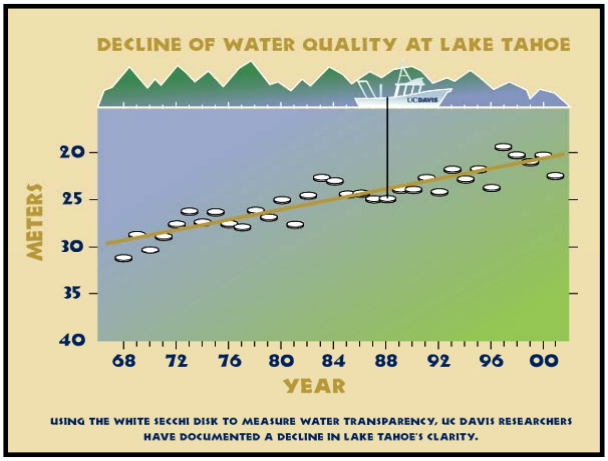
Nevada Division of Environmental Protection Lahontan Regional Water Quality Control Board

WELCOME

This is the first edition of a quarterly newsletter on a new program to protect Lake Tahoe called the Total Maximum Daily Load, or "TMDL." In this issue, we introduce the TMDL concept and describe how it's being applied to protect Lake Tahoe's legendary but declining clarity. TMDLs provide a framework mandated by the federal Clean Water Act to scientifically understand and control the sources of pollutants that impair lake clarity. The TMDL will form the basis for a comprehensive and collaborative lake clarity restoration plan. Once completed, it is anticipated that the TMDL will greatly enhance our scientific understanding of lake processes and help guide the implementation of existing projects and programs.

CAUSE FOR CONCERN

The Tahoe Basin is a changing landscape, with significant portions of this once pristine region now urbanized. Studies during the past forty years have shown that many factors have interacted to degrade the Lake Tahoe Basin's air quality, terrestrial landscape, and water quality. These factors include land disturbance, increasing resident and tourist population, habitat destruction, air pollution, soil erosion, roads and road maintenance, and loss of natural landscapes capable of detaining and infiltrating rainfall runoff. Since 1968, there has been a decline of Lake Tahoe's clarity at an alarming rate of nearly one foot per year, as measured by lowering a dinner plate sized disk, known as a Secchi disk, into the lake until it is no longer visible.



AGENCY RESPONSE

The Lake Tahoe Basin benefits from the hard work of numerous federal, state and local agencies. The collective efforts of these agencies have provided the scientific platform upon which the TMDL will be built. Ultimately, all TMDLs require the approval of the U.S. Environmental Protection Agency (USEPA) after the adoption by state water quality protection agencies. In California, the Lahontan Regional Water Quality Control Board (LRWQCB) regulates water pollution sources in all water bodies east of the Sierra Nevada crest, and has the primary responsibility of protecting water quality in the California portion of the Lake Tahoe Basin. The Nevada Division of Environmental Protection (NDEP) is the corresponding authority

for the Nevada portion of the Basin, and is an equal partner with the LRWQCB in developing and adopting the Lake Tahoe TMDL. Both agencies are conducting this multi-year project in collaboration with other local, State and Federal agencies responsible for protecting Lake Tahoe and its watershed, including the Tahoe Regional Planning Agency (TRPA), the California Tahoe Conservancy (CTC), the Nevada Division of State Lands, the California Air Resources Board (CARB), the U.S. Forest Service (USFS), and several others.

Total Maximum Daily Loads and Water Quality Restoration Planning

A TMDL is a **water quality restoration plan** designed to reduce the amount of pollution contributing to the decline of Lake Tahoe's clarity. Technically, a TMDL is defined as the amount of a specific pollutant that a water body can receive and still meet water quality standards. Research at Lake Tahoe has shown that it is the load or mass (kilograms per year) of fine-sediment and nutrients, and not simply their concentration (milligrams per liter) in stream flow or runoff, that affects the long-term clarity trend.

The 1972 Clean Water Act (CWA) established the TMDL program for water bodies that do not achieve their water quality standards. A TMDL represents the *assimilative capacity* of the water body, or its ability to accept contaminants without exceeding a level of water quality that protects its environmental and social values. TMDLs usually involve an effort to characterize a water body's response to pollutant loads by means of a water quality model, followed by a calculation of the load reduction necessary to restore the water body to its desired condition. The calculated allowable loading is then allocated to existing and expected future pollutant sources. The Lake Tahoe TMDL will provide measurable targets for load reduction that can be used to guide watershed and air quality restoration efforts such as the Environmental Improvement Program, which is a basin-wide restoration plan developed by the TRPA, as well as small scale individual projects.

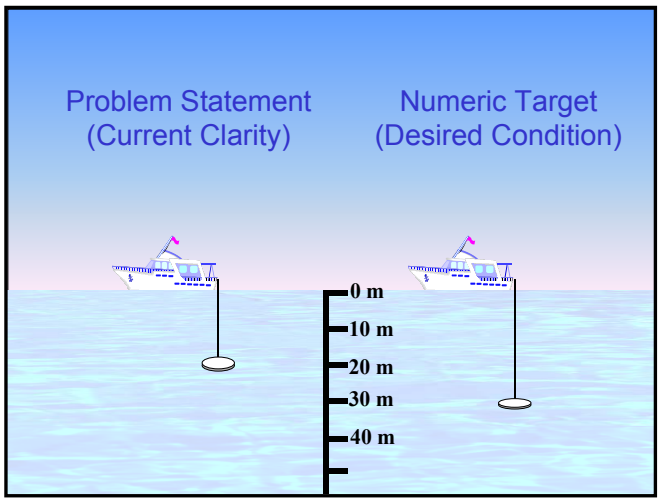
TMDL Approach

Elements of a TMDL

- **Problem Statement**
- **Numeric Target**
- **Source Analysis**
- **Linkage Analysis**
- **Load Allocations**
- **Margin of Safety**
- **Implementation Plan**

The U.S. EPA considers the following TMDL elements critical to meeting Clean Water Act requirements. The **problem statement** must clearly define the environmental concern and identify the pollutant for which the TMDL will be established. Next, **numeric targets** must be defined for lake water quality measures of concern (e.g., Secchi depth and associated parameters such as algae and particle concentrations). For Lake Tahoe, this has been determined by existing water quality standards. Particularly, the clarity standard for Lake Tahoe is currently being violated, which indicates the problem. The existing annual average Secchi depth is approximately 20 meters (66 feet), while the water quality standard, or numeric target, calls for an annual average clarity of 29.6 meters (97 feet).

The third step is to identify **sources** of critical pollutants (nutrients and fine sediments) and evaluate their loading. Fourth, and most critical to the process, is to establish the **linkage** between pollutant loading and lake response. To accomplish this, a clarity model is being developed for Lake Tahoe that ties nutrient and fine sediment inputs to clarity loss. From this linkage analysis, it is then possible to calculate and **allocate** a target for pollutant loading among contributing sources (including a **margin of safety**), such that the numeric targets will be achieved. Finally, it is necessary to identify follow-up monitoring needs and establish a plan to ensure adequate TMDL **implementation**, and to provide for its adjustment in the future if appropriate.



TMDLs Make a Nice Fit for Lake Tahoe

Watershed scale planning, science-based decision making, measurable objectives, and interagency collaboration are fundamental to successful water quality management in the Lake Tahoe Basin. This understanding is reflected in the beneficial pollution control measures that are currently underway, such as installation of erosion control projects, construction of storm water treatment facilities, building limitations, and preservation and restoration of environmentally sensitive lands. However, until now, there were neither sufficient resources nor information to determine the magnitude of reduction in fine-sediment and nutrient loading necessary to restore Lake Tahoe's historic clarity.

Science-Based Decision Making

For many years, it has been appreciated that in order to affect lake management for the purpose of achieving water clarity standards and thresholds, we need to know:

- **What are the specific sources of sediment and nutrients to the lake and what are their respective contributions?**
- **How much of a reduction in loading is necessary to achieve the desired thresholds and/or water quality standards for Lake Tahoe?**
- **How will this reduction be achieved?**

The TMDL will be an important contribution to each of these issues.

The TMDL will provide science-based, measurable targets for pollutant reduction that will be used in designing restoration activities and watershed planning. This will provide water quality and land-use managers with guidance on the degree of effort needed to achieve the desired level of water clarity as expressed by the TRPA's Environmental Thresholds and by the States of California and Nevada's Water Quality Standards. TMDL implementation will be consistent with the principle of *adaptive management*, by which resource management strategies are constantly refined through a step-wise process of monitoring, data evaluation, decision making and action.

RESEARCH AND DATA COLLECTION

As a resource of national importance, Lake Tahoe has received of a great deal of scientific attention. This rich historic knowledge base will be used in concert with new research currently underway to facilitate the conversion of best available information and understanding into restoration planning. This requires basic and applied research, expanded monitoring, data gathering, and best professional judgment.

Current scientific understanding is built upon 40 years of investigation as well as more recent efforts such as the 1997 Presidential Forum, the USFS's Watershed Assessment, the Lake Tahoe Science Symposia, recommendations of the Lake Tahoe Science Advisory Group, the establishment of numerous working groups that discuss specific technical issues, and literally hundreds of meetings between interested agencies, research institutions and public stakeholders. In order to further this understanding, the LRWQCB and the California Air Resources Board (CARB) submitted a joint budget request to the State of California for funding to pursue recommended scientific investigations. In July 2001, this budget request was approved and work began on an ambitious 2-3 year collaborative program to investigate critical information gaps in the following topics.

New Research and Monitoring Projects

- **Reconstruction of historic meteorology** – UC Davis
- **Loading of fine sediment** – Collective Effort
- **Stream channel erosion** – USDA National Sedimentation Laboratory
- **Groundwater** – US Army Corps of Engineers
- **Nearshore water quality** – Desert Research Institute (DRI)
- **Sewer line exfiltration** – US Army Corps of Engineers
- **Stormwater runoff monitoring** - Tahoe Research Group (TRG), DRI
- **Statistical analysis of loading related to land use characteristics** Hydrokios Consulting, DRI, TRG
- **Watershed Modeling** – Tetra Tech Inc.
- **Biologically available phosphorus** – University of Nevada, Reno
- **Characterization and fate of particles in Lake Tahoe** – UC Davis
- **Application of Clarity Model** – UC Davis
- **Stormwater BMP evaluations and implementation feasibility** – GeoSyntech Consulting
- **Establish air quality monitoring network** – California Air Resources Board (CARB), TRPA and others
- **Characterization of air quality emission sources** – CARB
- **Modeling of atmospheric deposition to Lake Tahoe** – CARB
- **Data management** – TRPA

This combined level of effort is unique and will include well over 100 participants. Development of the TMDL Research Team has been collaborative and includes a wide cross section of top university, agency and consulting scientists from both public and private sectors. This diversity of participants allows for a multi-disciplinary approach, that, in concert with our existing understanding of Lake Tahoe and its watershed, will provide the scientific basis for the Lake Tahoe TMDL.

Initial Lake Tahoe Nutrient Budget

	Total-N	Total-P	Dissolved-P
Atmospheric Deposition	234 (59%)	12.4 (28%)	5.6 (39%)
Stream loading	82 (20%)	13.3 (31%)	2.4 (17%)
Direct runoff	23 (6%)	12.3 (28%)	2.4 (17%)
Groundwater	60 (15%)	4 (9%)	4 (27%)
Shore erosion	1 (<1%)	1.6 (4%)	No Data
Total	400	43.6	14.4

(values as metric tons)

A preliminary nutrient budget contained in the Lake Tahoe Watershed Assessment (2000), indicates the relative contributions of several pollutant sources. An important product of the TMDL Research Program will be to further refine source categories and the loadings of these pollutants and of fine sediment.

Key to this effort is a greatly expanded monitoring program that will provide a more detailed accounting of a number of these sources. The storm water runoff monitoring project being conducted for the TMDL represents the first time such an extensive, basin-wide investigation of urban storm water runoff has been done at Lake Tahoe. New research will also allow us to evaluate the potential sources of pollutants from groundwater, and stream channel erosion.

Since the lake has an extremely long retention time for the pollutants of concern, the direct effect of restoration on lake clarity may not be seen for many years. Based on the results of expanded monitoring, new research, and data collection, predictive relationships for water quality versus land-use will be developed. These relationships will provide scientists with the ability to develop powerful ecosystem models that will predict the effect of various pollutant loading scenarios without having to wait decades to see how the lake responds.

Scientist measuring stream conditions

Watershed modeling will use available data on atmospheric and meteorological inputs, pollutant generation rates from different land uses, spatial information such as topography and impervious surface, BMP effectiveness and implementation, and stream bank erosion. The overall goal of the watershed model is to quantify pollution loading to Lake Tahoe and to simulate watershed scale changes in hydrology and pollutant loading resulting from implementation of different BMP scenarios. This will serve as the framework for refining the nutrient and sediment budget, help to identify regions of elevated load, and allow us to quantify the effects of management scenarios.

While atmospheric deposition has received some scientific attention, calculating the TMDL requires a higher level of confidence in whole-lake loading estimates for this source. The importance of direct deposition of pollutants to Lake Tahoe has prompted the CARB to design an extensive project to study air quality and atmospheric deposition in the Lake Tahoe Basin. CARB's atmospheric modeling will determine the relative contribution of in-basin versus out-of-basin air pollution sources.

Finally, a powerful Clarity Model developed by UC Davis will be utilized to examine lake response to loading and ultimately to develop the load capacity (TMDL) for Lake Tahoe. The model will also be run to examine expected changes in lake condition based on various load reduction strategies. The goal of the model is to run simulations of up to 50 years in duration, with the ability to change loading characteristics during that period.

Young scientist prepares for Secchi disk

TIMETABLE AND INTEGRATION WITH OTHER LAKE TAHOE BASIN ENVIRONMENTAL DOCUMENTS

A chart of the TMDL project timeline is provided on the outside cover. In order to establish the TMDL, two years of new research and monitoring data will be collected, interpreted, and combined with a wealth of historical data. Lake response modeling will be conducted in early 2005, resulting in a TMDL containing the overall load reductions (called the 'Technical' TMDL) for public review by Spring 2005.

Simultaneous with the final stages of TMDL development, the LRWQCB will also be undertaking substantial research and public outreach into various methods of pollution load reduction and TMDL implementation scenarios. From April 2003 through June 2006, best management practices (BMPs) for reducing all pollutant sources will be evaluated and eventually combined into a number of alternative scenarios or combinations that will achieve the necessary total load reduction established by the TMDL.

Participating agencies and other stakeholders will be involved through public education, technical workshops and discussion of implementation scenarios. Successful TMDL development must include a high degree of stakeholder review and input. It is expected that public input participation will be especially significant during the allocation phase, when necessary load reductions are distributed and an implementation plan is developed. The LRWQCB and NDEP plan to adopt the final TMDL by January 2007, after which it will be submitted to

the U.S. EPA for approval. Following its adoption, the TMDL can be revised in the future based on refinement of the science and review of progress toward its implementation.

It is expected that the TMDL and implementation plan will be incorporated into the TRPA's Regional Plan (scheduled for adoption in June 2007). Along with the USFS Lake Tahoe Basin Management Unit's Forest Plan, these three planning documents will guide Tahoe's restoration efforts.

Planning Documents to be Updated in Spring 2007

- **TRPA - Regional Plan**
- **LRWQCB - Basin Plan**
- **USFS - Forest Plan**

It is anticipated that these documents will be updated with the use of information developed for the Lake Tahoe Nutrient and Sediment TMDL.

FUTURE ACTIVITIES AND SOURCES OF INFORMATION

The Lahontan Regional Water Quality Control Board and Nevada Division of Environmental Protection, in partnership with U.S. Forest Service, Tahoe Regional Planning Agency, California Air Resources Board and other entities, have conducted extensive outreach on the TMDL. This effort is ongoing and is available to anyone who desires to meet with Regional Board staff and to learn about the project. The LRWQCB plans to conduct yearly public workshops throughout the Basin to inform the public on the progress of TMDL related research and development and other activities. As development progresses, the number of outreach meetings will increase.

The above-mentioned agencies with substantial technical support from USEPA, USACE, CTC and many others meet regularly at the staff, management and executive levels to coordinate all research, technical and planning activities. These coordinated efforts are designed to produce consistency among the Lahontan Basin Plan, the TRPA Regional Plan, and the USFS Forest Plan.

The LRWQCB is also developing a Lake Tahoe TMDL website with links to all relevant activities and information sources, including: research and overall project plans, outreach materials, media coverage, and related TMDL information including this and future newsletters. Thank you for your interest in the restoration of Lake Tahoe and please feel free to contact us with any additional questions or concerns.

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Lake Tahoe TMDL Timeline