

CHAPTER 7: WATER QUALITY ATTAINMENT STRATEGIES INCLUDING TOTAL MAXIMUM DAILY LOADS

Water Quality Attainment Strategies (WQAS) including Total Maximum Daily Loads (TMDLs) deemed necessary and appropriate to ensure attainment and maintenance of water quality standards in the Region are presented in this chapter.

7.1 Region-Wide Water Quality Attainment Strategies and TMDLs

7.1.1 Water Quality Attainment Strategy and TMDL for Diazinon and Pesticide-related Toxicity in Urban Creeks

The following sections establish a water quality attainment strategy and TMDL for diazinon and pesticide-related toxicity in the Region's urban creeks, including actions and monitoring necessary to implement the strategy. The term "pesticides," as used here, refers to substances (or mixtures of substances) intended for defoliating plants, regulating plant growth, or preventing, destroying, repelling, or mitigating pests that may infest or be detrimental to vegetation, humans, animals, or households, or be present in any agricultural or nonagricultural environment. The term "urban creeks," as used here, refers to freshwater streams that flow through urban areas, including incorporated cities and towns and unincorporated areas with similar land use intensities. This strategy applies to all San Francisco Bay Region urban creeks.

The numeric targets, allocations, and implementation plan described below are intended to ensure that urban creeks meet applicable water quality standards established to protect and support beneficial uses. This strategy will also reduce pesticide concentrations in the Bay resulting from urban creek flows. The effectiveness of the implementation actions, the monitoring undertaken to track progress toward meeting the targets, and the most current scientific understanding pertaining to pesticide-related toxicity will be periodically reviewed, and the strategy will be adapted as necessary to reflect changing conditions and information.

7.1.1.1 Problem Statement

In 1998, a number of the Region's urban creeks were placed on the 303(d) list of impaired waters due to toxicity attributed to diazinon. In the early 1990s, many urban creek water samples collected from selected creeks throughout the Region were toxic to aquatic organisms. Studies found that pesticides, particularly diazinon, caused the toxicity. The 303(d) listings were based on observed toxicity, diazinon detections, and similarities among the Region's urban pesticide use profiles.

When pesticide-related toxicity occurs in urban creek water, creeks do not meet the narrative toxicity objective. When pesticide-related toxicity occurs in sediment, the creeks also do not meet the narrative sediment objective. Likewise, when creek water or sediment is toxic, creeks do not meet the narrative population and community ecology objective. Urban creek waters that fail to meet these objectives are not protective of cold and warm freshwater habitats.

Although U.S. EPA phased out urban diazinon applications at the end of 2004, other pesticides may now pose potential water quality and sediment quality concerns because they are used as diazinon

replacements and because pesticide regulatory programs, as currently implemented, allow pesticides to be used in ways that threaten water quality.

7.1.1.2 Numeric Targets

The numeric targets below interpret the applicable narrative objectives in terms of quantitatively measurable water quality parameters. Meeting these pesticide-related toxicity and diazinon concentration targets will protect cold and warm freshwater habitats. These targets shall be met at all urban creek locations, including those near storm drain outfalls where urban runoff enters receiving waters.

Pesticide-Related Toxicity

The toxicity targets are expressed in terms of acute toxic units (TU_a) and chronic toxic units (TU_c). The targets are as follows: pesticide-related acute and chronic toxicity in urban creek water and sediment, as determined through standard toxicity tests, shall not exceed 1.0 TU_a or 1.0 TU_c, where TU_a = 100/NOAEC and TU_c = 100/NOEC. “NOAEC” refers to the “no observed adverse effect concentration,” which is the highest tested concentration of a sample that causes no observable adverse effect (i.e., mortality) to exposed organisms during an acute toxicity test. For purposes of this strategy, “NOEC” refers to the “no observable effect concentration,” which is the highest tested concentration of a sample that causes no observable effect to exposed organisms during a chronic toxicity test. NOAEC and NOEC are both expressed as the percentage of a sample in a test container (e.g., an undiluted sample has a concentration of 100%). In both cases, an observable effect must be statistically significant. For purposes of this strategy, an undiluted ambient water or sediment sample that does not exhibit an acute or chronic toxic effect that is significantly different from control samples on a statistical basis shall be assumed to meet the relevant target.

The above definitions of TU_a and TU_c apply only to ambient conditions in the context of this diazinon and pesticide-related toxicity strategy. If toxicity exists in urban creeks but pesticides do not cause or contribute to the toxicity, these targets do not apply. Moreover, the numeric toxicity targets do not limit the Water Board’s authority to evaluate attainment of the narrative objectives through other appropriate means.

Diazinon

The diazinon concentration target is as follows: diazinon concentrations in urban creeks shall not exceed 100 ng/l as a one-hour average. The target addresses both acute and chronic diazinon-related toxicity.

7.1.1.3 Sources

Pesticides, including diazinon, enter urban creeks through urban runoff. Most urban runoff flows through storm drains owned and operated by the Region’s municipalities, industrial dischargers, large institutions (e.g., campuses), construction dischargers, and the California Department of Transportation (Caltrans). Urban runoff contains pesticides as a result of pesticides being manufactured, formulated into products, and sold through distributors and retailers to businesses and individuals who apply them for structural pest control, landscape maintenance, agricultural, and other pest management purposes. Factors that affect pesticide concentrations in urban creeks include the amount used, the chemical and physical properties of the pesticide and its product formulation, the sites of use (e.g., landscaping, turf, or paved surfaces), and irrigation practices and precipitation. In the San Francisco Bay Region, ants are the most common pest problem for which pesticides are used. Argentine ants are an introduced species. Pesticide use by structural pest control professionals and use of products sold over-the-counter can be among the greatest contributors of pesticides in urban runoff.

7.1.1.4 Total Maximum Daily Load

The assimilative capacity of the Region's urban creeks for diazinon and pesticide-related toxicity is the amount of diazinon and pesticide-related toxicity they can receive without exceeding water quality standards. For urban creeks to assimilate diazinon and other pesticide discharges and meet water quality standards, the targets must be met. Rather than establishing a mass-based TMDL to attain the targets, this TMDL is expressed in concentration units. The TMDL is equal to the targets.

The targets rely on a conservative approach that provides an implicit margin of safety to account for any lack of knowledge concerning the relationship between the allocations and water quality. Weather and seasons affect creek flows and pesticide loads, concentrations, and toxicity. By expressing the targets in terms of toxicity and diazinon concentrations, the inherent pesticide mass loads automatically reflect seasonal and other critical conditions as creek conditions change.

7.1.1.5 Allocations

The TMDL is allocated to all urban runoff, including urban runoff associated with municipal separate storm sewer systems, Caltrans facilities, and industrial, construction, and institutional sites. The allocations are expressed in terms of toxic units and diazinon concentrations, and are the same as the numeric targets and the TMDL.

7.1.1.6 Implementation

The cornerstone of this strategy is pollution prevention. Pesticide-related toxicity in the Region's urban creeks is to be eliminated and prevented by using pest management alternatives that protect water quality and by not using pesticides that threaten water quality. This can best be accomplished through the rigorous application of integrated pest management techniques and the use of less toxic pest control methods. The term "integrated pest management," as used here, refers to a process that includes setting action thresholds, monitoring and identifying pests, preventing pests, and controlling pests when necessary. Integrated pest management meets the following conditions:

- Pest control practices focus on long-term pest prevention through a combination of techniques, such as biological control, habitat manipulation, and modification of cultural practices;
- Pesticides are used only after monitoring indicates that they are needed;
- Treatments are made with the goal of removing only the target pest; and
- Pesticides are selected to minimize risks to human health, beneficial and non-target organisms, and the environment, including risks to aquatic habitats.

The term "less toxic pest control," as used here, refers to the use of pest control strategies selected to minimize the potential for pesticide-related toxicity in water and sediment.

Strategy implementation will focus on three areas: (1) regulatory programs, (2) education and outreach, and (3) research and monitoring. Regulatory programs will prevent pollution by using existing regulatory tools to ensure that pesticides are not applied in a manner that results in discharges that threaten urban creek uses. Education and outreach programs will focus on decreasing demand for pesticides that threaten water quality, while increasing awareness of alternatives that pose less risk to water quality. Research will fill existing information gaps, and monitoring will be used to measure implementation progress and success. The actions described below are intended to address these strategic goals.

When pesticide-related toxicity occurs in urban creeks, many entities share responsibility for the discharge, and therefore many entities share responsibility for implementing actions to ensure that pesticide-related toxicity does not threaten water quality. Although the allocations apply to all urban runoff, responsibility for attaining the allocations is not the sole responsibility of urban runoff management agencies, whose authority to regulate pesticide use is constrained. Actions to be implemented by regulatory agencies, urban runoff management agencies, and other entities are listed below. The agencies with the broadest authorities to oversee pesticide use and pesticide discharges include U.S. EPA, the California Department of Pesticide Regulation, and the Water Board. Regulatory and non-regulatory actions are needed to ensure that pesticide use does not result in discharges that cause or contribute to toxicity in urban creeks. Implementing these actions is expected to ensure attainment of the allocations. Many entities are already implementing these actions. Actions that can be required through NPDES permits are already in some permits and shall be incorporated into all applicable NPDES permits when the permits are reissued or by other regulatory actions if appropriate. Voluntary actions should commence immediately, and inter-agency coordination is already underway.

Water Board Actions

The role of the Water Board is to encourage, monitor, and enforce implementation actions, and to lead by example. The Water Board will implement the following actions related to regulatory programs:

- Track U.S. EPA pesticide evaluation and registration activities as they relate to surface water quality and share monitoring and research data with U.S. EPA;
- When necessary, request that U.S. EPA coordinate implementation of the Federal Insecticide, Fungicide, and Rodenticide Act and the Clean Water Act;
- Encourage U.S. EPA to fully address urban water quality concerns within its pesticide registration process;
- Work with the California Department of Pesticide Regulation, County Agricultural Commissioners, and the Structural Pest Control Board to ensure that pesticide applications result in discharges that comply with water quality standards;
- Interpret water quality standards for the California Department of Pesticide Regulation and County Agricultural Commissioners, and assemble available information (such as monitoring data) to assist the California Department of Pesticide Regulation and County Agricultural Commissioners in taking actions necessary to protect water quality; and
- Use authorities (e.g., through permits or waste discharge requirements) to require implementation of best management practices and control measures to minimize pesticide discharges to urban creeks.

The Water Board will implement the following actions related to outreach and education:

- Encourage integrated pest management and less toxic pest management practices;
- Encourage grant funding for activities likely to reduce pesticide discharges, promote less toxic pest management practices, or otherwise further the goals of this implementation plan; and
- Encourage pilot demonstration projects that show promise for reducing pesticide discharges throughout the Region.

The Water Board will implement the following actions related to research, monitoring, and overall program coordination:

- Promote and support studies to address critical data needs (see Adaptive Implementation, below); and
- Assist municipalities and others implementing this strategy by convening stakeholder forums to coordinate implementation.

U.S. Environmental Protection Agency Actions

U.S. EPA is responsible for implementing the Federal Insecticide, Fungicide, and Rodenticide Act and the Clean Water Act. U.S. EPA is therefore responsible for ensuring that both federal pesticide laws and water quality laws are implemented. U.S. EPA should exercise its authorities to ensure that foreseeable pesticide applications do not cause or contribute to water column or sediment toxicity in the Region's waters. Because some pesticides pose water quality risks, U.S. EPA should implement the following actions:

- Continue internal coordination efforts to ensure that pesticide applications and resulting discharges comply with water quality standards and avoid water quality impairment (i.e., restrict uses or application practices to manage risks);
- Continue and enhance education and outreach programs to encourage integrated pest management and less toxic pest control; and
- Complete studies to address critical data needs (see Adaptive Implementation, below).

California Department of Pesticide Regulation Actions

Like the Water Board, the California Department of Pesticide Regulation is part of the California Environmental Protection Agency. It regulates pesticide product sales and use within California pursuant to the California Food and Agricultural Code. When the California Department of Pesticide Regulation evaluates whether to register a pesticide product, it must give special attention to the potential for environmental damage, including interference with attainment of water quality standards. The California Department of Pesticide Regulation is mandated to protect water quality from environmentally harmful pesticide materials, which should include pesticides used such that their runoff violates water quality standards. The California Department of Pesticide Regulation should also recognize pesticides used such that their runoff poses a reasonable potential to violate water quality standards to be potentially harmful and take preventive action to address foreseeable risks. The Water Board will assist the California Department of Pesticide Regulation in identifying pesticides that could harm water quality.

The California Department of Pesticide Regulation must endeavor to mitigate adverse effects of pesticides that endanger the environment, such as existing or reasonably foreseeable pesticide-related violations of water quality standards. If a pesticide product has a demonstrated serious uncontrollable adverse effect, mitigation may include canceling its registration. Mitigation is also warranted to avoid existing and reasonably foreseeable serious uncontrolled adverse effects. The Water Board will notify the California Department of Pesticide Regulation whenever it obtains information concerning actual or potential water quality standard violations so the California Department of Pesticide Regulation can implement appropriate protective actions.

To be effective, this strategy relies on the California Department of Pesticide Regulation to use its authorities in concert with the Water Board. Consistent with its authorities, the California Department of Pesticide Regulation should implement the following actions:

- Work with the Water Board to identify pesticides applied in urban areas in such a manner that runoff does or could cause or contribute to water quality standard violations;

- Condition registrations, as appropriate, to require registrants to provide information necessary to determine the potential for their products to cause or contribute to water quality standard violations and to implement actions necessary to prevent violations;
- Continue and enhance efforts to evaluate the potential for registered pesticide products to cause or contribute to water quality standard violations (the California Department of Pesticide Regulation need not wait for the Water Board to evaluate potential water quality effects);
- Implement actions to eliminate pesticide-related water quality standard violations caused by registered pesticides;
- Implement actions to prevent potential pesticide-related water quality standard violations before they occur;
- Notify U.S. EPA of potential deficiencies in product labels for products that threaten water quality;
- Continue and enhance education and outreach programs to encourage integrated pest management and less toxic pest control (work with County Agricultural Commissioners, urban runoff management agencies, and the University of California Statewide Integrated Pest Management Program to coordinate activities);
- Continue and enhance efforts to prevent the introduction of new exotic pests to the Region; and
- Complete studies to address critical data needs (see Adaptive Implementation, below).

Collaboration within the California Environmental Protection Agency

As sister agencies within the California Environmental Protection Agency, the Water Board and the California Department of Pesticide Regulation should coordinate pesticide and water quality regulation in the Region. In 1997, the California Department of Pesticide Regulation and the State Water Resources Control Board entered into a management agency agreement. The California Department of Pesticide Regulation agreed to ensure that compliance with numeric and narrative water quality objectives is achieved. The State and Regional Water Boards retained responsibility for interpreting compliance with narrative water quality objectives. In light of the agreement, the Water Board and the California Department of Pesticide Regulation should work together to eliminate recurrences of water quality standard violations and prevent potential future violations. In consultation with the California Department of Pesticide Regulation, the Water Board will implement the following actions:

- Gather and review available information to identify pesticides most likely to run off into urban creeks and cause or contribute to water quality standard violations;
- Identify evaluation criteria that can be used to discern whether water quality standards are met (e.g., water quality objectives, targets, monitoring benchmarks, or other criteria);
- Evaluate available information to determine whether water quality standards are met and, if so, whether circumstances suggest that future violations are likely; and
- Notify the California Department of Pesticide Regulation and County Agricultural Commissioners if water quality standard violations exist or are likely to exist in the future due to pesticide discharges, thereby enabling these agencies to implement appropriate actions and assisting them in ensuring that their regulatory programs adequately protect water quality.

In consultation with the Water Board, the California Department of Pesticide Regulation should implement the following actions:

Water Quality Control Plan for the San Francisco Bay Basin

- When available information is insufficient to conclude whether water quality standards are met, work with the Water Board to identify information needed to evaluate the potential for pesticide discharges to cause or contribute to water quality standard violations;
- Obtain information necessary to determine whether water quality standards are or are likely to be met from pesticide product registrants, U.S. EPA, and other sources (conservative [i.e., protective] assumptions may be used to fill information gaps);
- Evaluate whether water quality standards are likely to be met (e.g., consider pesticide use, toxicity, application sites and techniques, runoff potential, and environmental persistence; estimate foreseeable water and sediment pesticide concentrations; and consider Water Board evaluation criteria);
- When pesticide discharges are or are likely to cause or contribute to water quality standard violations, identify and evaluate possible corrective actions (using the Water Board's evaluation criteria) and implement those needed to ensure that water quality standards will be met; and
- When available information suggests that pesticide discharges appear likely to cause or contribute to water quality standard violations in the future (assuming standards are currently met), identify and evaluate possible preventive actions and, commensurate with the weight of the evidence, implement those actions needed to ensure that water quality standards will be met.

Sometimes, a pesticide-by-pesticide approach may be counterproductive, particularly if existing pesticide problems are likely to be replaced by new pesticide problems. As appropriate, the California Department of Pesticide Regulation may evaluate several pesticides at once if related to a specific application method, application site of concern, or other shared factor.

During adaptive implementation reviews (see "Adaptive Implementation," below), the Water Board will consider the extent to which inter-agency collaboration is sufficient to address water quality concerns. If necessary, the Water Board will notify the California Department of Pesticide Regulation of deficiencies and could consider the need to use its own regulatory authorities to control pesticide discharges.

County Agricultural Commissioners' Actions

County Agricultural Commissioners are the local enforcement agents for the California Department of Pesticide Regulation. They provide local enforcement of applicable pesticide laws and, when necessary to address local circumstances (e.g., localized toxicity in an urban creek), can adopt local regulations (subject to California Department of Pesticide Regulation approval) that govern the conduct of pest control operations and the records and reports of those operations. County Agricultural Commissioners should implement the following actions:

- Continue and enhance enforcement related to illegal sale or use of pesticides, including pesticides sold over-the-counter;
- Continue to enforce the phase out of diazinon products and any new regulations affecting pesticide applications and their water quality risks;
- Continue and enhance efforts to prevent the introduction of new exotic pests to the Region;
- Provide outreach and training to pest control licensees regarding water quality issues as part of pest control business license registration and inspection programs; and
- Work with the California Department of Pesticide Regulation, urban runoff management agencies, and the University of California Statewide Integrated Pest Management Program to coordinate education and outreach programs to minimize pesticide discharges.

Structural Pest Control Board Actions

The Structural Pest Control Board is responsible for licensing structural pest control professionals. The Structural Pest Control Board requires training and examinations to maintain a license to practice structural pest control, and regulates the advertising practices of structural pest control businesses. The Structural Pest Control Board should implement the following actions:

- Through licensing and other authorities, work to ensure that structural pest control practices result in discharges that comply with water quality standards;
- Work to develop a mechanism through which consumers can determine which structural pest control providers offer services most likely to protect water quality; and
- Work to enhance initial and continuing integrated pest management training for structural pest control licensees.

University of California Actions

The University of California Statewide Integrated Pest Management Program promotes pest management education and outreach throughout California. The University of California should implement the following actions:

- Continue and enhance educational efforts targeting urban pesticide users to promote integrated pest management and less toxic pest management practices;
- Continue to encourage and support efforts to identify and improve new less toxic pest management strategies for the urban environment;
- Continue to serve as a resource for information on alternative pest management practices that protect water quality and develop publications others can use to support outreach activities;
- Continue to train University of California Master Gardeners to help disseminate information about integrated pest management and pest management alternatives that protect water quality; and
- Work with the California Department of Pesticide Regulation, County Agricultural Commissioners, and urban runoff management agencies to coordinate education and outreach programs to minimize pesticide discharges.

Urban Runoff Management Agencies and Similar Entities Actions

NPDES permits for urban runoff management agencies and similar entities responsible for controlling urban runoff (e.g., industrial facilities, construction sites, California Department of Transportation facilities, universities, and military installations) shall require implementation of best management practices and control measures. Urban runoff management agencies' and similar entities' respective responsibilities for addressing these allocations and targets will be satisfied by complying with the requirements set forth below and permit-related requirements based on them.

Requirements in each NPDES permit issued or reissued and applicable for the term of the permit shall be based on an updated assessment of control measures intended to reduce pesticides in urban runoff. Control measures implemented by urban runoff management agencies and other entities (except construction and industrial sites) shall reduce pesticides in urban runoff to the maximum extent practicable. Control measures for construction and industrial sites shall reduce discharges based on Best Available Technology Economically Achievable. All permits shall remain consistent with the section of this chapter titled "Surface Water Protection and Management—Point Source Control - Stormwater

Discharges.” These requirements shall be included in permits no later than five years after the effective date of this strategy. If these requirements prove inadequate to meet the targets and allocations, the Water Board will require additional control measures or call for additional actions by others until the targets and allocations are attained.

The following general requirements shall be implemented through NPDES permits issued or reissued for urban runoff discharges:

- Reduce reliance on pesticides that threaten water quality by adopting and implementing policies, procedures, or ordinances that minimize the use of pesticides that threaten water quality in the discharger’s operations and on the discharger’s property;
- Track progress by periodically reviewing the discharger’s pesticide use and pesticide use by its hired contractors;
- Train the discharger’s employees to use integrated pest management techniques and require that they rigorously adhere to integrated pest management practices;
- Require the discharger’s contractors to practice integrated pest management; and
- Study the effectiveness of the control measures implemented, evaluate attainment of the targets, identify effective actions to be taken in the future, and report conclusions to the Water Board.

The following education and outreach requirements shall also be implemented through NPDES permits issued or reissued for urban runoff discharges:

- Undertake targeted outreach programs to encourage communities within a discharger’s jurisdiction to reduce their reliance on pesticides that threaten water quality, focusing efforts on those most likely to use pesticides that threaten water quality;
- Work with the California Department of Pesticide Regulation, County Agricultural Commissioners, and the University of California Statewide Integrated Pest Management Program to coordinate education and outreach programs to minimize pesticide discharges.
- Encourage public and private landscape irrigation management that minimizes pesticide runoff; and
- Facilitate appropriate pesticide waste disposal, and conduct education and outreach to promote appropriate disposal.

The following monitoring and reporting requirements shall also be implemented through NPDES permits issued or reissued for urban runoff discharges:

- Monitor diazinon and other pesticides discharged in urban runoff that pose potential water quality threats to urban creeks; monitor toxicity in both water and sediment; and implement alternative monitoring mechanisms, if appropriate, to indirectly evaluate water quality as described below (see Monitoring, below);
- Disseminate monitoring data to appropriate regulatory agencies; and
- Contribute to studies to address critical data needs (see Adaptive Implementation, below).

The following requirements related to regulatory programs shall also be implemented through NPDES permits issued or reissued for urban runoff discharges:

- Track U.S. EPA pesticide evaluation and registration activities as they relate to surface water quality and, when necessary, encourage U.S. EPA to coordinate implementation of the Federal

Insecticide, Fungicide, and Rodenticide Act and the Federal Clean Water Act and to accommodate water quality concerns within its pesticide registration process;

- Assemble and submit information (such as monitoring data) as needed to assist the California Department of Pesticide Regulation and County Agricultural Commissioners in ensuring that pesticide applications within the Region comply with water quality standards; and
- Report violations of pesticide regulations (e.g., illegal handling) to County Agricultural Commissioners.

The actions above may be implemented by individual urban runoff management entities, jointly by two or more entities acting in concert, or cooperatively through a regional approach, as appropriate.

NPDES permits issued or reissued for industrial, construction, and California Department of Transportation facilities shall implement the general requirements and education and outreach requirements listed above and monitoring requirements as appropriate.

Private Entities Actions

Most pesticides do not occur naturally in the environment; they are manufactured. Pesticide manufacturers and formulators sell products to distributors and retailers, who sell them to the pesticide users who apply them. These private entities should implement the following actions to prevent pesticide-related toxicity in urban creeks:

- Pesticide manufacturers and formulators should minimize potential pesticide discharges by developing and marketing products designed to avoid discharges that exceed water quality standards. (Many manufacturers successfully market such products.) They should also undertake studies to address critical data needs (see Adaptive Implementation, below);
- Distributors and retailers should offer point-of-sale information on less toxic alternatives. They should also offer and promote less toxic alternatives to customers;
- Pest control advisors should recommend integrated pest management strategies so pesticides that could threaten water quality are used only as a last resort; and
- Pesticide users (e.g., private citizens, professional pesticide applicators, school districts, transit districts, and mosquito abatement and vector control districts) should adopt integrated pest management and less toxic pest control techniques so pesticide applications do not contribute to pesticide runoff and toxicity in urban creeks.

7.1.1.7 Monitoring

Monitoring is needed to demonstrate target attainment and to track and evaluate the effectiveness of strategy implementation. Diazinon monitoring needs to demonstrate that diazinon concentrations meet the target. When the concentrations consistently drop below the target, such monitoring may no longer be needed. However, because other pesticides will continue to be applied in urban areas, the need to monitor for water and sediment toxicity—and sometimes specific pesticides—will likely remain well after achieving the diazinon concentration target.

A number of programs monitor pesticide concentrations and toxicity in the Region's waters, including the Water Board's Surface Water Ambient Monitoring Program, the California Department of Pesticide Regulation's Surface Water Protection Program, and the Regional Monitoring Program for Trace Substances. Municipal storm water NPDES permits may also require dischargers to characterize their

discharges and receiving waters. This can involve monitoring toxicity and specific pollutants, like diazinon, in storm drain systems and urban creeks.

Monitoring Requirements

Monitoring requirements shall be implemented through NPDES permits issued or reissued for urban runoff discharges. Urban runoff management agencies shall undertake monitoring efforts related to pesticides and toxicity. They shall design and implement a monitoring program to answer the following questions:

- Is the diazinon concentration target being met?
- Are the toxicity targets being met?
- Is toxicity observed in urban creeks caused by a pesticide?
- Is urban runoff the source of any observed toxicity in urban creeks?
- How does observed pesticide-related toxicity in urban creeks (or pesticide concentrations contributing to such toxicity) vary in time and magnitude across urban creek watersheds, and what types of pest control practices contribute to such toxicity?
- Are actions already being taken to reduce pesticide discharges sufficient to meet the targets, and if not, what should be done differently?

The monitoring program may be developed by individual urban runoff management agencies, jointly by two or more agencies acting in concert, or cooperatively through a regional approach. Designing the program shall involve characterizing watersheds, selecting representative creeks, identifying sample locations, developing sampling plans, and selecting appropriate analytical tests of water and sediment. Chemical and toxicity tests shall be conducted on urban creek water and sediment. At a minimum, tests shall be used to measure the following:

- Water column toxicity;
- Sediment toxicity;
- Diazinon concentrations in water (until the diazinon concentration target is met consistently); and
- Concentrations of other pesticides that pose potential water quality and sediment quality threats, as feasible.

Sampling frequency, timing, and number of samples shall be adequate to answer the monitoring questions above and any others set forth for the monitoring program.

Additional types of monitoring tools may be used to support and optimize conventional water and sediment monitoring. For example, monitoring in storm drain systems or near application sites may be useful in selecting creek sampling strategies because pesticide concentrations are easier to detect nearer to the pesticide application site. Efforts to monitor parameters that can serve as surrogates or indicators of pesticide-related water quality conditions may moderate the need for more comprehensive water quality monitoring. While some toxicity and pollutant monitoring will always be necessary, extensive monitoring will be less important if other information is collected that can be used to evaluate the potential for toxicity or specific pollutants to occur in water. Alternative monitoring information can also help focus water quality monitoring efforts and mitigation actions. Such monitoring could include reviewing pesticide sales and use data for the Region, pesticide fate and transport data, and public attitudes

regarding pesticides and water quality. If undertaken, such monitoring may seek to answer the following questions:

- What pesticides pose the greatest water quality risks?
- How is the use of such pesticides changing?
- Are existing actions effective in reducing pesticide discharges that threaten water quality?
- What approach is best for monitoring toxicity and pesticides in urban creek water and sediment?

Monitoring Benchmarks

To determine whether measured or predicted pesticide concentrations in water are cause for concern, monitoring benchmarks are needed. Ideally, water quality criteria would be used; however, water quality criteria do not exist for most pesticides. In the absence of water quality criteria, a monitoring benchmark may be calculated as follows. Such a monitoring benchmark is not a water quality objective unless adopted as such by the Water Board. Where valid tests have determined four-day LC₅₀ values for aquatic organisms (the concentration that kills one half of the test organisms), a monitoring benchmark may be calculated by dividing the lowest LC₅₀ value measured by the appropriate benchmark factor from Table 7.1.1-1 (typically 14 or less for a registered pesticide).

$$\text{Monitoring Benchmark} = \text{Lowest LC}_{50} \div \text{Benchmark Factor}$$

Where multiple LC₅₀ measurements are available, the lowest “genus mean acute value” may be used in place of the lowest LC₅₀. The term “genus mean acute value,” as used here, refers to the geometric mean of the available “species mean acute values” within a genus. The term “species mean acute value,” as used here, refers to the geometric mean of available four-day LC₅₀ values for each species. Other available information regarding the pesticide (such as its potential for sub-lethal effects) may also be considered to determine if lower monitoring benchmarks are appropriate to reflect attainment of the narrative objectives. Table 7.1.1-1 is not intended for deriving monitoring benchmarks for sediment tests.

Table 7.1.1-1 Benchmark Factors

Number of Data Requirements Satisfied ^a	Benchmark Factor ^b
2	16
3	14
4	14
5	12
6	10
7	8

Notes:

^a U.S. EPA water quality criteria guidelines require data for at least eight taxonomic families to derive water quality criteria.

^b These values apply only when both daphnid and salmonid toxicity data are available. U.S. EPA typically requires such data to register a pesticide.

When monitoring data demonstrate that pesticide concentrations exceed monitoring benchmarks, the information will be considered during periodic reviews undertaken as part of adaptive implementation (see below). When pesticide concentrations exceed monitoring benchmarks, the Water Board may consider such information in determining compliance with the narrative toxicity, sediment, and population and community ecology objectives. The Water Board may also seek additional toxicity data to derive water quality criteria. The Water Board may inform other regulatory agencies (e.g., the California Department of Pesticide Regulation) about the potential threat to water quality and seek action to prevent water quality impairment.

7.1.1.8 Adaptive Implementation

Adaptive implementation entails taking immediate actions commensurate with available information, reviewing new information as it becomes available, and modifying actions as necessary based on the new information. Taking immediate action allows progress to occur while more and better information is collected and the effectiveness of current actions is evaluated. Table 7.1.1-2 lists specific actions the Water Board will use to track its progress and an implementation timeframe.

Table 7.1.1-2: Water Board Implementation Measure Tracking

Action	Schedule
Summarize pesticide regulatory activities as they relate to water quality, and identify opportunities to advise pesticide regulatory oversight agencies regarding future actions	Annually
Summarize research and monitoring data for pesticide regulatory oversight agencies and others, and determine where to focus future monitoring efforts based on critical data needs	Annually
Describe urban pesticide use trends and identify pesticides likely to affect water quality	Annually
Notify pesticide regulatory oversight agencies if water quality standard violations exist or are likely to exist in the future due to pesticide discharges	At least annually
Identify waters impaired by pesticide-related toxicity and waters where there is a potential for impairment	Biennially
Meet or correspond with pesticide regulatory oversight agencies regarding their	At least annually

Water Quality Control Plan for the San Francisco Bay Basin

Action	Schedule
roles in protecting water quality	
Place required actions in NPDES stormwater permits	No later than five years from effective date of strategy
Report implementation status to Water Board	Annually

Periodic Review

The Water Board will review this strategy approximately every five years. The reviews will be coordinated through the Water Board's continuing planning program and will provide opportunities for stakeholder participation. If any modifications are needed, they will be incorporated into the Basin Plan. At a minimum, the following focusing questions will be used to conduct the reviews. Additional focusing questions will be developed in collaboration with stakeholders during each review.

- Are changes in urban creek conditions moving toward improvements in water quality (e.g., toward target attainment)?
- If it is unclear whether there is progress, how should monitoring efforts be modified to measure trends?
- If there has not been adequate progress, how might the implementation actions or allocations be modified to improve progress?
- Is there new information that suggests the need to modify the targets, allocations, or implementation actions?
- If so, how should the strategy be modified?

During the periodic reviews, the Water Board will consider newly available information regarding such topics as market trends, monitoring results, tools for risk evaluation, outreach effectiveness, and regulatory actions.

Additional Sources

As the strategy is implemented, additional sources of pesticide-related toxicity may emerge, either as the result of a new discharge or a new pesticide being applied. In such situations, the allocations for additional sources shall be the same as those for the existing sources unless the Water Board finds these allocations to be inappropriate or chooses to refine the strategy in some other manner.

Critical Data Needs

Various types of information and tools are needed to adequately evaluate the risks associated with pesticide runoff. To the extent possible, the pesticide industry should shoulder the burden of collecting this information and developing appropriate tools. At times, however, the citizens of the Region (as represented by the Water Boards, the urban runoff management agencies, and others) should lead by example. Therefore, the pesticide industry should undertake and others should support and promote the following actions:

- Conduct surveillance monitoring of surface waters and sediment and publicly report the results;
- Develop publicly available and commercially viable analytical methods to detect ecologically relevant concentrations of pesticides that pose water quality risks;

- Develop procedures that can be used to identify potential causes of toxicity in water and sediment (e.g., Toxicity Identification Evaluation procedures);
- Complete publicly available studies that characterize the fate and transport of pesticides applied in urban areas;
- Develop and adopt evaluation methods (e.g., quantitative fate and transport models) for urban pesticide applications, including applications to impervious surfaces; and
- Complete publicly available studies to support the development of water quality criteria for pesticides in water and sediment.

7.2 WATER QUALITY ATTAINMENT STRATEGIES AND TMDLS FOR SAN FRANCISCO BAY AND BAY SEGMENTS

7.2.1 Water Quality Attainment Strategy to Support Copper Site-specific Objectives for San Francisco Bay, and Nickel Site-specific Objectives for South San Francisco Bay

The Water Quality Attainment Strategy (WQAS) for copper in all San Francisco Bay segments (see Figure 7.2.1-1) and nickel in South San Francisco Bay is designed to prevent water quality degradation and ensure attainment of the copper and nickel site-specific objectives (SSOs). This section describes the details of the WQAS and how the Water Board will use its regulatory authority to implement this strategy.

The four elements of the WQAS are:

- Control measures/actions to minimize the discharge of copper (from wastewater treatment plants, urban runoff, anti-fouling boat paints, and lagoons to ensure that significant copper sources are properly managed)
- Statistically-based water quality "triggers" and a receiving water monitoring program that would initiate additional control measures/actions if the "triggers" are exceeded
- Metal translators that will be used to compute copper and nickel effluent limits for the municipal wastewater treatment plants discharging to South San Francisco Bay
- Metal translators that will be used to compute copper effluent limits for municipal and industrial wastewater treatment plants that discharge to deep water (see Section 4.6.1 for definition) north of the Dumbarton Bridge

7.2.1.1 Background

All San Francisco Bay segments (see Figure 7.2.1-01) meet water quality objectives for copper and nickel. Since the mid-1980s, because of effective treatment and successful pollution prevention and source control efforts, substantial reductions in metal loading to San Francisco Bay segments have been achieved. Other sources that are difficult to manage such as urban runoff (which includes copper from automobile brake pads), historical deposits of copper in the Bay sediments, and natural sources of copper are among the dominant contributions to current ambient water concentrations. SSOs (see Chapter 3) for dissolved copper in all Bay segments (and nickel in South San Francisco Bay) have been derived using toxicity data representing site-specific conditions in all San Francisco Bay segments, and these SSOs fully protect San Francisco Bay beneficial uses.



Figure 7.2.1-1 Segments of San Francisco Bay showing location of Hayward Shoals as a line connecting Little Coyote Point and the Oakland Airport.

7.2.1.2 Implementation Plan and Monitoring Program

This section discusses the actions and ambient monitoring program-needed to ensure continued attainment of the copper site-specific objectives throughout San Francisco Bay and-ensure that copper sources are properly managed so ambient copper levels do not increase due to potential increases in loading of copper to San Francisco Bay. The implementation plan also calls for requirements in NPDES permits to support investigations to resolve three key areas of remaining technical uncertainty regarding copper: urban tributary loads and trends; toxicity to benthic organisms; and possible effects on the olfactory system of salmonids.

Control Measures for Urban Runoff Management Agencies

The NPDES permits for urban runoff management agencies shall require the implementation of best management practices and copper control measures designed to prevent urban runoff discharges from causing or contributing to exceedances of copper water quality objectives. Requirements in each permit issued or reissued and applicable for the term of the permit shall be based on an updated assessment of control measures intended to reduce copper in stormwater runoff to the maximum extent practicable. Urban runoff management agencies must implement control measures targeting: vehicle brake pads, architectural copper, copper pesticides, and industrial copper use. Additionally, these permits shall contain requirements to conduct or cause to be conducted: monitoring of copper loading to the Bay at locations and frequency sufficient to track loading trends; and technical studies to investigate possible copper sediment toxicity and sublethal effects on salmonids.

If an ambient trigger concentration in any San Francisco Bay segment (see Ambient Monitoring Program, below) is exceeded, all urban runoff management agencies discharging to that segment shall submit a report to the Water Board that describes best management practices that are currently being implemented and additional measures, with a schedule, that will be implemented to prevent their copper discharges from causing or contributing to the exceedance.

Control Measures for Wastewater Treatment Facilities

The management measures for municipal and industrial wastewater treatment facilities will be implemented through their individual NPDES permits, which shall include the following elements:

- Water quality-based effluent limits (WQBELs) computed from the SSOs.
- Baseline Program of pollution prevention measures.
- Requirement to conduct or cause to be conducted technical studies to investigate possible copper sediment toxicity and sublethal effects on salmonids.
- Effluent Monitoring and Reporting.

The baseline pollution prevention measures for wastewater facilities include:

- Evaluate copper sources (all municipal and industrial facilities)
- Confirm industrial facility compliance with local pre-treatment copper limits (municipal facilities only)
- Control municipal water supply pipeline corrosion from commercial and residential sources (municipal facilities only)

More advanced, facility-specific pollution prevention measures shall be implemented by facilities that exceed a copper effluent limit due to increased copper influent loading compared to the previous year's performance. Additionally, if an ambient trigger concentration (see Ambient Monitoring Program, below)

is exceeded, each municipal and industrial wastewater facility discharging to that segment of the Bay shall evaluate the history of its facility's effluent copper concentrations. Those facilities with increasing copper effluent trends shall develop and implement plans to control these increasing levels.

Metal Translators

An important regulatory element of the WQAS is the specification of metal translators. Water quality objectives for copper and nickel are expressed as dissolved metal concentrations. Effluent limits for the wastewater dischargers' treatment facilities are expressed as total metal concentrations and must be calculated according to the procedure outlined in the "Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California." Therefore, for metals like copper and nickel, the calculation of an effluent limit requires the use of a ratio of total to dissolved metals called the metal translator.

South San Francisco Bay copper and nickel translators were developed using a regression relationship between the translators and total suspended solids (TSS). The translators were computed by evaluating the upper 95 percent confidence interval regression relationship at the median TSS value for South San Francisco Bay. For this reason, there is a single translator value for each metal (Table 7.2.1-1). The higher translators that result from using the upper confidence level regression result in lower numeric effluent limits and provide an additional measure of protection of beneficial uses.

There is not a strong relationship between TSS and translators for the segments of the Bay north of the Dumbarton Bridge. There are geographic differences in computed translators between the northernmost segments and those in the southern segments the Bay. In such cases, median and 90th percentile translators can be computed from available data for use in computing average monthly and maximum daily effluent limits, respectively. The translators in Table 7.2.1-2 apply only to deepwater wastewater discharges to San Francisco Bay because the available translator data are not representative of shallow water discharge (defined as those wastewater discharges that have been granted an exception to the prohibition against wastewater discharges into non-tidal water, dead-end sloughs or at any point that wastewater does not receive dilution of at least 10:1) locations. Shallow water wastewater dischargers must develop translators applicable to the discharge location at the time of permit reissuance.

Table 7.2.1-1 Translators Applicable to South San Francisco Bay Municipal Wastewater Discharges for Copper and Nickel

Bay Segments	Copper Translator For Effluent Limit Calculation	Nickel Translator For Effluent Limit Calculation
South San Francisco Bay	0.53	0.44

Table 7.2.1-2 Translators Applicable to Other San Francisco Bay Municipal and Industrial Wastewater Deep Water Discharges for Copper

Bay Segments	Copper Translator For Average Monthly Effluent Limit Calculation	Copper Translator For Maximum Daily Effluent Limit Calculation
Suisun Bay San Pablo Bay	0.38	0.66
Central San Francisco Bay Lower San Francisco Bay	0.73	0.87

Copper From Anti-Fouling Boat Paint

Paints applied to boats and ships to control unwanted “fouling” growth on their hulls often contain copper-based biocides. In San Francisco Bay, there are major ports, industrial piers, and dozens of marinas. Boats and ships coated with copper-containing biocides may release copper directly into the Bay during storage, operation, and in-water maintenance.

The Water Board is relying on the authority of the California Department of Pesticide Regulation (DPR) to regulate the pesticidal use of copper in antifouling paints such that water quality objectives will be attained. The Water Board will work with DPR as it executes its regulatory strategy for biocides in marine antifouling coatings, which includes monitoring to evaluate water quality impacts and review of registration status.

Control Measures for Lagoons

There are many managed lagoons that are hydraulically connected to the Bay. Because of nutrient loading and stagnant conditions, excessive growth of aquatic plants and algae can cause nuisance conditions. In addition to mechanical harvesting, copper-based algaecides are used to control nuisance plant and algae growth. The application of these algaecides is permitted under the State Water Board’s Statewide General NPDES Permit (Order No. 2004-0009-DWQ) for discharges of aquatic pesticides to surface waters. The Water Board recognizes coverage under the general permit as being sufficient to ensure that application of copper pesticides to lagoons shall not cause or contribute to violations of the water quality objectives.

Ambient Monitoring Program

The implementation plan establishes copper control measures in order to prevent increases in ambient dissolved copper concentrations. Ambient concentrations of copper in the Bay have remained essentially unchanged from 1993 through 2006 and are not expected to increase in the future. In order to determine systematically if ambient concentrations have increased, specific copper concentration triggers are compared to data collected through the Regional Monitoring Program for Trace Substances (RMP). This is accomplished by calculating every year the three-year rolling mean of RMP copper concentrations in segments of the Bay. These rolling mean concentrations will be compared to trigger concentration values for each segment. The trigger concentrations (shown in Table 7.2.1-3) were calculated in order to detect a change (from 2003 concentrations) in dissolved copper concentration of about 1 µg/L with a statistical power of 99%. If the trigger concentration is exceeded in any Bay segment, the Water Board will investigate causes of the exceedance and potential control options and require wastewater and urban runoff dischargers to that segment to investigate whether they have caused or contributed to the

exceedance and, if so, to identify and submit a plan and schedule to implement controls to resolve their contribution to the exceedance.

The Water Board will assess the continued appropriateness of the SSOs for San Francisco Bay should conditions change in Bay water quality. Dissolved organic carbon (DOC) will be used as a surrogate measure of the protective effect of Bay water against copper water column toxicity. An analysis and evaluation of trends in DOC data collected through the RMP will determine whether or not additional water column toxicity tests are needed to confirm that the SSOs are protective. In addition, the Water Board will evaluate sediment copper concentration and sediment toxicity data collected through the RMP to assess possible effects related to copper accumulation in Bay sediments. The need for a reevaluation of the SSOs or other regulatory actions will be established through the triennial review of the Basin Plan.

Table 7.2.1-3 Dissolved Copper ($\mu\text{g/L}$) Trigger Concentrations at 99% Statistical Power

Bay Segment (or portion thereof)	Trigger Level ($\mu\text{g/L}$)
Suisun Bay	2.8
San Pablo Bay	3.0
Central San Francisco Bay Lower San Francisco Bay (north Hayward Shoals)	2.2
Lower San Francisco Bay (south of Hayward Shoals)	3.6
South San Francisco Bay	4.2

7.2.2 San Francisco Bay Mercury TMDL

The following sections establish the allowable annual mercury load (Total Maximum Daily Load [TMDL]) to San Francisco Bay, and actions and monitoring necessary to implement the TMDL. The numeric targets, allocations, and associated implementation plan will ensure that all San Francisco Bay segments and Suisun Marsh attain applicable water quality standards, including the mercury water quality objectives set forth in Table 3-3B, established to protect and support beneficial uses.

The TMDL allocations and implementation plan focus on controlling the amount of mercury that reaches the Bay and identifying and implementing actions to minimize mercury bioavailability. The organic form of mercury (methylmercury) is toxic and bioavailable, but information on ways of controlling methylmercury production is limited. However, this is an area of active research and strategies for controlling this process are forthcoming. The effectiveness of implementation actions, monitoring to track progress toward targets, and the scientific understanding pertaining to mercury will be periodically reviewed and the TMDL may be adapted as warranted.

7.2.2.1 Problem Statement

San Francisco Bay and Suisun Marsh are impaired because mercury contamination is adversely affecting existing beneficial uses, including sport fishing, preservation of rare and endangered species, and wildlife habitat. Mercury concentrations in San Francisco Bay fish are high enough to threaten the health of humans who consume them. In addition, mercury concentrations in some bird eggs harvested from the shores of San Francisco Bay are high enough to account for abnormally high rates of eggs failing to hatch.

In the context of this TMDL, “San Francisco Bay” refers to the following water bodies:

- Sacramento/San Joaquin River Delta (within San Francisco Bay region)
- Suisun Bay
- Carquinez Strait
- San Pablo Bay
- Richardson Bay
- Central San Francisco Bay
- Lower San Francisco Bay
- South San Francisco Bay (including the Lower South Bay)

This TMDL also addresses the following mercury-impaired water bodies that exist within the water bodies listed above:

- Castro Cove (part of San Pablo Bay)
- Oakland Inner Harbor (part of Central San Francisco Bay)
- San Leandro Bay (part of Central San Francisco Bay)

7.2.2.2 Numeric Targets

TMDL numeric targets interpret narrative and/or numeric water quality standards, including beneficial uses and water quality objectives. To protect humans who consume Bay fish, the average fish tissue mercury concentration for a commonly consumed fish species is specified below as a human health target. To protect wildlife and rare and endangered species, the average fish tissue mercury concentration in fish consumed by piscivorous birds is specified below as a wildlife target. The goal of this target is that controllable water quality factors not cause detrimental mercury concentrations in San Francisco Bay wildlife, which is consistent with the bioaccumulation objective in Chapter 3. To achieve the human health and wildlife targets and to attain water quality standards, the Baywide suspended sediment mercury concentration target is 0.2 mg mercury per kg dry sediment.

The Regional Monitoring Program (RMP) conducts monitoring relevant to evaluating progress toward meeting the sediment and human health and wildlife targets. The following passages describe acceptable approaches to evaluate progress toward meeting the targets. Other approaches can be considered during adaptive implementation reviews.

Suspended Sediment Target

The suspended sediment target (0.2 mg mercury per kg dry sediment) shall be compared to the annual median Bay suspended sediment mercury concentration found through RMP monitoring. The suspended sediment mercury concentration shall be computed as the difference between total and dissolved mercury concentration in a water sample (at each location) divided by the suspended sediment concentration for that same sample.

Human Health Target

The human health target is a fish tissue mercury concentration (0.2 mg mercury per kg fish tissue). This target applies to average wet weight fish tissue muscle concentrations in 60 cm long striped bass. The RMP conducts fish tissue sampling and analysis in San Francisco Bay every three years. Progress toward attainment of the human health target shall be evaluated by tracking mercury concentrations in striped bass, a commonly consumed sport fish with relatively high mercury concentrations. Striped bass are routinely caught in three size ranges: 45-59 cm (small), 60-82 cm (medium), and larger than 82 cm (large). To provide sufficient data to evaluate the target, striped bass in the small and medium size ranges should be caught and analyzed. The best functional relationship between mercury concentration and length shall be established for the fish caught, and the resulting equation of fit shall be evaluated at 60 cm to compute the mercury concentration to compare to the human health target. The RMP tracks mercury concentrations in other San Francisco Bay sportfish, such as halibut and jack-smelt. This information will be used to assess overall trends and human health risks.

Wildlife Target

The wildlife target is a fish tissue mercury concentration (0.03 mg mercury per kg fish). This target applies to average wet weight whole fish concentrations in 3–5 cm length fish.

The RMP is developing a long term monitoring program to evaluate mercury concentrations in small fish typically consumed by birds, including by the California least tern. Progress toward attainment of the wildlife target will be evaluated by tracking mercury concentrations in 3–5 cm long Bay fish. The RMP is also collaborating with the U.S. Fish and Wildlife Service on long-term monitoring and analysis of bird egg mercury concentrations.

7.2.2.3 Sources and Losses

During the California Gold Rush, cinnabar mines in the Central Coast Ranges produced the mercury used to extract gold from the Sierra Nevada foothills. Mercury was later mined and used to produce munitions, electronics, and health care and commercial products.

The year 2003 estimate of total mercury inputs to the San Francisco Bay is about 1220 kg/yr. The sources of mercury in San Francisco Bay include bed erosion (about 460 kg/yr), the Central Valley watershed (about 440 kg/yr), urban stormwater runoff (about 160 kg/yr), the Guadalupe River watershed (about 92 kg/yr), direct atmospheric deposition (about 27 kg/yr), non-urban stormwater runoff (about 25 kg/yr), and wastewater discharges (about 18 kg/yr). There is a potential that mercury may enter the Bay from Bay margin contaminated sites and abandoned mercury mines outside the Guadalupe watershed. An evaluation of these potential sources is addressed below under Mercury TMDL Implementation.

Using box models for sediment and mercury inputs and outputs to and from San Francisco Bay, the 2003 estimate for San Francisco Bay mercury losses is approximately 1700 kg/yr. Mercury leaves the Bay by transport to the Pacific Ocean via the Golden Gate, the net result of dredging and disposal (in-Bay and upland), and other losses.

7.2.2.4 Allocations

Tables 7.2.2-1 through 7.2.2-5 present load and wasteload allocations for San Francisco Bay mercury sources. Table 7.2.2-1 presents load and wasteload allocations by source category and the 2003 estimated annual loads. Tables 7.2.2-2 through 7.2.2-5 contain wasteload allocations for individual wastewater and

Water Quality Control Plan for the San Francisco Bay Basin

urban stormwater discharges to San Francisco Bay. When summed, the individual allocations equal the category totals for urban stormwater and wastewater shown in Table 7.2.2-1.

Table 7.2.2-1 Mercury Load and Wasteload Allocations By Source Category

Source	2003 Mercury Load (kg/yr)	Allocation (kg/yr)
Bed erosion ^a	460	220
Central Valley Watershed	440	330
Urban Stormwater Runoff	160	82
Guadalupe River Watershed (mining legacy)	92 ^b	2
Atmospheric deposition	27	27
Non-urban stormwater runoff	25	25
Wastewater (municipal and industrial)	18	12
Sediment dredging and disposal ^c	net loss	0
		≤ ambient concentration

Notes:

- ^a Bed erosion occurs as mercury buried in Bay sediment becomes available for biological uptake when overlying sediment erodes.
- ^b This load does not account for mercury captured in ongoing sediment removal programs conducted in the watershed.
- ^c Sediment dredging and disposal often moves mercury-containing sediment from one part of the Bay to another. The dredged sediment mercury concentration generally reflects ambient conditions in San Francisco Bay sediment. This allocation is both mass-based and concentration-based. The allocation will be implemented by confirming both that the combined effect of dredging and disposal continues to be a net loss and that the mercury concentration of dredged material disposed in the Bay must be at or below the Baywide ambient mercury concentration. This allocation ensures that this source category continues to represent a net loss of mercury.

Table 7.2.2-2 Individual Wasteload Allocations for Mercury in Urban Stormwater Discharges

Entity	NPDES Permit	Allocation (kg/yr) ^a	Load Reduction (kg/yr) ^b
Santa Clara Valley Urban Runoff Pollution Prevention Program	CAS029718	23	21
Alameda Countywide Clean Water Program	CAS029831	20	19
Contra Costa Clean Water Program	CAS029912	11	11
San Mateo County Stormwater Pollution Prevention Program	CAS029921	8.4	8.0
Vallejo Sanitation and Flood Control District	CAS612006	1.6	1.6
Fairfield-Suisun Urban Runoff Management Program	CAS612005	1.6	1.5
American Canyon	CAS612007	0.14	0.13
Sonoma County area ^c	CAS000004	1.6	1.5
Napa County area ^c	CAS000004	1.6	1.5
Marin County area ^c	CAS000004	3.3	3.2
Solano County area ^c	CAS000004	0.81	0.77
San Francisco County area ^{c,d}	CAS000004	8.8	8.4
Total		82^e	78^e

Notes:

- ^a Allocations implicitly include all current and future permitted discharges within the geographic boundaries of municipalities and unincorporated areas including, but not limited to, California Department of Transportation (Caltrans) roadways and non-roadway facilities and rights-of-way, atmospheric deposition, public facilities, properties proximate to stream banks, industrial facilities, and construction sites.
- ^b This column contains calculated load reductions relative to the estimated 2003 urban stormwater runoff annual load that are consistent with attaining the wasteload allocation. Demonstration of such load reductions is an alternative manner of showing compliance with the allocations.
- ^c Includes unincorporated areas and all municipalities in the county that are in the Region and drain to the Bay. The statewide municipal stormwater general permit issued by the State Water Resources Control Board covers these municipalities.
- ^d This urban stormwater runoff load estimate does not account for treatment provided by San Francisco's combined sewer system. The treatment provided by the Bayside facilities (NPDES permit CA0037664) will be credited toward meeting the allocation and load reduction.
- ^e These totals differ slightly from the column sum due to rounding.

Table 7.2.2-3 Individual Wasteload Allocations for Mercury in Municipal Wastewater Discharges

Permitted Entity (Bold type indicates advanced treatment)	NPDES Permit	2000–2003 Load (kg/yr)	Interim Allocation (kg/yr)	Final Allocation (kg/yr)
American Canyon, City of	CA0038768	0.12	0.095	0.095
California Department of Parks and Recreation, Angel Island State Park	CA0037401	0.013	0.013	0.013
Benicia, City of	CA0038091	0.088	0.088	0.088
Burlingame, City of	CA0037788	0.089	0.089	0.089
Calistoga, City of	CA0037966	0.016	0.016	0.016
Central Contra Costa Sanitary District	CA0037648	2.23	1.8	1.3
Central Marin Sanitation Agency	CA0038628	0.18	0.15	0.11
Delta Diablo Sanitation District	CA0038547	0.31	0.25	0.19
East Bay Dischargers Authority	CA0037869	3.6	2.9	2.2
Dublin-San Ramon Services District (CA0037613) Hayward Shoreline Marsh (CA0038636) Livermore, City of (CA0038008) Union Sanitary District, wet weather (CA0038733)				
East Bay Municipal Utilities District	CA0037702	2.6 ^a	2.1	1.5
East Brother Light Station	CA0038806	0.00001	0.000012	0.000012
Fairfield-Suisun Sewer District	CA0038024	0.22	0.17	0.17
Las Gallinas Valley Sanitary District	CA0037851	0.17	0.13	0.10
Marin County Sanitary District, Paradise Cove	CA0037427	0.00055	0.00055	0.00055
Marin County Sanitary District, Tiburon	CA0037753	0.0099	0.0099	0.0099
Millbrae, City of	CA0037532	0.052	0.052	0.052
Mountain View Sanitary District	CA0037770	0.034	0.034	0.034
Napa Sanitation District	CA0037575	0.28	0.23	0.17
Novato Sanitary District	CA0037958	0.079	0.079	0.079
Palo Alto, City of	CA0037834	0.38	0.31	0.31
Petaluma, City of	CA0037810	0.063	0.063	0.063
Pinole, City of	CA0037796	0.055	0.055	0.055

Water Quality Control Plan for the San Francisco Bay Basin

Permitted Entity (Bold type indicates advanced treatment)	NPDES Permit	2000–2003 Load (kg/yr)	Interim Allocation (kg/yr)	Final Allocation (kg/yr)
Contra Costa County, Port Costa Wastewater Treatment Plant	CA0037885	0.00072	0.00072	0.00072
Rodeo Sanitary District	CA0037826	0.060	0.060	0.060
Saint Helena, City of	CA0038016	0.047	0.047	0.047
San Francisco, City and County of, San Francisco International Airport WQCP	CA0038318	0.032	0.032	0.032
San Francisco, City and County of, Southeast Plant	CA0037664	2.7	2.1	1.6
San Jose/Santa Clara WPCP	CA0037842	1.0	0.80	0.80
San Mateo, City of	CA0037541	0.32	0.26	0.19
Sausalito-Marín City Sanitary District	CA0038067	0.078	0.078	0.078
Seafirth Estates	CA0038893	0.00036	0.00036	0.00036
Sewerage Agency of Southern Marin	CA0037711	0.13	0.10	0.076
Sonoma Valley County Sanitary District	CA0037800	0.041	0.041	0.041
South Bayside System Authority	CA0038369	0.53	0.42	0.32
South San Francisco/San Bruno WQCP	CA0038130	0.29	0.24	0.18
Sunnyvale, City of	CA0037621	0.15	0.12	0.12
US Naval Support Activity, Treasure Island WWTP	CA0110116	0.026	0.026	0.026
Vallejo Sanitation & Flood Control District	CA0037699	0.57	0.46	0.34
West County Agency, Combined Outfall	CA0038539	0.38 ^c	0.30	0.23
Yountville, Town of	CA0038121	0.040	0.040	0.04
Total		17^b	14^b	11^b

Notes:

^a This allocation includes wastewater treatment and all wet weather facilities.

^b Total differs slightly from the column sum due to rounding.

^c Mercury monitoring data quality concerns pertaining to this discharger will need to be addressed during the next review.

Table 7.2.2-4 Individual Wasteload Allocations for Mercury in Petroleum Refinery Wastewater Discharges

Permitted Entity	NPDES Permit	Allocation (kg/yr)
Chevron Products Company	CA0005134	0.34
ConocoPhillips	CA0005053	0.13
Martinez Refining Co. (formerly Shell)	CA0005789	0.22
Ultramar, Golden Eagle	CA0004961	0.11
Valero Refining Company	CA0005550	0.08
Total		0.9

Table 7.2.2-5 Individual Wasteload Allocations for Mercury in Industrial (Non-Petroleum Refinery) Wastewater Discharges^c

Permitted Entity	NPDES Permit	Allocation (kg/yr)
C&H Sugar Co.	CA0005240	0.0013
Crockett Cogeneration	CA0029904	0.0047
The Dow Chemical Company	CA0004910	0.041
General Chemical ^a	CA0004979	0.21
GWF Power Systems, Site I	CA0029106	0.0016
GWF Power Systems, Site V	CA0029122	0.0025
Hanson Aggregates, Amador Street	CA0030139	0.000005
Hanson Aggregates, Olin Jones Dredge Spoils Disposal	CA0028321	0.000005
Hanson Aggregates, Tidewater Ave. Oakland	CAA030147	0.000005
Pacific Gas and Electric, East Shell Pond	CA0030082	0.00063
Pacific Gas and Electric, Hunters Point Power Plant	CA0005649	0.020
Rhodia, Inc.	CA0006165	0.011
San Francisco, City and Co., SF International Airport Industrial WTP	CA0028070	0.051
Southern Energy California, Pittsburg Power Plant	CA0004880	0.0078
Southern Energy Delta LLC, Potrero Power Plant	CA0005657	0.0031
United States Navy, Point Molate	CA0030074	0.013
USS-Posco	CA0005002	0.045
Total		0.4^b

Notes:

^a Data quality concerns pertaining to this discharger will need to be addressed during the next review.

^b Total differs slightly from the column sum due to rounding.

° Wasteload allocations for industrial wastewater discharges do not include mass from once-through cooling water. The Water Board will apply intake credits to once-through cooling water as allowed by law.

7.2.2.5 Total Maximum Daily Load

The mercury TMDL for San Francisco Bay is the sum of the load and wasteload allocations, 700 kg/yr. The Bay will attain applicable water quality standards for mercury when the overall mercury load is reduced to the TMDL and mercury methylation control measures are implemented.

A TMDL must include a margin of safety to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality. This TMDL's targets and allocations rely on conservative assumptions, which thereby provide an implicit margin of safety. The adaptive approach to implementation provides an additional margin of safety.

There is no evidence that mercury contamination in San Francisco Bay is worse at any particular time of year. Therefore, the TMDL and allocation scheme do not have a seasonal component.

7.2.2.6 Mercury TMDL Implementation

The San Francisco Bay mercury TMDL implementation plan has four objectives: (1) reduce mercury loads to achieve load and wasteload allocations, (2) reduce methylmercury production and consequent risk to humans and wildlife exposed to methylmercury, (3) conduct monitoring and focused studies to track progress and improve the scientific understanding of the system, and (4) encourage actions that address multiple pollutants. The plan establishes requirements for dischargers to reduce or control mercury loads and identifies actions necessary to better understand and control methylmercury production. In addition, it addresses potential mercury sources and describes actions necessary to manage risks to Bay fish consumers. The adaptive implementation section describes the method and schedule for evaluating and adapting the TMDL and implementation plan as needed to assure water quality standards are attained.

Mercury Source Control Actions

This section, organized by mercury source categories, specifies actions required to achieve allocations and implement the TMDL.

Central Valley Watershed

The Central Valley Regional Water Quality Control Board (Central Valley Water Board) is developing mercury TMDLs for several mercury-impaired water bodies in its region that drain to San Francisco Bay. The Central Valley Water Board staff is currently developing a mercury TMDL for portions of the Delta within the Central Valley region designed to meet the Central Valley watershed's load allocation. This Delta mercury TMDL is scheduled for consideration as a Basin Plan Amendment by the Central Valley Water Board by December 2006.

Attainment of the load allocation shall be assessed as a five-year average annual mercury load by one of two methods. First, attainment may be demonstrated by documentation provided by the Central Valley Water Board that shows a net 110 kg/yr decrease in total mercury entering the Delta from within the Central Valley region. Alternatively, attainment of the load allocation may be demonstrated by multiplying the flow-weighted suspended sediment mercury concentration by the sediment load measured at the RMP Mallard Island monitoring station. If sediment load estimates are unavailable, the load shall be assumed to be 1,600 million kg of sediment per year. The mercury load fluxing past Mallard Island will be less than or equal to 330 kg/yr after attainment of the allocation.

The allocation for the Central Valley watershed should be achieved within 20 years after the Central Valley Water Board begins implementing its TMDL load reduction program. Studies need to be conducted to evaluate the time lag between the remediation of mercury sources and resulting load reductions from the Delta. An interim loading milestone of 385 kg/yr of mercury, halfway between the current load and the allocation, should be attained ten years after implementation of the Central Valley Delta TMDL begins. This schedule will be reevaluated as the load reduction plans are implemented.

Urban Stormwater Runoff

The wasteload allocations shown in Table 7.2.2-2 shall be implemented through the NPDES stormwater permits issued to urban runoff management agencies and the California Department of Transportation (Caltrans). The urban stormwater runoff allocations implicitly include all current and future permitted discharges, not otherwise addressed by another allocation, and unpermitted discharges within the geographic boundaries of urban runoff management agencies (collectively, "source category") including, but not limited to, Caltrans roadway and non-roadway facilities and rights-of-way, atmospheric deposition, public facilities, properties proximate to stream banks, industrial facilities, and construction sites.

The allocations for this source category should be achieved within 20 years, and, as a way to measure progress, an interim loading milestone of 120 kg/yr, halfway between the current load and the allocation, should be achieved within ten years. If the interim loading milestone is not achieved, NPDES-permitted entities shall demonstrate reasonable and measurable progress toward achieving the 10-year loading milestone.

The NPDES permits for urban runoff management agencies shall require the implementation of best management practices and control measures designed to achieve the allocations or accomplish the load reductions derived from the allocations. In addition to controlling mercury loads, best management practices or control measures shall include actions to reduce mercury-related risks to humans and wildlife. Requirements in each permit issued or reissued and applicable for the term of the permit shall be based on an updated assessment of control measures intended to reduce pollutants in stormwater runoff to the maximum extent practicable and remain consistent with the section of this chapter titled "Surface Water Protection and Management—Point Source Control—Stormwater Discharges." The following additional requirements are or shall be incorporated into NPDES permits issued or reissued by the Water Board for urban runoff management agencies.

1. Evaluate and report on the spatial extent, magnitude, and cause of contamination for locations where elevated mercury concentrations exist;
2. Develop and implement a mercury source control program;
3. Develop and implement a monitoring system to quantify either mercury loads or loads reduced through treatment, source control, and other management efforts;
4. Monitor levels of methylmercury in discharges;
5. Conduct or cause to be conducted studies aimed at better understanding mercury fate, transport, and biological uptake in San Francisco Bay and tidal areas;
6. Develop an equitable allocation-sharing scheme in consultation with Caltrans (see below) to address Caltrans roadway and non-roadway facilities in the program area, and report the details to the Water Board;

7. Prepare an annual report that documents compliance with the above requirements and documents either mercury loads discharged, or loads reduced through ongoing pollution prevention and control activities; and
8. Demonstrate progress toward (a) the interim loading milestone, or (b) attainment of the allocations shown in Table 7.2.2-2, by using one of the following methods:
 - Quantify the annual average mercury load reduced by implementing (a) pollution prevention activities, and (b) source and treatment controls. The benefit of efforts to reduce mercury-related risk to wildlife and humans should also be quantified. The Water Board will recognize such efforts as progress toward achieving the interim milestone and the mercury-related water quality standards upon which the allocations and corresponding load reductions are based. Loads reduced as a result of actions implemented after 2001 (or earlier if actions taken are not reflected in the 2001 load estimate) may be used to estimate load reductions.
 - Quantify the mercury load as a rolling five-year annual average using data on flow and water column mercury concentrations.
 - Quantitatively demonstrate that the mercury concentration of suspended sediment that best represents sediment discharged with urban runoff is below the suspended sediment target.

Once the Water Board accepts that a requirement has been completed by an urban runoff management agency, it need not be included in subsequent permits for that agency. These requirements apply to municipalities covered by the statewide municipal stormwater general permit (issued by the State Water Resources Control Board) five years after the effective date of the San Francisco Bay mercury TMDL.

Urban runoff management agencies have a responsibility to oversee various discharges within the agencies' geographic boundaries. However, if it is determined that a source is substantially contributing to mercury loads to the Bay or is outside the jurisdiction or authority of an agency the Water Board will consider a request from an urban runoff management agency which may include an allocation, load reduction, and/or other regulatory requirements for the source in question.

Within the jurisdiction of each urban runoff management agency, Caltrans is responsible for discharges associated with roadways and non-roadway facilities. Consequently, Caltrans shall be required to implement the following actions:

1. Develop and implement a system to quantify mercury loads or loads reduced through control actions;
2. Prepare an annual report that documents mercury loads or loads reduced through control actions; and
3. Develop an equitable allocation-sharing scheme that reflects Caltrans load reduction responsibility in consultation with the urban runoff management agencies, and report the details to the Water Board. Alternatively, Caltrans may choose to implement load reduction actions on a watershed or regionwide basis in lieu of sharing a portion of an urban runoff management agency's allocation. In such a case, the Water Board will consider a separate allocation for Caltrans for which they may demonstrate progress toward attaining an allocation or load reduction in the same manner mentioned previously for municipal programs.

Guadalupe River Watershed (Mining Legacy)

In the near term, the effort underway to develop the Guadalupe River Watershed Mercury TMDL will be the mechanism used to implement and track progress toward achieving the load allocation. Ultimately, the Water Board expects the implementation plan for the Guadalupe River Watershed Mercury TMDL to integrate implementation efforts relative to that TMDL with those implementation efforts for the San Francisco Bay mercury TMDL.

The Guadalupe River Watershed Mercury TMDL will provide a watershed-wide mercury management strategy. Efforts are already underway in the watershed to take early actions to reduce mercury loads, and more are planned. A high priority for the watershed-based strategy is to control upper watershed sources associated with the mining legacy to avoid compromising actions taken in the lower watershed. The strategy will include measures that prevent mercury-laden sediment from reaching the Bay, either by removal or by preventing their transport to the Bay. The strategy will also feature measures intended to reduce methylmercury production and risks to human health and wildlife. An essential component of the strategy will also involve testing and evaluation of new techniques and control measures, the benefits of that may apply throughout the Bay. As the mercury load, methylation, and reductions resulting from these efforts are quantified by the dischargers identified through the Guadalupe River Watershed Mercury TMDL process, the Water Board will consider how the reductions achieved will be counted toward fulfillment of the load reductions required to meet the Guadalupe River watershed load allocation.

The Guadalupe River watershed mining legacy mercury load allocation is expected to be attained within 20 years after the Water Board begins implementing the Guadalupe River Watershed Mercury TMDL. As a way to measure progress, an interim-loading milestone of 47 kg/yr of mercury, halfway between the current load and the allocation, should be achieved within ten years. If the interim loading milestone is not achieved, dischargers shall make reasonable and measurable progress toward achieving the ten-year load reduction through implementation of the watershed-wide strategy.

Progress toward (a) the interim loading milestone, or (b) attainment of the allocation, shall be demonstrated by the dischargers identified through the Guadalupe River Watershed TMDL using one of the methods listed below:

- Quantify the annual average mercury load reduced by implementing (a) pollution prevention activities, (b) source and treatment controls, and (c) if applicable, other efforts to reduce methylation or mercury-related risks to humans and wildlife consistent with the watershed-based strategy. The Water Board will recognize loads reduced resulting from activities implemented after 1996 (or earlier if actions taken are not reflected in the 2001 load estimate) to estimate load reductions.
- Quantify the mercury load as a rolling five-year annual average using data on flow and water column mercury concentrations.
- Quantitatively demonstrate that the mercury concentration of suspended sediment that best represents sediment discharged from the watershed to San Francisco Bay is below the suspended sediment target.

Municipal Wastewater

The individual municipal wastewater wasteload allocations shown in Table 7.2.2-3 shall be implemented via individual mass limits and an aggregate mass limit that is the sum of the individual allocations, 11 kg/yr. The Water Board will issue a San Francisco Bay watershed mercury NPDES permit to all dischargers listed in Table 7.2.2-3 to implement the individual and aggregate mass limits.

The wasteload allocations for this source category shall be achieved within 20 years, and, as a way to measure progress, interim individual allocations equal to a 20 percent reduction from 2000-2003 annual mass discharge levels shall be achieved within 10 years. These interim allocations, shown in Table 7.2.2-3, shall be implemented via individual mass limits and an aggregate mass limit that is the sum of the individual interim allocations, 14 kg/yr. During the initial ten years, individual mass limits shall be the 2000-2003 annual mass discharge levels shown in Table 7.2.2-3, and the aggregate mass limit is the sum of these individual mass discharge levels.

If any aggregate mass limit is exceeded, the Water Board will pursue enforcement actions against those individual dischargers whose mass discharges exceed their individual mass limits.

The mass limits and the following requirements shall be incorporated into the watershed NPDES permit for municipal wastewater dischargers:

- Develop and implement effective programs that include but are not limited to pollution prevention to control mercury sources and loading, a plan and schedule of actions and effectiveness measures applicable for the term of the permit, based on identification of the largest and most controllable sources and an updated assessment of source control measures and wastewater treatment technologies (the level of effort shall be commensurate with the mercury load and performance of the facility) and quantify the mercury load avoided or reduced;
- Develop and implement effective programs to reduce mercury-related risks to humans and wildlife and quantify risk reductions resulting from these activities;
- Comply with water quality-based effluent limitations, to be elaborated through the permit, that are consistent with the assumptions and requirements of the mercury wasteload allocation;
- Track individual facility and aggregate wastewater loads and the status of source control and pollution prevention activities;
- Monitor levels of methylmercury in discharges;
- Conduct or cause to be conducted studies aimed at better understanding mercury fate, transport, the conditions under which mercury methylation occurs, and biological uptake in San Francisco Bay and tidal areas;
- Conduct or cause to be conducted studies to evaluate the presence or potential for local effects on fish, wildlife, and rare and endangered species in the vicinity of wastewater discharges; and
- Prepare an annual report that documents mercury loads from each facility, mercury and methylmercury effluent concentrations, and ongoing source control activities, including mercury loads avoided through control actions.

The watershed NPDES permit shall also specify conditions that apply to each individual facility. These conditions are intended to minimize the potential for adverse effects in the immediate vicinity of discharges and to ensure that municipal wastewater facilities maintain proper operation, maintenance, and performance. If a facility exceeds its individual mercury load allocation as a 12-month rolling average

or an effluent mercury trigger concentration, it shall be required to report the exceedance in its individual Self-Monitoring Report, implement a corrective action plan, and to submit a report within 60 days that:

- Evaluates the cause of the trigger or mass exceedances;
- Evaluates the effectiveness of existing pollution prevention or pretreatment programs and methods for preventing future exceedances;
- Evaluates the feasibility and effectiveness of technology enhancements to improve plant performance;
- Evaluates other measures for preventing future exceedances, depending on the cause of an exceedance; and
- Includes an action plan and time schedule to correct and prevent trigger exceedances.

Effluent mercury trigger concentrations for secondary treatment facilities are a daily maximum of 0.065 µg/l total mercury and monthly average of 0.041 µg/l total mercury. For advanced treatment facilities, effluent mercury trigger concentrations are a daily maximum of 0.021 µg/l total mercury and a monthly average of 0.011 µg/l total mercury.

The Water Board will pursue enforcement action against dischargers that do not respond to exceedances of triggers or do not implement reasonable actions to correct and prevent trigger exceedances. Determination of reasonable actions will be based on an updated assessment of source control measures and wastewater treatment technologies applicable for the term of each issued or reissued permit.

Industrial Wastewater

The individual wasteload allocations for the industrial wastewater discharges from the five Bay Area petroleum refineries (Chevron, ConocoPhillips, Martinez Refining Co., Ultramar Golden Eagle, and Valero) listed in Table 7.2.2-4, and the individual wasteload allocations for all other industrial wastewater facilities listed in Table 7.2.2-5 shall be implemented via individual mass limits and an aggregate mass limit that is the sum of the individual allocations, 1.3 kg/yr. If the aggregate mass limit is exceeded, the Water Board will pursue enforcement actions against those individual dischargers whose mass discharges exceed their individual mass limits.

The mass limits and the following requirements shall be incorporated into NPDES permits for all industrial wastewater dischargers:

- Develop and implement effective programs to control mercury sources and loading including demonstration that discharge levels represent good performance based on an updated assessment of source control measures and wastewater treatment technologies (the level of effort will be commensurate with the mercury load and performance of the facility) and quantify the mercury load avoided or reduced;
- Develop and implement effective programs to reduce mercury-related risks to humans and wildlife and quantify the risk reductions resulting from these activities;
- Comply with water quality-based effluent limitations, to be elaborated through the permit, that are consistent with the assumptions and requirements of the mercury wasteload allocation;
- Monitor levels of methylmercury in discharges;
- Conduct or cause to be conducted studies aimed at better understanding mercury fate, transport, the conditions under which mercury methylation occurs, and biological uptake in San Francisco Bay and tidal areas;

- Conduct or cause to be conducted studies to evaluate the presence or potential for local effects on fish, wildlife, and rare and endangered species in the vicinity of wastewater discharges; and
- Prepare an annual report that documents mercury loads from each facility, mercury and methylmercury effluent concentrations, and ongoing source control activities, including mercury loads avoided through control actions.

The NPDES permits for industrial facilities shall also specify conditions that apply to each individual facility. These conditions are intended to minimize the potential for adverse effects in the immediate vicinity of discharges and to ensure that industrial wastewater facilities maintain proper operation, maintenance, and performance. If a facility exceeds its individual mercury load allocation as a 12-month rolling average or an effluent mercury trigger concentration, it shall be required to report the exceedance in its individual Self-Monitoring Report, implement a corrective action plan, and submit a report within 60 days that:

- Evaluates the cause of the trigger or mass exceedances;
- Evaluates the effectiveness of existing pollution prevention or pretreatment programs and methods for preventing future exceedances;
- Evaluates the feasibility and effectiveness of technology enhancements to improve plant performance;
- Evaluates other measures for preventing future exceedances, depending on the cause of an exceedance; and
- Includes an action plan and time schedule to correct and prevent trigger exceedances.

Effluent mercury trigger concentrations are a daily maximum of 0.062 µg/l total mercury and monthly average of 0.037 µg/l total mercury.

The Water Board will pursue enforcement action against dischargers that do not respond to exceedances of triggers or do not implement reasonable actions to correct and prevent trigger exceedances.

Determination of reasonable actions will be based on an updated assessment of source control measures and wastewater treatment technologies applicable for the term of each issued or reissued permit.

Bay Area petroleum refineries shall be required to work collaboratively with the Water Board to investigate the environmental fate of mercury in crude oil and report findings to the Water Board within five years of the effective date of the San Francisco Bay mercury TMDL implementation plan. These requirements may be implemented via the Water Board's authority under Section 13267 of the California Water Code or petroleum refinery wastewater NPDES permits. The report shall address two key questions:

1. What are the potential pathways by which crude oil mercury could be discharged to the Bay from Bay Area petroleum refining facilities?
2. What are the annual mercury loads associated with these discharge pathways?

Sediment Dredging and Disposal

The allocation for sediment dredging and disposal is both mass-based and concentration-based. The mercury concentration in dredged material disposed of in the Bay shall not exceed the 99th percentile mercury concentration of the previous 10 years of Bay sediment samples collected through the Regional Monitoring Program (excluding stations outside the Bay like the Sacramento River, San Joaquin River, Guadalupe River and Standish Dam stations). Prior to disposal, the material shall be sampled and analyzed according to the procedures outlined in the 2001 U.S. Army Corps of Engineers document

“Guidelines for Implementing the Inland Testing Manual in the San Francisco Bay Region.” All in-Bay disposal of dredged material shall comply with the Dredging and Disposal of Dredged Sediment program described in Chapter 4 and the Long-Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region.

The process of dredging and disposing of dredged material in the Bay may enhance biological uptake and methylmercury exposure. To address this concern, permitted dredging and disposal operations shall demonstrate that their activities are accomplished in a manner that does not increase bioavailability of mercury. As part of this demonstration, the Waste Discharge Requirements for such operations shall include requirements to conduct or cause to be conducted studies to better understand how their operations affect mercury fate, transport, and biological uptake.

Atmospheric Deposition

Mercury that deposits directly on the Bay surface and the surrounding watershed is attributed to both remote and local sources. The extent to which these sources can be controlled is unknown and the Water Board’s authority to control such sources is limited. The load allocation does not allow an increase of current loads, and does not require a reduction from this source category at this time. Recent scientific studies suggest that mercury newly deposited from the atmosphere may be more available for biological uptake than mercury already present in an aquatic system. As such, the following implementation efforts need to be undertaken to evaluate the significance of atmospheric deposition and the feasibility of load reductions:

- The U.S. Environmental Protection Agency should investigate the significance of atmospheric deposition and actively pursue national and international efforts to reduce the amount of mercury released through combustion of fossil fuels; and
- The Bay Area Air Quality Management District should conduct a local mercury emissions inventory, investigate the significance of local mercury air emissions, evaluate the effectiveness of existing control measures and the feasibility of additional controls.

If local air sources are found to contribute substantially to atmospheric deposition loading to the Bay and its surrounding watershed, the Water Board will consider assigning allocations and load reductions to individual air sources and work with the Bay Area Air Quality Management District to ensure allocations are achieved.

New Mercury Sources

As the TMDL is implemented, new sources of mercury may emerge either as the result of a new facility applying for a discharge permit or as a result of a new source being discovered. The Water Board will consider establishing a load or wasteload allocation for a new mercury source under any of the following circumstances:

- The allocation from one or more existing sources of the same category (e.g., municipal wastewater) will be reduced by an amount equal to the new allocation; or
- The Water Board finds that the magnitude of the new allocation is negligible compared to load reductions from all sources that will have been realized prior to establishing the new allocation; or
- The allocation is for a previously unquantified discharge of mercury from a source category that does not already have an allocation.

This section specifies actions required for sources that are potentially either discharging mercury or enhancing methylmercury production in the Bay.

Mercury Mines

Local inactive mercury mines shall be addressed through continued implementation of the Mines and Mineral Producers Discharge Control Program (Mines Program) described in Chapter 4. The key regulatory component of this established program is that property owners of inactive and active mine sites that discharge stormwater contaminated by contact with any overburden, raw material, intermediate products, finished products, byproducts, or waste products are required to comply with NPDES industrial stormwater regulations. Under the Mines Program, the Water Board has the authority to issue individual industrial permits or allow the discharger to obtain coverage under the industrial stormwater general permit issued by the State Water Resources Control Board. For those mines that are not currently meeting the conditions set forth in the Mines Program, responsible parties shall attain compliance within five years of the effective date of the San Francisco Bay mercury TMDL implementation plan.

Bay Margin Contaminated Sites

A number of former industrial and military sites that contain mercury-enriched sediment surround the Bay. Available data are insufficient at this time to determine whether these sites may be discharging to the Bay. While the load these sites contribute to the Bay may be small relative to known sources, these sites may pose local threats. As such, cleanup of these sites is a Water Board priority and many cleanups are underway. The Water Board will require parties responsible for Bay margin contaminated sites to:

1. Quantify mercury mass on site such that the upper 95% confidence limit of the mean value is no more than 20% higher than the estimated mean;
2. Determine seasonal and spatial patterns of total mercury and methylmercury in sediments on site;
3. Estimate future mercury mass on site and patterns of contamination after planned remediation efforts are complete;
4. Determine seasonal patterns of total mercury and methylmercury in the water column at the site;
5. Collect prey items for local fish and birds and assess mercury concentrations; and
6. Quantify rate of sediment accretion or erosion at the site.

These requirements shall be incorporated into relevant site cleanup plans within five years of the effective date of the San Francisco Bay mercury TMDL, and the actions shall be fully implemented within ten years of the effective date of this TMDL.

Wetlands

Wetlands may contribute substantially to methylmercury production and biological exposure to mercury within the Bay. Plans for extensive wetland restoration in the San Francisco Bay region raise the concern that mercury methylation may increase, thereby increasing the amount of mercury entering the food web. Implementation tasks related to wetlands focus on managing existing wetlands and ensuring that new constructed wetlands are designed to minimize methylmercury production and subsequent transfer to the food web. . Implementation actions identified in the Suisun Marsh TMDL for dissolved oxygen (Section 7.9.1) are expected to reduce methylmercury production and the overall load of mercury into the Bay.

The Water Board issues Waste Discharge Requirements and Clean Water Act Section 401 certifications that set forth conditions related to Bay filling and the construction and management of wetlands. To implement the San Francisco Bay mercury TMDL, the Waste Discharge Requirements and Section 401 certifications for wetland projects shall include provisions that the restored wetland region be designed and operated to minimize methylmercury production and biological uptake, and result in no net increase in mercury or methylmercury loads to the Bay. Additionally, to demonstrate compliance with the provisions, projects must conduct mercury monitoring or cause such monitoring to be conducted, to determine how tidal wetlands and wetlands restoration impact net methylmercury production and/or bioaccumulation into the food web. Monitoring may be conducted on a project or regional basis. A regional approach to measuring and understanding patterns of mercury in biosentinel species (e.g., fish) conducted by a discharger-funded regional monitoring program is desirable and should be coordinated across individual restoration projects.

There is much active research on mercury cycling in wetlands. Information about how to manage wetlands to suppress or minimize mercury methylation will be adaptively incorporated into this implementation plan as it becomes available.

Risk Management

The mercury problem in San Francisco Bay may take decades to solve. However, there are activities that should be undertaken immediately to help manage the risk to consumers of mercury-contaminated fish. In this effort, the Water Board will work with the California Office of Environmental Health Hazard Assessment, the California Department of Health Services, and dischargers that pursue risk management as part of their mercury-related programs. The risk management activities will include the following:

- Providing multilingual fish-consumption advice to the public to help reduce methylmercury exposure through community outreach, broadcast and print media, and signs posted at popular fishing locations;
- Regularly informing the public about monitoring data and findings regarding hazards of eating mercury-contaminated fish; and
- Performing special studies needed to support health risk assessment and risk communication.
- Investigate ways to address public health impacts of mercury in San Francisco Bay/Delta fish, including activities that reduce actual and potential exposure of and mitigate health impacts to those people and communities most likely to be affected by mercury in San Francisco Bay caught fish, such as subsistence fishers and their families.

Adaptive Implementation

The Water Board will adapt the TMDL to incorporate new and relevant scientific information such that effective and efficient actions can be taken to achieve TMDL goals. Approximately every five years, the Water Board will review the San Francisco Bay mercury TMDL and evaluate new and relevant information from monitoring, special studies, and scientific literature. The reviews will be coordinated through the Water Board's continuing planning program and will provide opportunities for stakeholder participation. Any necessary modifications to the targets, allocations, or implementation plan will be incorporated into the Basin Plan. At a minimum, the following focusing questions will be used to conduct the reviews. Additional focusing questions will be developed in collaboration with stakeholders during each review.

Water Quality Control Plan for the San Francisco Bay Basin

1. Is the Bay progressing toward TMDL targets as expected? If it is unclear whether there is progress, how should monitoring efforts be modified to detect trends? If there has not been adequate progress, how might the implementation actions or allocations be modified?
2. What are the loads for the various source categories, how have these loads changed over time, and how might source control measures be modified to improve load reduction?
3. Is there new, reliable, and widely accepted scientific information that suggests modifications to targets, allocations, or implementation actions? In particular, is there new evidence regarding methylmercury that might justify a methylmercury TMDL or allocation, either in addition to or instead of the total mercury TMDL and allocations? If so, how should the TMDL be modified?
4. Are effective risk management activities in place to reduce human and wildlife exposure to methylmercury? If not, how should these activities be modified or enhanced?
5. Do prey fish monitoring data confirm that TMDL load allocations are adequate to attain the wildlife target?
6. Are mercury mine and Bay margin contaminated site cleanups proceeding as expected? Are any additional actions needed to protect water quality?

Using available data, the load and wasteload allocations were determined on the basis of their sufficiency to achieve water quality standards. As part of the adaptive implementation process, the Water Board will review the TMDL as a whole and determine whether new evidence suggests revisions of specific load and wasteload allocations that will result in more strategic, efficient, and cost effective achievement of water quality standards. For example, as reliable information becomes available regarding methylation control or the relative bioavailability of sources, the Water Board will consider adjusting allocations to implement the TMDL more effectively. The Water Board may also consider revising implementation requirements and/or resulting permit requirements if such changes are consistent with the assumptions and requirements of the allocations and the cumulative effect of such changes will ensure attainment of water quality standards.

Achievement of the allocations for three of the largest source categories (Central Valley Watershed, Urban Stormwater Runoff, Guadalupe River Watershed) is projected to take 20 years, with an interim 10-year milestone of fifty percent achievement. Approximately 10 years after the effective date of the TMDL or any time thereafter, the Water Board will consider modifying the schedule for achievement of the load allocations for a source category or individual discharger provided that they have complied with all applicable permit requirements and all of the following have been accomplished relative to that source category or discharger:

- A diligent effort has been made to quantify mercury loads and the sources of mercury and potential bioavailability of mercury in the discharge;
- Documentation has been prepared that demonstrates that all technically and economically feasible and cost effective control measures recognized by the Water Board as applicable for that source category or discharger have been fully implemented, and evaluates and quantifies the comprehensive water quality benefit of such measures;
- A demonstration has been made that achievement of the allocation will require more than the remaining 10 years originally envisioned; and
- A plan has been prepared that includes a schedule for evaluating the effectiveness and feasibility of additional control measures and implementing additional controls as appropriate.

Achievement of the wasteload allocations for municipal wastewater dischargers is required within 20 years, and interim allocations within 10 years. The interim allocations are expected to be attained through aggressive pollution prevention and other cost-effective mercury reduction methods. The final wasteload allocations are expected to be attained through wastewater treatment system improvements and/or implementation of a pollutant offset program. Approximately 10 years after the effective date of the TMDL or any time thereafter, the Water Board will consider modifying the schedule for achievement of the wasteload allocations or revisions to wasteload allocations if:

- The State Board has not established a pollutant offset program that can be implemented within the 20 years required to achieve final wasteload allocations;
- It can be demonstrated that all reasonable and feasible efforts have been taken to reduce mercury loads; and
- It can be demonstrated that no adverse local effects will result.

At approximately 20 years after the start of implementation and after taking the steps regarding schedule modification listed above, if a source category or individual discharger cannot demonstrate achievement of its allocation, despite implementation of all technically and economically feasible and cost effective control measures recognized by the Water Board as applicable for that source category or discharger, the Water Board will consider revising the allocation scheme provided that any resulting revisions ensure water quality standards are attained.

Load and wasteload allocations have been assigned to individual entities. However, assigning loads by watersheds could be a useful approach for managing pollutant loads, particularly if net environmental benefits can be realized. A watershed-based allocation program would only involve watersheds in the San Francisco Bay region that drain to the Bay. Such an approach could involve urban runoff management programs, wastewater facilities, and other dischargers in a watershed accepting joint responsibility for load reductions. An acceptable watershed allocation program may include incentives for agencies to implement load reduction activities and account for avoided mercury loads as well as incentives for strategic removal or sequestration of mercury already in the system. Credits could be used to offset annual loads and attain allocations for multiple sources. In addition, the Water Board will encourage and consider a pilot mercury mass offset program if it is demonstrated that such a program is a more cost effective and efficient means of achieving water quality standards, and the relative potential for mercury from different sources to enter the food web and the potential for adverse local impacts have been evaluated. These programs should recognize and reward ongoing efforts that are above and beyond those required by this TMDL. Until such programs are established, the Water Board will consider mercury source control and risk reduction activities on a case-by-case basis to determine how they contribute toward achievement of TMDL goals. The Water Board will also include in any new or modified NPDES permit a reopener to implement a pollutant offset program when it is established.

7.2.3 San Francisco Bay Polychlorinated Biphenyls TMDL

The following sections establish the TMDL for total polychlorinated biphenyls including dioxin-like PCBs congeners (hereinafter referred to as PCBs) for the San Francisco Bay. The associated numeric target, allocations, and implementation plan are designed to ensure attainment of beneficial uses and water quality objectives for the San Francisco Bay.

7.2.3.1 Problem Statement

All segments of the San Francisco Bay have been identified as impaired due to elevated levels of PCBs in sport fish. Neither the narrative water quality objective, which states that controllable water quality factors shall not cause a detrimental increase in toxic substances found in bottom sediments or aquatic life, nor the numeric water quality objective of 0.00017 µg/L total PCBs in water is attained in the San Francisco Bay. The existing beneficial use for commercial and sport fishing is not fully supported.

This TMDL addresses impairment of San Francisco Bay segments by PCBs. In the context of this TMDL, "San Francisco Bay" refers to all of the following water bodies:

- Sacramento/San Joaquin Delta (within Region 2)
- Suisun Bay
- Carquinez Strait
- San Pablo Bay
- Richardson Bay
- San Francisco Bay, Central
- San Francisco Bay, Lower (including)
 - Central Basin, San Francisco
 - Mission Creek
 - Oakland Inner Harbor (Fruitvale site)
 - Oakland Inner Harbor (Pacific Dry-Dock Yard 1 site) San Francisco Bay, South

This TMDL is intended to achieve protection of the commercial and sport fishing beneficial use and to the extent that other beneficial uses are affected by PCBs, the TMDL will also ensure protection of other beneficial uses, specifically, preservation of rare and endangered species, estuarine habitat and wildlife habitat.

7.2.3.2 Numeric Target

The numeric target (also referred to as the TMDL target) to protect both human health and wildlife is an average fish tissue concentration of 10 micrograms total PCBs per kilogram of typically consumed fish, on a wet weight basis (10 µg/kg wet weight). Attainment of the total PCBs fish tissue numeric target will also protect human health and wildlife for dioxin-like PCBs.

Attainment of the fish tissue target for PCBs in San Francisco Bay will be initially evaluated by comparing the average total PCBs concentrations in the edible portion of two fish species, white croaker (size class, 20 to 30 centimeters in length) and shiner surfperch (size class, 10 to 15 centimeters in length) to the target. Comparison of the fish target against these two species of fish is considered to be protective and provides a margin of safety for the TMDL, because PCBs concentrations in these species are the highest of the fish species measured and sport recreational fishers likely consume a variety of fish species, including those species with lower PCBs concentrations. As part of the adaptive implementation of this TMDL, the Water Board will require the collection of additional information regarding recreational and subsistence fishers' patterns of consumption and evaluate if fish species other than white croaker and shiner surfperch should be considered to evaluate attainment of the target.

The number of fish samples collected to determine compliance with the target will be based on guidance described in USEPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories

(EPA 823-B-00-007) and on the statistical power needed to demonstrate trends in total PCBs concentration over time.

7.2.3.3 Sources

Sources of PCBs to fish and the water column of San Francisco Bay fall into two categories: (1) external sources including atmospheric deposition, Central Valley inflow, municipal and industrial wastewater discharges, and urban and non-urban stormwater runoff; and (2) internal sources, including movement or release of PCBs already in San Francisco Bay sediments, specifically, dredging and in-Bay disposal of dredged sediment, erosion of bay bottom sediment containing PCBs (bed erosion), and in-Bay contaminated sediment sites. These sources and estimates of associated loads are shown in Table 7.2.3-1. Decreases of PCBs in San Francisco Bay occur via out-of-Bay dredge material disposal, natural attenuation, and outflow through the Golden Gate.

Table 7.2.3-1 PCBs Sources and Current Loads to San Francisco Bay

Source Category	PCBs Loads
Kilograms per year	
External	
Direct Atmospheric Deposition	Net Loss
Central Valley Watershed	11
Municipal Wastewater Dischargers	2.3
Industrial Wastewater Dischargers	0.035
Urban and Non Urban Stormwater Runoff	20
Total	33^a
Internal	
Sediment Dredging and Disposal	Net Loss
Bed Erosion	Not Quantified
In-Bay Contaminated Sediment	Not Quantified

a. Total differs from column sum due to rounding

7.2.3.4 Total Maximum Daily Load

The TMDL for PCBs in San Francisco Bay is 10 kg/year. Calculation of the TMDL is based on two models: a food-web PCBs bioaccumulation model and a long-term fate mass balance model. The model results predict that attainment of the numeric target will occur when the total PCBs concentration in surface sediments in the Bay declines to one $\mu\text{g}/\text{kg}$, which will be achieved when loads from external sources are reduced to 10 kg/year.

7.2.3.5 Load and Wasteload Allocations

Water Quality Control Plan for the San Francisco Bay Basin

Load allocations are presented in Table 7.2.3-2 for source categories. Individual wasteload allocations for municipal wastewater dischargers and industrial wastewater dischargers are presented in Table 7.2.3-3 and Table 7.2.3-4. Individual wasteload allocations for stormwater runoff to county-based watersheds are presented in Table 7.2.3-5.

Table 7.2.3-2 Load and Wasteload Allocations

Source Category	Allocations
Kilograms per year	
External	
Direct Atmospheric Deposition	0 ^a
Central Valley Watershed	5
Municipal Wastewater Dischargers	2
Industrial Wastewater Dischargers	0.035
Stormwater Runoff	2
Stormwater Runoff Treatment by Municipal Wastewater Dischargers	1
Total	10^b

- a. Zero allocation reflects overall net loss to the atmosphere
- b. Total differs from column sum due to rounding

Table 7.2.3-3 Individual Wasteload Allocations For Municipal Wastewater Dischargers

Permitted Entity	NPDES Permit	Allocations kilograms per year
American Canyon, City of	CA0038768	0.002
Benicia, City of	CA0038091	0.009
Burlingame, City of	CA0037788	0.01
Calistoga, City of	CA0037966	0.002
Central Contra Costa Sanitary District	CA0037648	0.1
Central Marin Sanitation Agency	CA0038628	0.04
Delta Diablo Sanitation District	CA0038547	0.04
East Bay Dischargers Authority	CA0037869	0.3
Dublin-San Ramon Services District (CA0037613)		
Hayward Shoreline Marsh (CA0037702)		
Livermore, City of (CA0038008)		
Union Sanitary District, Wet Weather (CA0038733)		
East Bay Municipal Utilities District	CA0037702	0.3
East Brother Light Station	CA0038806	0.00030
Fairfield-Suisun Sewer District	CA0038024	0.05
Las Gallinas Valley Sanitary District	CA0037851	0.01
Marin County Sanitary District, Paradise Cove	CA0037427	0.00003
Marin County Sanitary District, Tiburon	CA0037753	0.002
Millbrae, City of	CA0037532	0.007
Mt. View Sanitary District	CA0037770	0.007
Napa Sanitation District	CA0037575	0.04
Novato Sanitary District	CA0037958	0.02
Palo Alto, City of	CA0037834	0.09
Petaluma, City of	CA0037810	0.02
Pinole, City of	CA0037796	0.009
Contra Costa County, Port Costa Wastewater Treatment Plant	CA0037885	0.0001
Rodeo Sanitary District	CA0037826	0.002
Saint Helena, City of	CA0038016	0.001
San Francisco, City and County of, San Francisco International Airport WQCP	CA0038318	0.002
San Francisco, City and County of, Southeast Plant	CA0037664	0.3
San Jose/Santa Clara WPCP	CA0037842	0.4

Water Quality Control Plan for the San Francisco Bay Basin

Permitted Entity	NPDES Permit	Allocations kilograms per year
San Mateo, City of	CA0037541	0.04
Sausalito-Marín City Sanitary District	CA0038067	0.005
Seafirth Estates	CA0038893	0.00001
Sewerage Agency of Southern Marin	CA0037711	0.01
Sonoma Valley County Sanitary District	CA0037800	0.01
South Bayside System Authority	CA0038369	0.06
South San Francisco/San Bruno WQCP	CA0038130	0.03
Sunnyvale, City of	CA0037621	0.05
US Naval Support Activity, Treasure Island WWTP	CA0110116	0.002
Vallejo Sanitation & Flood Control District	CA0037699	0.05
West County Agency, Combined Outfall	CA0038539	0.05
Yountville, Town of	CA0038121	0.001
Total		2^a

a) Total differs from column sum due to rounding

Table 7.2.3-4 Individual Wasteload Allocations for Industrial Wastewater Dischargers

Permitted Entity	NPDES Permit	Allocations ^a
		kilograms per year
C&H Sugar and Crockett Community Services District.	CA0005240	0.00006
Chevron Products Company	CA0005134	0.003
ConocoPhillips	CA0005053	0.0006
Crockett Cogeneration LP, and Pacific Crockett Energy, Inc.	CA0029904	0.0006
General Chemical	CA0004979	0.0009
GWF Power Systems, Site I	CA0029106	0.0001
GWF Power Systems, Site V	CA0029122	0.0001
Hanson Aggregates, Amador Street	CA0030139	0.00003
Hanson Aggregates, Olin Jones Dredge Spoils Disposal	CA0028321	0.00003
Hanson Aggregates, Tidewater Ave., Oakland	CA0030147	0.00003
Morton Salt	CA0005185	0.00008
Pacific Gas and Electric, East Shell Pond	CA0030082	0.00003
Rhodia, Inc.	CA0006165	0.0003
San Francisco, City and Co., SF International Airport Industrial WTP	CA0028070	0.002
Shell Oil Products US and Equilon Enterprises LLC	CA0005789	0.002
Mirant Delta LLC, Pittsburg Power Plant	CA0004880	0.0008
Mirant Potrero LLC, Potrero Power Plant	CA0005657	0.0003
Tesoro Refining and Marketing Company	CA0004961	0.002
The Dow Chemical Company	CA0004910	0.0006
USS-Posco	CA0005002	0.02
Valero Refining Company	CA0005550	0.0007
Total		0.035^b

-
- a. Wasteload allocations for industrial wastewater dischargers do not include mass from once-through cooling water. The Water Board will apply intake credits to once-through cooling water as allowed by law.
- b. Total differs from column sum due to rounding

Table 7.2.3-5 County-Based Watershed Wasteload Allocations for Stormwater Runoff

County^b	Allocations^a kilograms per year
Alameda	0.5
Contra Costa	0.3
Marin	0.1
Napa	0.05
San Francisco ^c	0.2
San Mateo	0.2
Santa Clara	0.5
Solano	0.1
Sonoma	0.05
Total	2

- a. Allocations implicitly include all current and future permitted discharges within the geographic boundaries of municipalities and unincorporated areas within the County. Examples of discharges include but are not limited to California Department of Transportation (Caltrans) roadways and non-roadway facilities and rights-of-way, atmospheric deposition, public facilities, properties proximate to stream banks, industrial facilities, and construction sites.
- b. Includes unincorporated areas and all municipalities in the county that drain to the Bay and are part of the San Francisco Bay Region.
- c. Does not account for treatment provided by San Francisco's combined sewer system. The treatment provided by the City and County of San Francisco's Southeast Plant and Northpoint Wet Weather Facility (NPDES permit CA0037664) will be credited toward meeting the allocation and load reduction.

7.2.3.6 Implementation Plan

The implementation plan includes three general implementation categories: control of external loadings of PCBs to the Bay, control of internal sources of PCBs within the Bay, and actions to manage risks to Bay fish consumers. In addition, the plan includes monitoring to measure attainment of the numeric target and load allocations, and measuring implementation progress. The plan will be implemented in phases via an adaptive implementation strategy founded on requiring actions in each category based on the current state of knowledge of PCBs sources and control measures, while also conducting studies to improve our understanding of PCBs sources, control options, and fate in the environment.

External Sources

This section, organized by source categories, specifies actions required to achieve allocations and implement the TMDL.

Central Valley Watershed

Sediments entering the Bay from the Central Valley have lower concentrations of PCBs than in-Bay sediment. Major mass loading events that occur during episodic high flow conditions generally flow directly out of the Bay through the Golden Gate. It is anticipated that the Central Valley allocation will be attained through natural attenuation.

Municipal and Industrial Wastewater Dischargers

Wasteload allocations shall be implemented through NPDES permits that require implementation of best management practices to maintain optimum treatment performance for solids removal and the identification and management of controllable sources. NPDES permits shall include effluent limits based on current performance and a requirement for quantification of PCBs loads to the Bay in order to determine attainment of the wasteload allocations. Compliance with effluent limits shall be determined using a Title 40, Code of Federal Regulations, Part 136 analytical method (**effective as of April 25, 2007**). In addition, municipal and industrial wastewater dischargers will be required to support actions to reduce the health risks of people who eat PCBs-contaminated, San Francisco Bay fish and to conduct or cause to be conducted monitoring, and studies to fill critical data needs identified in the adaptive implementation section.

It is the Water Board's intent to implement individual wasteload allocations via numeric water quality-based effluent limitations for PCBs in NPDES permits. These limits shall represent individual dischargers' PCBs loads, consistent with the underlying assumptions and requirements of the wasteload allocations. In the absence of actual discharge performance data sufficient to calculate such limits, the Water Board will apply appropriate uncertainty factors to the individual wasteload allocations.

Dischargers shall also be required to conduct sufficient monitoring of their effluent, which accounts for discharge variability and blended effluent, to enable calculation of current PCBs loading. These requirements will be implemented via NPDES permits or the Water Board's authority under Section 13267 of the California Water Code, such that monitoring begins no later than January 2009 and is completed in a timely manner.

Stormwater Runoff

Stormwater runoff wasteload allocations shall be achieved within 20 years and shall be implemented through the NPDES stormwater permits issued to stormwater runoff management agencies and the California Department of Transportation (Caltrans). The urban stormwater runoff wasteload allocations implicitly include all current and future permitted discharges, not otherwise addressed by another allocation, and unpermitted discharges within the geographic boundaries of stormwater runoff management agencies including, but not limited to, Caltrans roadway and non-roadway facilities and rights-of-way, atmospheric deposition, public facilities, properties proximate to stream banks, industrial facilities, and construction sites.

Requirements in each NPDES permit issued or reissued, shall be based on an updated assessment of best management practices and control measures intended to reduce PCBs in urban stormwater runoff. Control measures implemented by stormwater runoff management agencies and other entities (except construction and industrial sites) shall reduce PCBs in stormwater runoff to the maximum extent practicable. Control measures for construction and industrial sites shall reduce discharges based on best available technology economically achievable. All permits shall remain consistent with Section 4.8 - Stormwater Discharges.

In the first five-year permit term, stormwater permittees will be required to implement control measures on a pilot scale to determine their effectiveness and technical feasibility. In the second permit term, stormwater permittees will be required to implement effective control measures, that will not cause significant adverse environmental impacts, in strategic locations, and to develop a plan to fully implement control measures that will result in attainment of allocations, including an analysis of costs, efficiency of control measures and an identification of any significant environmental impacts. Subsequent permits will include requirements and a schedule to implement technically feasible, effective and cost efficient control measures to attain allocations. If, as a consequence, allocations cannot be attained, the Water Board will take action to review and revise the allocations and these implementation requirements as part of adaptive implementation.

In addition, stormwater permittees will be required to develop and implement a monitoring system to quantify PCBs urban stormwater runoff loads and the load reductions achieved through treatment, source control and other actions; support actions to reduce the health risks of people who consume PCBs-contaminated San Francisco Bay fish; and conduct or cause to be conducted monitoring, and studies to fill critical data needs identified in the adaptive implementation section.

Stormwater runoff management agencies have a responsibility to oversee various discharges within the agencies' geographic boundaries. However, if it is determined that a source is substantially contributing to PCBs loads to the Bay or is outside the jurisdiction or authority of an agency the Water Board will consider a request from an stormwater runoff management agency which may include an allocation, load reduction, and/or other regulatory requirements for the source in question.

Urban Stormwater Runoff Treatment by Municipal Wastewater Dischargers

Routing of urban stormwater runoff through municipal wastewater treatment facilities may be an efficient means of reducing PCBs, and other particle-associated contaminant loads to the Bay. This load allocation shall be implemented through a permit. Within five years of adoption of this TMDL, the Water Board will consider issuance of a permit under which municipal wastewater dischargers can apply for a portion of this reserved allocation.

Internal Sources

In-Bay PCB-Contaminated Sites

A number of former industrial and military sites adjacent to PCBs-enriched sediment are found throughout the Bay. This TMDL does not require any specific party to implement new actions for in-Bay PCB-contaminated sites. However, cleanup of these sites is a Water Board priority and many cleanups are underway. The Water Board will maintain an inventory of contaminated sites and continue to set priorities for investigating and remediating the sites. The existing list of in-Bay PCB-contaminated sites referred to in this TMDL is based on data collected under the Bay Protection Toxic Cleanup Program, which identified sites with total PCBs in sediment that exceed 180 µg/kg. This TMDL does not set a cleanup level for total PCBs in sediment. The fish tissue target of 10 µg/kg and the sediment goal of one ug/kg are not cleanup standards, nor should they be considered appropriate, or relevant, and applicable requirements (ARARs) or a "to-be-considered" ARAR under the National Contingency Plan, 40 CFR Part 300 et. Seq. or the 1986 Superfund Amendments and Reauthorization Act. An analysis of the feasibility, technical practicability, and potential environmental impacts of individual clean-up actions is currently required prior to conducting cleanup of contaminated in-Bay sediment overseen by the Water Board and the Department of Toxic Substances Control and will continue to be required, notwithstanding this TMDL. The Water Board has the authority to approve, disapprove or condition these projects to minimize adverse environmental impacts while achieving the goals of environmental cleanup.

The Water Board will coordinate cleanup actions with the U.S. EPA and the Department of Toxic Substances Control, and advise them that the fish tissue target and sediment goal do not constitute cleanup standards for ARARs. The Water Board will issue cleanup orders as necessary. The Water Board will require responsible parties for each specific Bay margin contaminated site to:

- 1) Estimate the pre-cleanup and post-cleanup vertical and lateral extent of PCBs in Bay sediments;
- 2) Estimate the pre-cleanup and post-cleanup mass of PCBs in Bay sediments;
- 3) Quantify rate(s) of sediment accretion, erosion or natural attenuation;
- 4) Implement on-land source control measures, if necessary, to ensure that on-land sources of PCBs do not further contaminate in-Bay sediments;
- 5) Evaluate post-cleanup, the residual risks to humans and wildlife;
- 6) Support actions to reduce the health risks of people who consume PCBs-contaminated San Francisco Bay fish;
- 7) Conduct or cause to be conducted studies to fill critical data needs identified in the Adaptive Implementation section.

These requirements shall be incorporated into relevant site investigation plans within five years of the effective date of this TMDL, and the actions shall be fully implemented within ten years of the effective date of this TMDL or as agreed to in the individual site investigation plan.

Navigational Dredging

The PCBs concentration in dredged material disposed of in the Bay shall not exceed the 99th percentile PCBs concentration of the previous 10 years of Bay sediment samples collected through the RMP (excluding stations outside the Bay like the Sacramento River, San Joaquin River, Guadalupe River and Standish Dam stations). Prior to disposal, the material shall be sampled and analyzed according to the procedures outlined in the 2001 U.S. Army Corps of Engineers document "Guidelines for Implementing the Inland Testing Manual in the San Francisco Bay Region." All in-Bay disposal of dredged material shall comply with Section 4.20, entitled Dredging and Disposal of Dredged Sediment, including the Long Term Management Strategy. Additionally, dredged material dischargers will be required to conduct or cause to be conducted studies to fill critical data needs identified in the Adaptive Implementation section.

Risk Management

Load reductions and attainment of the numeric target to support fishing in the Bay as a beneficial use will take time to achieve. However, there are actions that should be undertaken prior to achievement of the numeric fish tissue target to help manage the risk to consumers of PCBs-contaminated fish. The Water Board will work with the California Office of Environmental Health Hazard Assessment, the California Department of Toxic Substances Control, the California Department of Public Health, dischargers, and interested parties to pursue risk management strategies. The risk management activities will include the following:

- Investigating and implementing actions to address the public health impacts of PCBs in San Francisco Bay/Delta fish, including activities that reduce the actual and potential exposure of, and mitigate health impacts to, people and communities most likely to be consuming PCB-contaminated fish from San Francisco Bay, such as recreational and subsistence fishers and their families;

- Providing multilingual fish-consumption advice to the public to help reduce PCBs exposure through community outreach, broadcast and print media, and signs posted at popular fishing locations;
- Regularly informing the public about monitoring data and findings regarding hazards of eating PCB-contaminated fish; and
- Conducting special studies needed to support health risk assessment and risk communication, including the collection of additional information regarding recreational and subsistence fishers' patterns of consumption.

7.2.3.7 Critical Data Needs

Additional data and other information will be needed to assess both the progress toward attainment of the fish tissue target and to evaluate the need for modifications to the implementation plan, TMDL, and/or allocations. Dischargers will be required to conduct or cause to be conducted the following studies to fill critical data needs.

- PCBs mass budget modeling and food web model improvements – Model refinements to improve our ability to predict recovery rates of the Bay from impairment by PCBs, to help strategically focus implementation actions on those actions with the most potential for success, and to help better our understanding of the role in-Bay PCBs-contaminated sites play in the Bay's recovery.
- Rate of natural attenuation of PCBs in the Bay environments –A better understanding of local rates of natural attenuation in order to predict with more certainty the recovery time of the Bay.

Monitoring

Monitoring to demonstrate progress toward attainment of the TMDL target shall be conducted by maintaining discharger-funded RMP monitoring of PCBs in San Francisco Bay fish, sediments, and water at a spatial scale and frequency to track trends in the decline of PCBs in the Bay. Monitoring of load allocations to demonstrate progress towards attainment shall be conducted by municipal and industrial wastewater dischargers and stormwater permittees as discussed in external sources above.

Continued regular monitoring of PCB loads from the Central Valley and other tributaries to the Bay shall be conducted by maintaining discharger-funded RMP monitoring in order to provide information on the long term decline of PCBs to the Bay and to confirm the assumption that Central Valley loads are being reduced due to natural attenuation. Monitoring of loads allocated to other sources will be considered as part of the RMP special studies.

Adaptive Implementation

Adaptive implementation entails taking actions commensurate with the existing, available information, reviewing new information as it becomes available, and modifying actions as necessary based on the new information. Taking action allows progress to occur while more and better information is collected and the effectiveness of current actions is evaluated. Accordingly, this TMDL will be implemented in phases starting with actions described in each source category, risk management, monitoring, and critical data needs section above with subsequent modifications and phases based on improved knowledge of PCBs sources, control measures, and fate in the environment.

The Water Board will adapt the TMDL and implementation plan to incorporate new and relevant scientific information such that effective and efficient measures can be taken to achieve the allocations

and numeric fish tissue target. The Water Board staff will present an annual progress report to the Water Board on implementation of the TMDL that includes evaluation of new and relevant information that becomes available through implementation actions, monitoring, special studies, and the scientific literature. Within ten years of the effective date of the TMDL, Water Board will consider a Basin Plan amendment that will reflect and incorporate the data and information that is generated in the intervening years. The Water Board will consider amending the PCBs TMDL and implementation plan as necessary to ensure attainment of water quality standards in a timely manner while considering the financial and environmental consequences of new control measures.

In particular, achievement of the allocations for stormwater runoff, which is projected to take 20 years, will be challenging. Consequently, the Water Board will consider modifying the schedule for achievement of the load allocations for stormwater runoff provided that dischargers have complied with all applicable permit requirements and accomplished all of the following:

- A diligent effort has been made to quantify PCBs loads and the sources of PCBs in the discharge;
- Documentation has been prepared that demonstrates that all technically and economically feasible and cost-effective control measures recognized by the Water Board have been fully implemented, and evaluates and quantifies the PCBs load reduction of such measures;
- A demonstration has been made that achievement of the allocation will require more than the remaining 10 years originally envisioned; and
- A plan has been prepared that includes a schedule for evaluating the effectiveness and feasibility of additional control measures and implementing additional controls as appropriate.

7.2.4 North San Francisco Bay Selenium Total Maximum Daily Load (TMDL)

The following sections establish the TMDL for selenium in North San Francisco Bay segments (North Bay) including the portion of the Sacramento/San Joaquin Delta (within the San Francisco Bay region), Suisun Bay, Carquinez Strait, San Pablo Bay, and Central Bay. The associated numeric targets, allocations, and implementation plan are designed to ensure attainment of selenium water quality standards, including beneficial uses in the North Bay.

7.2.4.1 Problem Statement

This TMDL addresses selenium impairment in North San Francisco Bay segments. Selenium is an essential and naturally-occurring micronutrient but in high quantities can cause reproductive impairment. Dietary uptake of particulate selenium is the most important exposure pathway for aquatic organisms, especially predators, and some types of food webs bioaccumulate selenium more efficiently than others. In the North Bay, selenium bioaccumulation at levels of concern has been detected only in clam-eating bottom feeders, such as white sturgeon and Sacramento splittail. Sturgeon feed predominantly on benthic organisms, including invasive, non-native clams (i.e., *Potamocorbula amurensis*) that are very efficient selenium bioaccumulators, which makes sturgeon susceptible to bioaccumulation of selenium to toxic levels. This TMDL is intended to ensure protection of the estuarine habitat beneficial uses, and to the extent that other beneficial uses are affected by selenium, the TMDL will also ensure protection of other beneficial uses, specifically, preservation of rare and endangered species, wildlife, and commercial and sport fishing beneficial uses.

7.2.4.2 Numeric Targets

The numeric targets for the North Bay are listed in Table 7.2.4-1.

Table 7.2.4-1 Numeric Targets for Selenium

Fish Tissue Targets	Water Column Target
8.0 µg/g whole-body dry weight	0.5 µg/L (dissolved total Se)
11.3 µg/g muscle tissue dry weight	

The whole-body fish tissue target protects against long-term chronic effects of selenium in fish and forms the basis for the water column target. Both the fish tissue and the water column targets will be evaluated to assess protection of beneficial uses. Attainment of the fish tissue targets will be assessed by comparing measured selenium concentrations in fish to the appropriate tissue. Concentrations in sturgeon will be compared to the muscle tissue target, because sturgeon are too large a fish to be analyzed whole and, therefore, comparison to the whole-body numeric target is not feasible. Use of nonlethal sampling methods, i.e., sampling of tissue plugs, in lieu of muscle tissue sampling for sturgeon, is allowed, if there is documentation that the nonlethal method provides data comparable to muscle tissue data.

7.2.4.3 Sources

The main inputs of selenium into the North Bay include contributions from the Sacramento and San Joaquin Rivers as Central Valley watershed load (4070 kg/yr), local tributaries (520 kg/yr), atmospheric deposition (<30 kg/yr), discharges from petroleum refineries (571 kg/yr), and municipal and industrial wastewater dischargers (117 kg/yr). While loads from the Sacramento River, local tributaries, including urban runoff, and atmospheric deposition represent natural background, the San Joaquin River loads include an anthropogenic source, agricultural drainage, generated by irrigation of seleniferous soils.

7.2.4.4 Total Maximum Daily Load and Allocations

The TMDL for selenium is 5300 kg/year and represents the sum of loads from the existing major sources (Table 7.2.4-2). Because selenium bioaccumulation is a long-term process, there is no evidence that selenium bioaccumulation is notably higher at any particular time of year, despite the strong seasonal variability in loads reaching the North Bay.

The TMDL is based on long-term estimates of loads from major sources; therefore the TMDL and allocations are expressed as annual loads.

Load allocations for major source categories are presented in Table 7.2.4-2. Individual wasteload allocations for petroleum refineries and municipal and industrial wastewater dischargers are presented in Table 7.2.4-3 and Table 7.2.4-4.

Table 7.2.4-2 Selenium Load Allocations

Load Category	Load Source	Allocations [kg total Se per year]
Load Allocations	Central Valley Watershed	4070
	Local Tributaries ¹	520
	Atmospheric deposition	<30
Wasteload Allocations	Petroleum Refineries	571
	Municipal Wastewater Dischargers	111
	Industrial Wastewater Dischargers	6
Total TMDL		5300²

1 An insignificant portion of this load is from urban runoff and therefore there is no allocation

2 Total TMDL load differs from column sum due to rounding

Table 7.2.4-3 Individual wasteload allocations for petroleum refineries

Permitted Entity	NPDES Permit	Allocation [kg/yr]
Chevron Products Company	CA0005134	111
Phillips66 (<i>formerly ConocoPhillips</i>)	CA0005053	93
Shell Oil Products US	CA0005789	244
Tesoro Refining and Marketing Company	CA0004961	60
Valero Refining Company	CA0005550	63
Total		571

Table 7.2.4-4 Individual wasteload allocations for municipal and industrial dischargers

Permitted Entity	NPDES Permit	Allocation [kg/yr]
Municipal		
City of American Canyon	CA0038768	1.6
City of Benicia	CA0038091	1.1
City of Calistoga	CA0037966	0.3
Central Contra Costa Sanitation District	CA0037648	17.4
Central Marin Sanitation Agency	CA0038628	4.0
Contra Costa Co. Sanitary District No.5	CA0037885	0.1
Delta Diablo Sanitary District	CA0038547	8.1
East Bay Municipal Utility District	CA0037702	30.0
Fairfield-Suisun Sewer District	CA0038024	9.7
Las Gallinas Valley Sanitary District	CA0037851	1.2
Marin County S.D. No 5	CA0037427	0.5
Mt. View Sanitary District	CA0037770	1.1
Napa Sanitation District	CA0037575	6.7
Novato Sanitary District	CA0037958	2.5
City of Petaluma	CA0037810	3.4
City of Pinole	CA0037796	2.2
Rodeo Sanitary District	CA0037826	0.4
Sausalito-Marin City Sanitary District	CA0038067	1.9
Sewerage Agency of Southern Marin	CA0037711	1.4
Sonoma Valley County Sanitary District	CA0037800	2.1
City of St. Helena	CA0038016	0.4
Treasure Island	CA0037810	0.1
Vallejo Sanitation & Flood Control District	CA0037699	6.7
West County Agency	CA0038539	7.9
Town of Yountville	CA0038121	0.2
Industrial		
Eco Services (formerly Solvay/Rhodia, Inc.)	CA0006165	0.7
USS-Posco Industries	CA0005002	4.5
C&H Sugar Company-Crockett WWTP	CA0005240	0.5
Total		117

Total load differs from column sum due to rounding

7.2.4.5 Implementation Plan

The intent of this implementation plan is to ensure attainment of selenium water quality standards. Existing selenium concentrations in the water column are below the TMDL target. Concentrations in sturgeon have been gradually decreasing since the late 1990s. For these reasons, it is appropriate to base the TMDL on current loading and focus the implementation plan on maintaining the current load into the future.

The main goal of the implementation plan is to prevent increases of selenium concentrations in North Bay waters and attain safe levels of selenium in fish, specifically sturgeon. This will be accomplished through:

- performance-based effluent limits for petroleum refineries;
- maintaining control actions to reduce loads from the San Joaquin River watershed; and
- continuation of ambient water quality monitoring in the North Bay and monitoring of flow and selenium concentrations in the lower San Joaquin River.

Because loads from the Sacramento River, local tributaries, and atmospheric deposition are representative of natural background, no implementation actions are necessary.

Petroleum Refineries

Wasteload allocations for the five North Bay petroleum refineries shall be implemented through NPDES permits with performance-based mass limits expressed as kg/day. The mass limit shall be calculated as the 95th percentile of the daily loads based on representative effluent data collected during the period of 2000 through 2012. Establishing mass limits as the 95th percentile of daily loads is consistent with the calculation of annual loads and the wasteload allocations. Petroleum refineries shall report their average annual load once per permit term. Compliance with the mass limits shall be determined on a monthly basis. The monthly average of daily loads should not exceed the mass limit. Permits shall also require the petroleum refineries to conduct or cause to be conducted monitoring to demonstrate attainment of the numeric targets.

Municipal and Industrial Wastewater Dischargers

NPDES permits for municipal and industrial wastewater dischargers are not required to have numeric effluent limits for selenium because these discharges have an insignificant impact on North Bay water quality, and no further selenium reductions are required to ensure attainment of the TMDL. To ensure ongoing protection of North Bay water quality, municipal and industrial wastewater dischargers shall be required to report their average annual load once per permit term to verify that selenium loading is consistent with the wasteload allocations identified in Table 7.2.4-4. Permits shall also require the dischargers to conduct or cause to be conducted monitoring to ensure the numeric targets are being attained in the North Bay.

Central Valley Watershed (San Joaquin River)

Selenium loads in the Sacramento River watershed are from naturally-occurring sources and are expected to remain at current levels or less. The San Joaquin River system conveys selenium-enriched agricultural drainage and runoff to the Delta and the North Bay. Attainment of the Central Valley watershed load allocation relies on continued efforts to manage and reduce discharges of agricultural subsurface drainage in the San Joaquin River watershed. The Central Valley Regional Water Quality Control Board has established three TMDLs for selenium in San Joaquin River system water bodies receiving

agricultural drainage. These TMDLs are implemented through the Grasslands Bypass Project, and implementation actions have gradually reduced the load of selenium discharged to these water bodies. Full attainment of the TMDLs is expected by 2019. Changes to the State Water or Central Valley Projects' operations, other upstream diversions, or flow modifications may cause increases of selenium loading into the North Bay, for example, from increased flows from the San Joaquin River but the magnitude and potential impacts of these changes are uncertain at this time. It is the intention of this Water Board to work with the State and the Central Valley Water Boards to ensure the current load allocation for the Central Valley watershed in the TMDL is attained.

Monitoring

Monitoring to demonstrate attainment of the TMDL targets shall be conducted by maintaining discharger-funded RMP monitoring of selenium in fish and water at a spatial scale and frequency to determine whether concentrations in fish, specifically sturgeon, remain low and water column and fish tissue targets are met.

Monitoring of loads to demonstrate that they are consistent with the wasteload allocations shall be conducted by petroleum refineries and municipal and industrial wastewater dischargers.

The Water Board will work with the State Water Board and Central Valley Water Board through their planning and regulatory processes to ensure that monitoring is conducted to evaluate changes in selenium concentrations and loads from the Central Valley Watershed and San Joaquin River and to ensure that any increases in selenium upstream are addressed through the State Water Board's or Central Valley Water Board's regulatory processes.

7.2.5 San Francisco Bay Beaches Bacteria TMDL

The following sections establish the TMDL for San Francisco Bay beaches impaired by bacteria. The numeric targets, load and waste load allocations, and implementation plan are designed to support and protect the Bay's designated beneficial use of water contact recreation (e.g., swimming and wading).

7.2.5.1 Problem Statement

The waters adjacent to several San Francisco Bay beaches are impaired by indicator bacteria. Bacteriological water quality objectives are exceeded based on elevated indicator bacteria densities, and thus, there is impairment of the water contact recreation (REC-1) beneficial use in these water bodies. Recreating in waters with elevated indicator bacteria densities has long been associated with adverse health effects. Specifically, national epidemiological studies demonstrate a causal relationship between adverse health effects and recreational water quality, as measured by indicator bacteria densities.

This TMDL addresses bacteria impaired beaches in San Francisco Bay east of the Golden Gate Bridge. The impaired beaches include:

- Aquatic Park Beach, San Francisco
- Jackrabbit, Sunnydale Cove, and Windsurfer beaches in Candlestick Point State Recreation Area, San Francisco
- Crissy Field Beach, San Francisco
- Parkside Aquatic and Lakeshore beaches on Marina Lagoon, City of San Mateo
- China Camp Beach, Marin County
- McNears Beach, Marin County

China Camp Beach and McNears Beach are on the list of impaired water bodies because levels of only one bacterial indicator in waters at these beaches, total coliform, exceeds the Basin Plan’s water quality objective. Waters at the other beaches exceed the bacterial indicator for Enterococcus and other bacterial indicators.

7.2.5.2 Sources

Bacteria sources are identified based on documentation of inadequately-treated human waste discharges, such as sanitary sewer overflow reports, and the scientific evidence linking land uses in the vicinity of the beaches to elevated bacteria concentrations in urban runoff to the beaches. If not properly managed, the following source categories have the potential to discharge bacteria to San Francisco Bay beaches at levels that cause or contribute to exceedances of water quality objectives: sanitary sewer collection systems, urban runoff, pets at the beaches, vessels, and wildlife. Wet weather discharges from the City of San Francisco’s combined sewer system that are authorized pursuant to U.S. EPA’s Combined Sewer Overflow (CSO) Control Policy (see Section 4.9 Wet Weather Overflows) are not considered a significant source of bacteria to these San Francisco beaches.

7.2.5.3 Numeric Targets

This TMDL establishes a desired, or target, condition for water contact recreation use at impaired San Francisco Bay beaches. The numeric targets are the Enterococcus water quality objectives established for water contact recreation uses in marine and estuarine waters (Table 3-1) and on the U.S. EPA’s 2012 recommended Enterococcus criteria for water contract recreation in marine and fresh water. The numeric targets for this TMDL are listed in Table 7.2.5-1.

Table 7.2.5-1 Numeric Targets for San Francisco Bay Beaches	
Enterococcus	
Geometric mean	< 35 MPN / 100 mL
Single sample maximum	No sample > 104 MPN / 100 mL

7.2.5.4 Total Maximum Daily Loads

The TMDL for San Francisco Bay beaches is equivalent to the Basin Plan’s water quality objectives and the numeric target for Enterococcus as shown in Table 7.2.5-1.

7.2.5.5 Load and Waste Load Allocations

Density-based pollutant allocations for bacteria source categories are the same as the numeric targets and the TMDL listed above. Table 7.2.5-2 summarizes the load and wasteload allocations for discharges of bacteria to impaired San Francisco Bay beaches.

Discharges of raw or inadequately-treated human waste are prohibited, and thus sanitary sewer collection systems and vessels have an allocation of zero.

All entities that discharge indicator bacteria or have jurisdiction over such discharges are responsible for meeting these allocations. Discharging entities will not be held responsible for uncontrollable discharges originating from wildlife. If non-nuisance wildlife contributions are found to be the cause of exceedances,

Water Quality Control Plan for the San Francisco Bay Basin

the TMDL targets and allocation scheme will be revisited as part of adaptive implementation. Implementing parties shall demonstrate achievement of allocations in the receiving water bodies (i.e., at the beach shoreline water quality monitoring stations).

All implementing parties are required to attain their respective allocations by taking a phased approach in which additional or enhanced actions are required if initial implementation actions do not result in attainment of the TMDL within approximately five years.

Table 7.2.5-2 Load and Wasteload Allocations for San Francisco Bay Beaches		
Pollutant Source Category	Enterococcus Geometric Mean^a (MPN/100 mL)	Enterococcus Single Sample Maximum (MPN/100mL)
Sanitary Sewer Collection Systems ^b	0	0
Urban Runoff ^c	< 35	No sample > 104
Vessels (Anchor-outs, recreational, houseboats)	0	0
Wildlife ^d	< 35	No sample > 104
<p>a. Based on a minimum of five consecutive samples equally spaced over a 30-day period.</p> <p>b. For the City of San Francisco, the wasteload allocation applies only to the collection system portion of the combined sewer system.</p> <p>c. Wasteload allocation for discharges from municipal separate storm sewer systems (NPDES No. CAS612008, CAS000004 and CAS000003).</p> <p>d. With the exception of nuisance wildlife, such as geese, wildlife is not a controllable source of bacteria. No management measures will be required for uncontrollable wildlife sources.</p>		

7.2.5.6 Implementation Plan

This Implementation Plan builds on management measures required by existing local, regional, and statewide regulations and orders to reduce or eliminate waste discharges from sanitary sewer collection systems, urban runoff, pets at beaches, and vessels. The plan requires actions consistent with existing regulations and orders, including the following:

- Water Board Municipal Regional Stormwater Permit (NPDES No. CAS612008)
- State Water Board NPDES Permit for Small Municipal Separate Storm Sewer Systems (MS4) (NPDES No. CAS000004)
- State Water Board Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (Order No. 2006-0003-DWQ as revised by Order No. 2008-0002-EXEC)
- State Water Board Stormwater Permit for California Department of Transportation (NPDES No. CAS000003)
- Basin Plan Discharge Prohibition No. 15 (Table 4.1), which states: “It shall be prohibited to discharge raw sewage or any waste failing to meet waste discharge requirements to any waters of the Basin.”
- Regional Water Board Cease and Desist Order for the City of San Mateo, Town of Hillsborough, and Crystal Springs County Sanitation District Sanitary Sewer Waste Discharges (Order No. R2-2009-0020)

- Regional Water Board NPDES Permit for the City and County of San Francisco Southeast Water Pollution Control Plant, North Point Wet Weather Facility, Bayside Wet Weather Facilities, and Wastewater Collection System (Order No. R2-2013-0029).

The entities responsible for implementing this plan are stated below, as are the regulatory mechanisms by which the Water Board may require that the actions be taken.

Sanitary Sewer Collection Systems

Wasteload allocations for sanitary sewer collection systems will be implemented through the requirements and provisions of the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems and, for Marina Lagoon beaches, Cease and Desist Order No. R2-2009-0020 issued by the Water Board to the City of San Mateo. In the case that further investigation or reduction of pathogen sources related to sanitary sewer collection systems is needed, such actions will be initiated through the Water Board's authorities under the California Water Code.

This TMDL requires no modifications to NPDES permitting of wet weather discharges from the City of San Francisco's combined sewer system, authorized pursuant to U.S. EPA's CSO Control Policy, as they are unnecessary to achieve the TMDL. The wasteload allocation in Table 7.2.5-2 only applies to the collection system portion of San Francisco's combined sewer system.

Urban Runoff

Wasteload allocations for urban runoff (i.e., municipal stormwater runoff and dry weather flows) shall be implemented through the Municipal Regional Stormwater Permit (NPDES No. CAS612008) and the State Water Board NPDES Permit for Small MS4s (NPDES No. CAS000004).

Urban runoff from the California Department of Transportation's (Caltrans') highways has not been found to be a significant source of indicator bacteria, largely because Caltrans' highways comprise a very small area within San Francisco Bay beach watersheds. If during the course of adaptive implementation, Caltrans' facilities are found to be sources of bacteria to San Francisco Bay beaches, wasteload allocations for such discharges will be implemented through the requirements of the State Water Board Stormwater Permit for Caltrans (NPDES No. CAS000003).

Municipal stormwater entities, including national, State, or regional park systems (hereinafter referred to as park authorities), that discharge stormwater to impaired beaches are required to submit a plan to the Water Board that describes current best management practices (BMPs), their current level of implementation, and additional BMPs and/or increased levels of implementation of existing BMPs to reduce discharges of bacteria from their storm drain systems that cause or contribute to exceedance of wasteload allocations. The plan shall include a schedule for implementation of the BMPs and enhanced BMPs.

Municipal stormwater entities and/or park authorities, as applicable, shall implement pet waste control measures to reduce discharges of bacteria at the beach and shall submit a plan to do so to the Water Board, as described above.

The Water Board will establish permit requirements to implement wasteload allocations based on implementation of BMPs. The Water Board will not include numeric limits in NPDES permits if the discharger demonstrates full implementation of technically feasible, effective, and cost efficient BMPs to control all controllable sources to, and discharges from, their storm drain systems.

Water Quality Control Plan for the San Francisco Bay Basin

Source	Action	Implementing Party	Completion Timeframe
	5. If private laterals are a likely source of bacteria to the beach, establish and implement a private lateral replacement program.	Sanitary sewer collection system authority, and Municipalities	5 years
Sewer Collection System & Urban Runoff	Establish and implement a protocol to enhance efforts to identify and correct illicit connections to the storm drain system.	Sanitary sewer collection system authority, and Municipal stormwater entity(s)	6 months
Urban Runoff	1. Submit a plan that describes BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to the beach. Include control of nuisance wildlife if it represents a likely source of bacteria to the beach. The plan shall include a schedule and milestones for implementation.	Municipal stormwater entity(s)	6 months
	2. Determine effectiveness of urban runoff controls: Assess beach monitoring data to determine if targets are met at the beach.	Municipal stormwater entity(s)	5 years
	After five years, begin enhanced implementation if targets not met		
	3. If targets are not met, submit: (a) a plan describing BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to the beach. The plan shall include an implementation schedule and milestones. and (b) a supplemental monitoring plan (<i>supplemental to ongoing beach monitoring</i>) to investigate remaining bacteria sources to the beach. This plan may develop data and a quantitative rationale to support (i) locations and types of enhanced bacteria BMPs, and/or (ii) revision of the numeric targets to reflect bacteria contributions from non-controllable sources. Include an implementation schedule.	Municipal stormwater entity(s)	5.5 years
	4. Where pets at the beach may be a source of bacteria to a beach, establish and implement protocols to control pet waste through such measures as providing bags, trash receptacles, and signage.	Park authority or Municipal stormwater entity(s)	6 months
Vessels	Where vessels represent a potential source of bacteria to the beach, begin or boost “no dumping” education efforts; identify and implement other needed BMPs, such as improving pump outs and other infrastructure.	Port authority, or marina owner	6 months from discovery of source
Wildlife	Where nuisance wildlife represents a potential source	Park authority, or	6 months

Water Quality Control Plan for the San Francisco Bay Basin

Source	Action	Implementing Party	Completion Timeframe
	of bacteria to the beach, and the beach is managed by a non-municipal park authority, establish and implement protocols to control this source of bacteria.	include in Urban Runoff enhanced BMPs plans	from discovery of source

Source	Action	Implementing Party	Completion Timeframe ^a
Sanitary Sewer Collection System	1. Comply with Statewide General Waste Discharge Requirements for Sanitary Sewer Systems and Order No. R2-2013-0029.	Port of San Francisco and SFPUC	Ongoing
	2. Submit an enhanced Sewer System Management Plan and Operations and Maintenance Plan for the combined sewer system (O&M Plan), as applicable, acceptable to the Executive Officer, that prioritizes sewer system inspections and repairs in areas within ¼ mile of the beach or otherwise connected to the beach. Include a diagram of prioritized infrastructure, a time schedule for implementing short- and long-term plans, and, as necessary, a schedule for developing the funds needed for the capital improvement plan. Complete inspections and repairs.	SFPUC, Port of San Francisco, and San Francisco Maritime National Historic Park	6 months 3 years
	3. Determine effectiveness of sewer system repairs: Assess beach monitoring data to determine if targets are met at the beach.	SFPUC	5 years
	4. If targets are not met, submit an enhanced Sewer System Management Plan and O&M Plan as applicable, acceptable to the Executive Officer, that prioritizes sewer system inspections and repairs in areas within ½ mile of the beach or otherwise connected to the beach. Include a diagram of prioritized infrastructure, a time schedule for implementing short- and long-term plans, and, as necessary, a schedule for developing the funds needed for the capital improvement plan. Complete inspections and repairs.	SFPUC, Port of San Francisco, and San Francisco Maritime National Historic Park	5.5 years 8 years
	5. If private laterals are a likely source of bacteria to the beach, establish and implement a private lateral replacement program or refocus existing lateral program efforts to address these sources.	SFPUC, Port of San Francisco, San Francisco Maritime National Historic Park, and City of San Francisco	5 years
Sewer Collection System &	Establish and implement a protocol to enhance efforts to identify and correct illicit connections to the storm drain system.	SFPUC, Port of San Francisco, and San Francisco	6 months

Water Quality Control Plan for the San Francisco Bay Basin

Source	Action	Implementing Party	Completion Timeframe ^a
Urban Runoff		Maritime National Historic Park	
Urban Runoff	1. Submit a plan acceptable to the Executive Officer describing BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to the beach. Include control of nuisance wildlife if it represents a likely source of bacteria to the beach. The plan shall include a schedule and milestones for implementation.	SFPUC, Port of San Francisco, San Francisco Maritime National Historic Park, and City of San Francisco	6 months
	2. Determine effectiveness of urban runoff controls: Assess beach monitoring data to determine if targets are met at the beach.	SFPUC	5 years
	3. If targets are not met, submit, acceptable to the Executive Officer: (a) a plan describing BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to the beach. The plan shall include an implementation schedule and milestones. and (b) a supplemental monitoring plan (<i>supplemental to ongoing beach monitoring</i>) to investigate remaining bacteria sources to the beach. This plan may develop data and a quantitative rationale to support (i) locations and types of enhanced bacteria BMPs, and/or (ii) revision of the numeric targets to reflect bacteria contributions from non-controllable sources. Include an implementation schedule.	SFPUC, Port of San Francisco, San Francisco Maritime National Historic Park, and City of San Francisco	5.5 years
	4. Where pet waste may be a source of bacteria to a beach, establish and implement protocols to control pet waste through such measures as providing bags, trash receptacles, and signage.	San Francisco Maritime National Historic Park	6 months

^a Timeframe begins on the effective date of this Basin Plan amendment

Water Quality Control Plan for the San Francisco Bay Basin

Source	Action	Implementing Party	Completion Timeframe^a
Sanitary Sewer Collection System	1. Comply with Statewide General Waste Discharge Requirements for sanitary sewer systems.	SFPUC and California State Parks	Ongoing
	2. Submit an enhanced Sewer System Management Plan and O&M Plan as applicable, acceptable to the Executive Officer, that prioritizes sewer system inspections and repairs in areas within ¼ mile of the beach or otherwise connected to the beach. Include a diagram of prioritized infrastructure, a time schedule for implementing short- and long-term plans, and, as necessary, a schedule for developing the funds needed for the capital improvement plan. Complete inspections and repairs.	SFPUC and California State Parks	6 months 3 years
	3. Determine effectiveness of sewer system repairs: Assess beach monitoring data to determine if targets are met at the beach.	SFPUC	5 years
	4. If targets are not met, submit an enhanced Sewer System Management Plan and O&M Plan as applicable, acceptable to the Executive Officer, that prioritizes sewer system inspections and repairs in areas within ½ mile of the beach or otherwise connected to the beach. Include a diagram of prioritized infrastructure, a time schedule for implementing short- and long-term plans, and, as necessary, a schedule for developing the funds needed for the capital improvement plan. Complete inspections and repairs.	SFPUC and California State Parks	5.5 years 8 years
	5. If private laterals are a likely source of bacteria to the beach, establish and implement a private lateral replacement program or refocus existing lateral program efforts to address these sources.	SFPUC and City of San Francisco	5 years
Sewer Collection System & Urban Runoff	Establish and implement a protocol to enhance efforts to identify and correct illicit connections to the storm drain system.	SFPUC and California State Parks	6 months
Urban Runoff	1. Submit a plan acceptable to the Executive Officer that describes BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to the beach. Include control of nuisance wildlife if it represents a likely source of bacteria to the beach. The plan shall include a schedule and milestones for implementation.	SFPUC, California State Parks, and City of San Francisco	6 months
	2. Determine effectiveness of urban runoff controls: Assess beach monitoring data to determine if targets are met at the beach.	SFPUC	5 years

Water Quality Control Plan for the San Francisco Bay Basin

Source	Action	Implementing Party	Completion Timeframe^a
	<p>3. If targets are not met, submit, acceptable to the Executive Officer:</p> <p>(a) a plan describing BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to the beach. The plan shall include an implementation schedule and milestones.</p> <p>and</p> <p>(b) a supplemental monitoring plan (<i>supplemental to ongoing beach monitoring</i>) to investigate remaining bacteria sources to the beach. This plan may develop data and a quantitative rationale to support (i) locations and types of enhanced bacteria BMPs, and/or (ii) revision of the numeric targets to reflect bacteria contributions from non-controllable sources. Include an implementation schedule.</p>	SFPUC, California State Parks, and City of San Francisco	5.5 years
	4. Where pet waste may be a source of bacteria to a beach, establish and implement protocols to control pet waste through such measures as providing bags, trash receptacles and signage.	California State Parks	6 months

^a Timeframe begins on the effective date of this Basin Plan amendment

Source	Action	Implementing Party	Completion Timeframe^a
Sanitary Sewer Collection System	1. Comply with Statewide General Waste Discharge Requirements for Sanitary Sewer Systems and Order No. R2-2013-0029.	Presidio Trust and SFPUC	Ongoing
	2a. Submit an enhanced Sewer System Management Plan and O&M Plan as applicable, acceptable to the Executive Officer, that prioritizes sewer system inspections and repairs in areas within ¼ mile of the beach or otherwise connected to the beach. Include a diagram of prioritized infrastructure, a time schedule for implementing short- and long-term plans, and, as necessary, a schedule for developing the funds needed for the capital improvement plan.	Presidio Trust and SFPUC	6 months
	Complete inspections and repairs.		3 years
	2b. Inspect laterals and all other components connecting SF Rec & Parks facilities to the sanitary sewer system. Repair all leaks. Submit annual status reports until all system components are inspected and repaired.	San Francisco Rec & Parks	1 year 3 years
	3. Determine effectiveness of sewer system repairs: Assess beach monitoring data to determine if targets are	SFPUC	5 years

Water Quality Control Plan for the San Francisco Bay Basin

Source	Action	Implementing Party	Completion Timeframe ^a
	met at the beach.		
	4. If targets are not met, submit an enhanced Sewer System Management Plan and O&M Plan as applicable, acceptable to the Executive Officer, that prioritizes sewer system inspections and repairs in areas within ½ mile of the beach or otherwise connected to the beach. Include a diagram of prioritized infrastructure, a time schedule for implementing short- and long-term plans, and, as necessary, a schedule for developing the funds needed for the capital improvement plan. Complete inspections and repairs.	Presidio Trust and SFPUC	5.5 years 8 years
	5. If private laterals are a likely source of bacteria to the beach, establish and implement a private lateral replacement program or refocus existing lateral program efforts to address these sources.	Presidio Trust and SFPUC	5 years
Sewer Collection System & Urban Runoff	Establish and implement a protocol to enhance efforts to identify and correct illicit connections to the storm drain system.	Presidio Trust and SFPUC	6 months
Urban Runoff	1. Submit a plan acceptable to the Executive Officer that describes BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to the beach. Include control of nuisance wildlife if it represents a likely source of bacteria to the beach. The plan shall include a schedule and milestones for implementation.	Presidio Trust, Golden Gate National Recreation Area, SFPUC, and San Francisco Rec & Parks	6 months
	2. Determine effectiveness of urban runoff controls: Assess beach monitoring data to determine if targets are met at the beach.	SFPUC	5 years
	3. If targets are not met, submit, acceptable to the Executive Officer: (a) a plan describing BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to the beach. The plan shall include an implementation schedule and milestones. and (b) a supplemental monitoring plan (<i>supplemental to ongoing beach monitoring</i>) to investigate remaining bacteria sources to the beach. This plan may develop data and a quantitative rationale to support (i) locations and types of enhanced bacteria BMPs, and/or (ii) revision of the numeric targets to reflect bacteria contributions from non-controllable sources. Include an implementation schedule.	Presidio Trust, Golden Gate National Recreation Area, SFPUC, and San Francisco Rec & Parks	5.5 years

Water Quality Control Plan for the San Francisco Bay Basin

Source	Action	Implementing Party	Completion Timeframe ^a
	4. Establish and implement protocols for enhancing efforts to control pet waste through such measures as providing bags, trash receptacles, signage at Crissy Beach, and increased rule enforcement during wet periods.	Golden Gate National Recreation Area	6 months

^a Timeframe begins on the effective date of this Basin Plan amendment

Source	Action	Implementing Party	Completion Timeframe ^a
Sanitary Sewer Collection System	1. Comply with Statewide General Waste Discharge Requirements for Sanitary Sewer Systems.	City of San Mateo	Ongoing
	2. Comply with Cease and Desist Order No. R2-2009-0020 (CDO) and any future amendments. In next annual CDO report, submit enhancements to the Infrastructure Renewal and Capacity Assurance Plans, acceptable to the Executive Officer, that prioritize sewer system inspections and repairs in areas within ¼ mile of the beach to the extent possible within the framework of the CDO. Include a diagram of prioritized infrastructure and time schedule. Complete inspections and repairs in prioritized area(s).	City of San Mateo	According to due dates in Cease and Desist Order
	3. Determine effectiveness of sewer system repairs: Assess beach monitoring data to determine if targets are met at the beach.	City of San Mateo	5 years
	4. If targets are not met, submit enhanced Infrastructure Renewal and Capacity Assurance Plans, acceptable to the Executive Officer, that prioritize sewer system inspections and repairs in areas within ½ mile of the beach or otherwise connected to the beaches. Include a diagram of prioritized infrastructure, a time schedule for implementing short- and long-term plans, and, as necessary, a schedule for developing the funds needed for the capital improvement plan. Complete inspections and repairs.	City of San Mateo	5.5 years 8 years
	5. If private laterals are a likely source of bacteria to the beach, establish and implement a private lateral replacement program or refocus existing lateral program efforts to address these sources.	City of San Mateo	2 years
Sewer Collection System & Urban Runoff	Establish and implement a protocol to enhance efforts to identify and correct illicit connections to the storm drain system.	City of San Mateo	6 months
Urban	1. Submit a plan acceptable to the Executive Officer that	City of San	6 months

Water Quality Control Plan for the San Francisco Bay Basin

Source	Action	Implementing Party	Completion Timeframe ^a
Runoff	describes BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to the beach. Include control of nuisance wildlife. The plan shall include a schedule and milestones for implementation.	Mateo	
	2. Determine effectiveness of urban runoff controls: Assess beach monitoring data to determine if targets are met at the beach.	City of San Mateo	5 years
	3. If targets are not met, submit, acceptable to the Executive Officer: (a) a plan describing BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to the beach. The plan shall include an implementation schedule and milestones. and (b) a supplemental monitoring plan (<i>supplemental to ongoing beach monitoring</i>) to investigate remaining bacteria sources to the beach. This plan may develop data and a quantitative rationale to support (i) locations and types of enhanced bacteria BMPs, and/or (ii) revision of the numeric targets to reflect bacteria contributions from non-controllable sources. Include an implementation schedule.	City of San Mateo	5.5 years

^a Timeframe begins on the effective date of this Basin Plan amendment

7.2.5.7 China Camp and McNears Beaches Implementation

Both China Camp and McNears beaches already meet the numeric targets for Enterococcus, and therefore no further implementation actions are necessary.

7.2.5.8 Water Quality Monitoring

Implementing parties are responsible for developing and implementing a monitoring plan sufficient to assess compliance with the numeric targets at the beaches. At a minimum, implementing parties shall continue monitoring the beaches as required under California Health and Safety Code section 115880 and provide a data evaluation report annually to the Water Board. It is recommended that the implementing parties select a lead entity to assess the monitoring data and compile the annual report.

If, after approximately five years, implementation actions do not result in achievement of numeric targets at a beach, supplemental monitoring (in addition to beach monitoring) is required to investigate and identify bacteria sources in the watershed that could be contributing to the bacteria impairment. This monitoring is intended to answer questions such as:

- Could bacteria sources be reduced by placing enhanced urban runoff BMPs in a certain location?
- Could bacteria sources be reduced by focusing sewer system investigations and repairs in a certain location?

- Are natural sources of bacteria contributing to a significant degree to the impairment at the beach?

Implementing parties need not wait four years if they wish to begin supplemental monitoring earlier. At any time, implementing parties may present data indicating the presence of natural sources of bacteria to the beach, such as non-nuisance wildfowl, to the Executive Officer of the Water Board, and the Water Board may consider developing new allocations that could include a natural source exclusion. Until such action is taken by the Water Board, the implementation requirements and completion dates shall remain in effect.

Beach monitoring and supplemental monitoring requirements are included on Tables 7.2.5-4 through 7.2.5-7.

7.2.5.9 Adaptive Implementation

The Water Board will adapt the TMDL and Implementation Plans to incorporate new and relevant scientific information such that effective and efficient measures can be taken to achieve standards. At approximately six-year intervals, Water Board staff will evaluate new and relevant information from implementation actions, water quality monitoring results, and the scientific literature, including any local reference system studies, U.S. EPA's revised recommended bacteria criteria, or new or revised State bacteria water quality objectives, and assess progress toward attaining the TMDL. Water Board staff will present that information to the Water Board, and the Water Board will consider a Basin Plan amendment that reflects any necessary modifications to the targets, load and wasteload allocations, or implementation plan.

7.3 WATER QUALITY ATTAINMENT STRATEGIES AND TMDLS FOR THE MARIN COASTAL BASIN (SEE [FIGURE 2-3](#))

7.3.1 Tomales Bay Watershed Pathogens TMDL

The overall goal of the Tomales Bay Watershed Pathogens Total Maximum Daily Load (TMDL) is to ensure protection of water contact recreational uses and Bay shellfish harvesting, thereby minimizing human exposure to disease-causing pathogens. The following sections establish a density-based pathogens TMDL for Tomales Bay and its tributaries, and actions and monitoring necessary to implement the TMDL. The TMDL defines allowable density-based water quality bacteria concentrations and prohibits the discharge of human waste. The associated implementation plan specifies the actions necessary to protect and restore beneficial uses. This TMDL strives to achieve a balance that allows human activities including agriculture, recreation, commercial fishing and aquaculture, and residential use to coexist and also restores and protects water quality. As outlined in the adaptive implementation section, the effectiveness of implementation actions, monitoring to track progress toward targets, and the scientific understanding pertaining to pathogens will be periodically reviewed and the TMDL may be adapted as warranted.

In addition to pathogens, animal and human waste contain nutrients that pose a threat to aquatic ecosystem beneficial uses. Tomales Bay, Walker Creek, and Lagunitas Creek are listed as impaired by excess nutrients. Human and animal wastes may also contain other harmful constituents such as steroids and pharmaceuticals. In addition to protecting pathogen-impaired beneficial uses such as shellfish harvesting, water contact recreation, and non-contact water recreation, by eliminating the discharge of

human waste and controlling the discharge of animal waste, this TMDL will also protect aquatic ecosystem beneficial uses such as marine habitat, estuarine habitat, cold and warm freshwater habitat, and wildlife habitat from other harmful constituents found in human and animal waste.

7.3.1.1 Problem Statement

Monitoring results for Tomales Bay and its main tributaries (Lagunitas, Walker, and Olema creeks) indicate that these waters exceed bacteria water quality objectives for shellfish harvesting and recreational waters (Table 3-1) and, as such, are impaired by pathogens. The presence of pathogens is inferred from high concentrations of fecal coliform bacteria (a commonly used indicator of human pathogenic organisms). Pathogen pollution is adversely affecting existing beneficial uses, which include shellfish harvesting (i.e., sport and commercial oyster, clam, and mussel harvesting), water contact recreation (i.e., swimming, fishing) and non-contact water recreation (i.e., boating, kayaking).

This TMDL addresses the following pathogen-impaired water bodies in the Tomales Bay Watershed:

- Tomales Bay
- Lagunitas Creek
- Walker Creek
- Olema Creek

7.3.1.2 Sources

If not properly managed, the following Tomales Bay Watershed sources have the potential to discharge pathogens to surface waters: on-site sewage disposal systems (OSDSs), small wastewater treatment facilities and sewage holding ponds, boat discharges, grazing lands, dairies, equestrian facilities, and municipal runoff. Pathogens sources are identified based on elevated coliform bacteria levels downstream of identified land uses or facilities and from documentation of inadequately treated human waste discharges.

- The Walker Creek watershed is dominated by grazing lands. Coliform bacteria levels and coliform loads from the Walker Creek watershed are extremely high during storm periods and a significant coliform source to Tomales Bay.
- High coliform levels detected in storm drains indicate that municipal runoff is a pathogens source.
- High coliform levels and loads downstream of residential homes and equestrian facilities suggest that failing septic systems, municipal runoff, and equestrian facilities are coliform sources.
- The Water Board regulates ten small wastewater treatment facilities and sewage holding ponds and prohibits direct discharges from these facilities into Tomales Bay or its tributaries. Four facilities have holding ponds and are permitted to discharge treated effluent to irrigation fields in the dry season. The other six wastewater treatment facilities utilize leach fields for dispersing treated effluent. Accidental malfunctions, including the breaching of ponds, a break in a sewage line, or land application when soil is saturated or it is raining, could result in discharge of untreated or partially treated effluent. Therefore, these facilities are considered potential sources.

In addition to the above sources, warm-blooded mammals and birds that reside in the watershed and Bay produce coliform bacteria. During non-storm periods Tomales Bay coliform levels are typically below the water quality objectives for shellfish harvesting waters, indicating that in-Bay wildlife such as seals and

birds are not significant sources. Approximately 30% of the lands draining to Tomales Bay are open space forested lands. Water quality monitoring of a watershed on the western shoreline of Tomales Bay with minimal human influences suggests that waters draining open space areas are below tributary bacteria water quality objectives and therefore terrestrial wildlife are not a significant source.

7.3.1.3 Numeric Targets

Table 7.3.1-1 contains the numeric water quality targets for the Tomales Bay Watershed Pathogens TMDL. The coliform bacteria targets are based on fecal coliform bacteria concentrations aimed at protecting shellfish harvesting and contact and non-contact water recreation beneficial uses. These density-based numeric targets define bacterial densities associated with minimal risk to humans and are the same as the water quality objectives contained in Table 3-1. The Tomales Bay targets are intended to protect the most sensitive beneficial use, shellfish harvesting. The tributary targets are intended to protect recreational uses. An additional numeric target for Tomales Bay is expressed as the number of days commercial shellfish growing areas are subjected to harvest closures due to elevated water column bacteria densities. Consistent with the definition of “threatened conditions” in the California Shellfish Protection Act, Tomales Bay shellfish growing areas shall not be closed for harvest for more than 30 days per calendar year. The California Department of Health Services requires shellfish growing areas to close for harvesting when 24-hour and 10-day rainfall totals exceed established thresholds. Rainfall thresholds are established based on the relationship between rainfall and observed fecal coliform levels in Bay waters and shellfish.

In addition, no human waste (raw sewage or inadequately treated waste) shall be discharged to Tomales Bay or its tributaries. The no human waste discharge target is consistent with Discharge Prohibitions 5 and 15, contained in Table 4-1. This target is necessary because human waste is a significant source of pathogenic organisms, including viruses; and attainment of fecal coliform targets alone may not sufficiently protect human health. The coliform bacteria targets, in combination with the human waste discharge prohibitions and the shellfish harvesting closure targets, are the basis for the TMDL and load allocations, and fully protect beneficial uses.

Table 7.3.1-1 Water Quality Targets^a for Tomales Bay and Its Tributaries
Zero discharge of human waste
Shellfish harvest closures < 30 days/year
Coliform Bacteria Levels (Expressed as Most Probable Number [MPN] of fecal coliforms per 100 mL of water)
Tomales Bay Median < 14 ^b and 90 th percentile < 43 ^c
Tomales Bay Tributaries Log mean <200 ^b and 90 th percentile < 400 ^c
<ul style="list-style-type: none"> a. These targets are applicable year-round b. Based on a minimum of five consecutive samples equally spaced over a 30-day period c. No more than 10% of total samples during any 30-day period may exceed this number.

7.3.1.4 Total Maximum Daily Load

Table 7.3.1-2 lists the Tomales Bay Watershed Pathogens TMDL. The TMDL consists of the density-based coliform bacteria TMDL targets. The TMDL ensures protection of water contact recreational uses and Bay shellfish harvesting, thereby minimizing human exposure to disease causing pathogens.

Table 7.3.1-2 Total Maximum Daily Load of Pathogens Indicators for Tomales Bay and its Tributaries		
Waterbody	Indicator Parameter	TMDL (Most Probable Number (MPN) of fecal coliforms per 100 mL of water)
Tomales Bay	Fecal coliform	Median < 14 ^a 90th Percentile < 43 ^b
Major Tributaries: Walker Creek Lagunitas Creek Olema Creek	Fecal coliform	Log mean <200 ^a 90th percentile < 400 ^b
^a . Based on a minimum of five consecutive samples equally spaced over a 30-day period. ^b . No more than 10% of total samples during any 30-day period may exceed this number.		

7.3.1.5 Load Allocations

TMDL targets are an interpretation of water quality standards, whereas TMDL allocations specify the amount (or concentration) of a pollutant that can be discharged to a waterbody such that standards are attained in both the receiving waterbody and all downstream waters. Table 7.3.1-3 presents density-based load allocations for Tomales Bay watersheds pathogens source categories that implement tributary targets, and Table 7.3.1-4 presents allocations to major tributaries, where they discharge to Tomales Bay, and implement the Bay targets. Load allocations to the tributaries reflect the highest fecal coliform concentrations that can be discharged while still attaining and maintaining the Bay shellfish harvesting water quality objectives. All entities in a watershed are responsible for meeting their source category allocation (Table 7.3.1-3) and the applicable geographic-based allocations (Table 7.3.1-4).

Discharging entities will not be held responsible for uncontrollable coliform discharges originating from wildlife. If wildlife contributions are determined to be the cause of exceedances, the TMDL targets and allocation scheme will be revisited as part of the adaptive implementation program. The discharge of human waste is prohibited. All sources of human waste have an allocation of zero. Nonpoint source runoff containing coliform bacteria of animal and wildlife origin, at levels that do not result in exceedances of water objectives, does not constitute wastewater with particular characteristics of concern to beneficial uses. Therefore, animal- and wildlife-associated discharges, in compliance with the conditions of this TMDL, do not constitute a violation of applicable discharge prohibitions.

7.3.1.6 Implementation Plan

The Tomales Bay Watershed Pathogens TMDL Implementation Plan builds upon previous and ongoing successful efforts to reduce pathogen loads in Tomales Bay and its tributaries. The plan requires actions consistent with the California Water Code (CWC 13000 et seq.), the state’s Nonpoint Source Pollution Control Program Plan (CWC Section 13369), the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (State Water Resources Control Board. 2004. Policy for

Implementation and Enforcement of the Nonpoint Source Pollution Prevention Control Program), and human waste discharge prohibitions (Prohibitions 5 and 15, Table 4-1).

This plan specifies required implementation measures (Table 7.3.1-5) for each of the source categories (Table 7.3.1-3). These implementation measures include evaluation of operating practices, development of comprehensive site-specific pathogens control measures and an implementation schedule for such management measures, and submittal of progress reports documenting actions undertaken. Progress reports may be submitted directly to the Water Board or, if designated, through third parties. These progress reports will serve as documentation that source reduction measures are being implemented. While third parties may provide valuable assistance to TMDL implementation, the discharger is the entity responsible for complying with the specified regulations and regulatory controls. Responsible parties within each source category are required to implement the measures as specified in Table 7.3.1-5. The numeric targets and load allocations are not directly enforceable. For purpose of demonstrating attainment of applicable allocations, responsible parties will only be responsible for compliance with specified implementation measures and applicable waste discharge requirements or waiver conditions.

Table 7.3.1-3 Density-Based Pollutant Wasteload and Load Allocations^a for Dischargers of Pathogens in Tomales Bay Watershed			
Categorical Pollutant Source	Wasteload and Load Allocations Fecal Coliform (MPN/100 mL)		
	For Direct Discharges to the Bay		For Discharges to Major Tomales Bay Tributaries
	Median^b	90th Percentile^c	Log Mean^b
Onsite Sewage Disposal Systems	0	0	0
Small Wastewater Treatment Facilities	0	0	0
Boat Discharges	0	0	N/A
Grazing Lands	<14	<43	< 200
Dairies	<14	<43	< 200
Equestrian Facilities	<14	<43	< 200
Municipal Runoff	<14	<43	< 200
Open space lands (terrestrial wildlife) ^d	<14	<43	< 200
In-Bay Background (marine wildlife) ^d	<14	<43	N/A

a. These allocations are applicable year-round. Wasteload allocations apply to any sources (existing or future) subject to regulation by a NPDES permit.

b. Based on a minimum of five consecutive samples equally spaced over a 30-day period.

c. No more than 10% of total samples during any 30-day period may exceed this number.

d. Open space lands and the Bay contain wildlife and are therefore recognized as potential source areas. These areas are not believed to be a significant source of pathogens and their contribution is considered natural background; therefore, no management measures are required.

Table 7.3.1-4 Density-Based Pollutant Load Allocations for Tomales Bay Tributaries	
Tributary	Allocation Fecal Coliform (MPN/100 mL) Log Mean
Walker Creek at Highway 1 Bridge	95 ^a
Lagunitas Creek at Green Bridge	95 ^a

a. Based on a minimum of five consecutive samples equally spaced over a 30-day period.

The state's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program requires that current and proposed nonpoint source discharges are regulated under waste discharge requirements (WDRs), waiver of waste discharge requirements, Basin Plan prohibitions, or some combination of these tools. Table 7.3.1-5 describes the method that will be used to regulate dischargers in each source category. The Water Board has established conditions for waiving WDRs for dairies. The Water Board intends to work with stakeholders to develop similar waiver conditions for grazing lands and equestrian facilities by 2009.

Table 7.3.1-5 Trackable Implementation Measures for the Tomales Bay Watershed Pathogens Total Maximum Daily Load

Source Category	Action	Implementing Party	Completion Dates
On-Site Sewage Disposal Systems (OSDS)	Submit to the Executive Officer for approval a plan and implementation schedule to evaluate OSDS performance for the Tomales Bay watershed and to bring identified OSDS up to County's repair standards.	Marin County, Community Development Agency	January 2007
	Report progress on implementation of OSDS evaluation and repair program.	Marin County, Community Development Agency	Starting January 2011 and biennially thereafter
Small Wastewater Treatment Facilities	Comply with applicable Waste Discharge Requirements (WDRs).	Small wastewater treatment facilities	As specified in the applicable WDRs
	Inspect and evaluate all permitted WDR facilities and update WDRs as warranted.	Water Board staff	January 2009
	Report progress on inspection and evaluation of WDR facilities.	Water Board staff	No less than once every five years starting in January 2009
Boat Discharges	In coordination with interested stakeholders in Tomales Bay, determine the adequacy of on-shore restroom facilities and boater disposal/pump out facilities, and prepare a schedule for a determination of Pumpout Facility Need and Public Hearing Notification, as appropriate.	Regional Water Board	January 2009

Water Quality Control Plan for the San Francisco Bay Basin

Source Category	Action	Implementing Party	Completion Dates
Boat Discharges (continued)	Water Board will coordinate with participating agencies and rely on their interests and authorities to develop and implement a Tomales Bay boating management plan that includes: evaluation of existing moorings and water quality impacts; permitting and enforcement procedures to ensure compliance with applicable mooring requirements and to ensure no sewage discharge from boats.	Point Reyes National Seashore, California Coastal Commission, California State Lands Commission, California State Parks, County of Marin, Regional Water Board, Gulf of the Farallones National Marine Sanctuary.	January 2009
	Report progress on implementation of boating management plan.	As specified in the Boating Management Plan: Point Reyes National Seashore, California Coastal Commission, California State Lands Commission, California State Parks, County of Marin, Regional Water Board, Gulf of the Farallones National Marine Sanctuary	As specified in the Boating Management Plan
	Comply with boating management plan for Tomales Bay.	Boaters	As specified in the Boating Management Plan
Grazing Lands ²	Submit a Report of Waste Discharge ¹ to the Water Board that provides the following: a description of the facility; identification of necessary site-specific grazing management measures to reduce animal waste runoff; and a schedule to implement identified management measures.	Dairies and ranchers (landowners and leasees). These Reports may be submitted individually or jointly or through a third party.	January 2009

Water Quality Control Plan for the San Francisco Bay Basin

Source Category	Action	Implementing Party	Completion Dates
	Comply with applicable Waste Discharge Requirements (WDRs) or waiver of WDRs.	Dairies and ranchers (landowners and leasees)	As specified in applicable WDRs or waiver of WDRs
	Report progress on implementation of grazing management measures that reduce animal waste runoff.	Dairies and ranchers (landowners and leasees). These reports may be submitted individually or jointly or through a third party.	As specified in applicable WDRs or waiver of WDRs
Dairies ³	Comply with applicable Waiver of Waste Discharge Requirements (WDRs) for confined animal facilities or requirements specified in applicable individual WDRs.	Dairies (landowners and leasees)	As specified in applicable WDRs or waiver of WDRs
Equestrian Facilities	Submit a Report of Waste Discharge ¹ to the Water Board that provides the following: a description of the facility; identification of necessary site-specific management measures to reduce animal waste runoff; and a schedule for implementation of identified management measures.	Equestrian facilities. These Reports may be submitted individually or jointly or through a third party.	January 2009

Water Quality Control Plan for the San Francisco Bay Basin

Source Category	Action	Implementing Party	Completion Dates
	Comply with applicable Waste Discharge Requirements (WDRs) or waiver of WDRs.	Equestrian facilities	As specified in applicable WDRs or waiver of WDRs.
	Report progress on implementation of management measures that reduce animal waste runoff.	Equestrian facilities. These reports may be submitted individually or jointly or through a third party.	As specified in applicable WDRs or waiver of WDRs
Municipal Runoff	Submit to Water Board for approval a stormwater management plan (that includes management measures to reduce pathogens runoff and a schedule for implementation of identified management measures.	Marin County, Stormwater Pollution Prevention Program	January 2009
	Report progress on implementation of pathogens reduction measures.	Marin County, Stormwater Pollution Prevention Program	As specified in approved stormwater management plan

¹ WDRs waiver conditions may allow for other submittals in lieu of a Report of Waste Discharge.

² Grazing lands include all land areas grazed by livestock such as ranchlands, riparian areas, and pasturelands. Confined animal facilities which are already regulated under existing WDRs or waiver of WDRs and are excluded from this requirement.

³ These implementation actions for Dairies are for the confined animal portions of the facilities and do not include the grazing areas. Implementation actions for grazing lands associated with dairies are included under Grazing lands.

Source Category	Regulatory Tool
On-site Sewage Disposal Systems (OSDS)	Waiver ^a of Waste Discharge Requirements Prohibition of Human Waste Discharge
Small Wastewater Treatment Facilities	Individual Waste Discharge Requirements Prohibition of Human Waste Discharge
Boat Discharges	Prohibition of Human Waste Discharge
Grazing Lands	Waiver ^a of Waste Discharge Requirements
Dairies	Waiver ^a of Waste Discharge Requirements or Individual WDRs, as appropriate
Equestrian Facilities	Waiver ^a of Waste Discharge Requirements
Municipal Runoff	NPDES Permit
^a Water Board retains the option of requiring individual waste discharge requirements or compliance with a discharge prohibition, as appropriate.	

Agricultural Water Quality Control Program Costs

The implementation measures for grazing lands and dairies constitute an agricultural water quality control program and therefore, consistent with California Water Code requirements (Section 13141), the cost of the program is estimated herein. The total program implementation cost for these agricultural sources is estimated to range between \$900,000 – \$2 million per year over the next 10 years. The estimated cost will be shared by Tomales Bay watershed grazing lands operators (approximately 150). This estimate includes the cost of implementing animal waste control and grazing management measures and is based on costs associated with technical assistance and evaluation, installation of water troughs, and cattle control fencing along all streams. The program cost estimate may be high as it does not account for implementation actions already underway or areas that may not require fencing. Besides fencing, other acceptable methods of managing livestock access to streams are not included in this cost estimate due to variability in costs and site specific applicability. Potential financing sources include federal and state water quality grants and federal agricultural grants.

Evaluation and Monitoring

Dischargers, stakeholders, and Water Board staff will conduct water quality monitoring to evaluate fecal coliform concentration trends in Tomales Bay and its tributaries. Five years after TMDL adoption, the Water Board will evaluate monitoring results and assess progress made toward attaining TMDL targets (Table 7.3.1-1) and load allocations (Table 7.3.1-3 and Table 7.3.1-4).

In 2009 and approximately every five years after the adoption of the TMDL, the Water Board will evaluate site specific, sub-watershed specific, and watershed-wide compliance with the trackable implementation measures specified in Table 7.3.1-5. In evaluating compliance with the trackable implementation measures, the Water Board will consider the level of participation of each source category as well as individual dischargers (as documented by Water Board staff or third parties).

If a discharger demonstrates that all implementation measures have been undertaken or that it is infeasible to meet their allocation due to wildlife contributions, the Water Board will consider revising allocations as appropriate. If source control actions are fully implemented throughout the Watershed and the TMDL targets are not met, the Water Board may consider re-evaluating or revising the TMDL and

Water Quality Control Plan for the San Francisco Bay Region

allocations. If, on the other hand, the required actions are not fully implemented, or are partially implemented, the Water Board may consider regulatory or enforcement action against parties or individual dischargers not in compliance.

The California Department of Health Services, working in consultation with the Shellfish Technical Advisory Committee, is encouraged to periodically evaluate, beginning in 2009, shellfish harvest closure guidelines and the relationship between precipitation, runoff, coliform levels, and water quality exceedances.

In order to assess water quality improvements and obtain additional information for further refinement of the TMDL, Water Board staff and stakeholders will collaborate in monitoring efforts. The main objectives of the Monitoring Program are to:

- Assess attainment of TMDL targets;
- Evaluate spatial and temporal water quality trends in the Bay and its tributaries;
- Further identify significant pathogens source areas;
- Evaluate coliform levels and loadings to the Bay at the terminus of major tributaries.
- Collect sufficient data to calibrate and validate the Bay hydrodynamic model to observed coliform levels; and
- Collect sufficient data to prioritize implementation efforts and assess the effectiveness of implementation actions.

Table 7.3.1-7 outlines the locations, constituents, sampling frequency, analytical methods, and the sampling entities for a baseline water quality monitoring program. Additional monitoring will be conducted as needed if funds are available. The Water Board, in coordination with the sampling entities and interested third parties, such as National Park Service, California Department of Health Services, commercial shellfish growers, the Inverness Public Utility District, and the Salmon Protection and Watershed Network will implement this long-term water quality monitoring program. All water quality monitoring (including Quality Assurance and Quality Control procedures) will be performed pursuant to the State Water Board's Quality Assurance Management Plan for the Surface Water Ambient Monitoring Program.

Table 7.3.1-7 Baseline Water Quality Monitoring Program			
Constituent	Location	Frequency	Sampling Entities
Tomales Bay			
Fecal Coliform ^a	California Department Health Services designated primary water quality monitoring stations	Weekly for five weeks beginning in January; Monthly March – December Weekly for five weeks during summer months	Shellfish Growers
Tributaries			
Fecal coliform Stream Flow	Olema Creek (tributary to Lagunitas)	Weekly for five weeks beginning in January; Monthly March - December Weekly for five weeks during summer months	National Park Service
Fecal coliform	West Shore tributaries	Same as above	Inverness Public Utilities District
Fecal coliform	East Shore tributaries	Same as above	Water Board
Fecal coliform Stream Flow	Lagunitas Creek	Same as above	Water Board, Salmon Protection and Watershed Network
Fecal coliform Stream Flow	Walker Creek	Same as above	Water Board
^a . <i>E. coli</i> monitoring may be used in the future to assess general water quality trends and exceedances. If <i>E. coli</i> is used, a Tomales Bay specific correlation factor linking fecal coliform and <i>E. coli</i> levels will need to be established.			

Adaptive Implementation

Approximately every five years, the Water Board will review the Tomales Bay Watershed Pathogens TMDL and evaluate new and relevant information from monitoring, special studies, and scientific literature. The reviews will be coordinated through the Water Board’s continuing planning program and will provide opportunities for stakeholder participation. Any necessary modifications to the targets, allocations, or implementation plan will be incorporated into the Basin Plan. In evaluating necessary modifications, the Water Board will favor actions that reduce sediment and nutrient loads, pollutants for which the Tomales Bay Watershed is also impaired. At a minimum, the following questions will be used

to conduct the reviews. Additional questions will be developed in collaboration with stakeholders during each review.

- Are the Bay and the tributaries progressing toward TMDL targets as expected? If progress is unclear, how should monitoring efforts be modified to detect trends? If there has not been adequate progress, how might the implementation actions or allocations be modified?
- What are the pollutant loads for the various source categories (including naturally occurring background pathogen contributions and the contribution from open space lands), how have these loads changed over time, how do they vary seasonally, and how might source control measures be modified to improve load reduction?
- Is there new, reliable, and widely accepted scientific information that suggests modifications to targets, allocations, or implementation actions? If so, how should the TMDL be modified?
- The allocations assume a conservative bacterial die-off rate of 0.02 per hour. This value is based on rates reported for San Francisco Bay in 1970. If bacterial die-off is found to be higher, higher allocations may be considered. What are bacterial die-off rates in the water column and stream sediments? Do they vary by season? What are bacteria transport times from sources to the Bay?
- How does estuarine mixing and dilution of tributary waters vary by flow and season?
- What is the relationship between precipitation, runoff, tributary loads, Bay coliform levels, and water quality exceedances and shellfish harvesting closures?
- Are there bacteria in Tomales Bay sediments that enter the water column during storm events? If yes, how should this process be accounted for?

If it is demonstrated that all reasonable and feasible source control measures have been implemented for a sufficient period of time and TMDL targets are still not being met, the Water Board will reevaluate water quality standards, TMDL targets and allocations as appropriate.

7.3.2 Total Maximum Daily Load for Mercury in Walker Creek and Soulajule Reservoir

Walker Creek and Soulajule Reservoir, which is located in the Walker Creek watershed, are impaired by mercury. This TMDL applies to Soulajule Reservoir and the freshwater portions of Walker Creek. The goal of the TMDL is to establish and maintain environmental conditions that will support beneficial uses of these waters established in Chapter 2.

The following sections establish a concentration-based TMDL for mercury in the Walker Creek watershed, and prescribe actions and monitoring necessary to implement and maintain the TMDL. The numeric targets, allocations, and associated implementation plan will ensure that Walker Creek and Soulajule Reservoir attain applicable water quality standards and achieve the TMDL.

The TMDL allocations and implementation plan are designed to control the amount of mercury discharged to Walker Creek and from Soulajule Reservoir, and prescribe and promote actions to minimize the potential for mercury to be present in the toxic and bioavailable form, methylmercury. Effectiveness of implementation actions, monitoring to track progress toward targets, and the scientific understanding pertaining to mercury will be periodically reviewed. The TMDL may be adapted as warranted.

7.3.2.1 Problem Statement

Walker Creek and SoulaJule Reservoir are impaired because mercury adversely affects beneficial uses, including wildlife habitat and all uses supporting aquatic life.

- Mercury concentrations in Walker Creek exceed the mercury freshwater aquatic life acute toxicity objective established to protect aquatic organisms (Table 3.4).
- Terrestrial species that primarily or exclusively eat fish (such as piscivorous birds, the most sensitive wildlife species in the watershed) are at risk from exposure to mercury due to its tendency to bioaccumulate in the food web. Because mercury concentrations in Walker Creek fish are high enough to threaten the health of piscivorous birds, the narrative bioaccumulation objective (see Chapter 3) and numeric aquatic organism and wildlife mercury water quality objective (Table 3-4a) are not being met.
- SoulaJule Reservoir is impaired because some fish in the reservoir exceed mercury levels considered safe for human consumption.
- The beneficial use aimed at protecting the health of people who choose to consume SoulaJule Reservoir fish (REC1) is impaired and the narrative bioaccumulation water quality objective is not being met.
- In 2004, the California Office of Environmental Health Hazard Assessment issued an interim advisory recommending that people limit consumption of reservoir fish due to elevated mercury levels.

7.3.2.2 Sources

The following sources have the potential to discharge mercury to surface waters in the Walker Creek watershed:

- **Gambonini Mine site** – An inactive mercury mine and the largest mercury processing facility in the watershed. Mining waste was not properly contained on-site, and consequently the site discharged large quantities of mercury-laden sediments prior to cleanup (initiated in 1998).
- **SoulaJule Watershed and Reservoir** – Two abandoned mercury mines are located in this watershed. SoulaJule Reservoir discharges into Walker Creek just downstream of the Gambonini Mine drainage.
- **Downstream depositional features** – Mercury-laden sediments in depositional areas (creek beds, banks, and floodplains) downstream of the mercury mines, which discharge mercury to the creek during storms.
- **Background** – Mercury is present at low concentrations throughout the watershed. Background levels account for atmospheric deposition and naturally occurring mercury found in the watershed's soils. The Walker Creek watershed background suspended sediment mercury concentration is 0.2 mg mercury per kg dry sediment.

7.3.2.3 TMDL Targets

- To protect wildlife and rare and endangered species, the mercury concentration in fish consumed by piscivorous birds shall not exceed 0.05 mg mercury per kg fish, measured in whole fish 5–15 cm in length, average wet weight nor shall it exceed 0.1 mg mercury per kg fish, measured in whole fish 15-35 cm in length, average wet weight. The goal of these targets, which are consistent

Water Quality Control Plan for the San Francisco Bay Region

with the bioaccumulation objective in Chapter 3, is to ensure that controllable water quality factors do not cause detrimental mercury concentrations in Walker Creek and Soulajule Reservoir wildlife.

- To protect aquatic organisms, water column mercury concentrations shall not exceed the water quality objective of 2.4 µg/l (one-hour average).
- To protect humans who consume Soulajule Reservoir and Walker Creek fish (assuming future conditions allow for the consumption of Walker Creek fish), water column mercury concentrations shall not exceed the California Toxics Rule (CTR) criterion of 0.050 µg/l (averaged over a 30-day period).

7.3.2.4 Allocations and Total Maximum Daily Load

The TMDL for Walker Creek is 0.5 mg mercury per kg suspended sediment and the TMDL for Soulajule Reservoir is 0.04 ng dissolved methylmercury per liter water. Concentration-based load allocations for Walker Creek and Soulajule Reservoir mercury sources are shown in Table 7.3.2-1.

Table 7.3.2-1 TMDL Mercury Wasteload and Load Allocations

Source	Wasteload Allocation	Load Allocation
Gambonini Mine site NPDES Permit no. CAS000001	5 mg mercury per kg suspended sediment	
Soulajule watershed and Reservoir		0.04 ng dissolved methylmercury per liter water 0.5 mg mercury per kg suspended sediment
Downstream depositional features ¹		0.5 mg mercury per kg suspended sediment
Background ²		0.2 mg mercury per kg suspended sediment
¹ Applies to sediment released from depositional features (creek beds, banks, and floodplains) downstream of the Gambonini Mine and Soulajule Reservoir. ² The background allocation applies to all areas in the Walker Creek watershed outside of the influence of the Gambonini Mine site or Soulajule Reservoir.		

7.3.2.5 Implementation Plan

The implementation plan builds upon previous and ongoing successful efforts to reduce mercury loads in Walker Creek and its tributaries. Table 7.3.2-2 contains the required implementation measures for each source. It is important to note that the numeric targets and load allocations in the TMDL are not directly enforceable. To demonstrate attainment of applicable allocations, responsible parties must demonstrate compliance with specified implementation measures and any applicable waste discharge requirements (WDRs) or waiver conditions.

Table 7.3.2-2 Implementation Measures for Walker Creek Mercury TMDL

Source	Action	Implementing Parties	Completion Date
Gambonini Mine Site	Apply for coverage under the State of California's Industrial Stormwater General Permit	Gambonini Mine Site owner(s)	2007
	Submit to the Water Board for approval a Stormwater Pollution Prevention Plan (SWPPP), implementation schedule, and monitoring plan		
Soulajule Reservoir	Submit to the Executive Officer of the Water Board, a monitoring and implementation plan and schedule to 1) characterize fish tissue, water, and suspended sediment mercury concentrations in Soulajule Reservoir and Arroyo Sausal Creek, and 2) develop and implement methylmercury production controls necessary to attain both in-reservoir and downstream TMDL targets	Marin Municipal Water District	2009
Downstream Depositional Features	Applicants seeking coverage under waste discharge requirements (WDRs) or waivers of WDRs to control pathogens, nutrients, or sediments discharges in the Walker Creek watershed shall incorporate management practices that minimize mercury discharges and methylmercury production	All creekside property owners downstream of Gambonini Mine and Soulajule Reservoir	2009
	All projects regulated under Clean Water Act Section 401 shall include provisions to minimize mercury discharges and methylmercury production		
	Comply with conditions of Marin County's Creek Permit Program		
	Update Marin County's Creek Permit Guidance for Unincorporated Areas of Marin to include specific guidance for projects in areas that may contain mercury-enriched sediments	County of Marin	2008

Cost Estimate: Agricultural Water Quality Control Program

Because the implementation measures for grazing lands constitute an agricultural water quality control plan, the cost of that program is estimated below, consistent with California Water Code requirements (Section 13141). We estimate that 100 percent of the downstream depositional areas can be considered grazing lands. Costs estimated for reducing mercury discharges and methylmercury production on grazing lands are \$1.5 to 2.5 million over a ten-year period. These costs are associated with reducing sediment discharges and enhancing habitat conditions on Walker Creek and its tributaries. Considering potential benefits to the public in terms of habitat restoration and water quality, we expect that a significant portion of the costs will be paid for with public funds.

Evaluation and Monitoring

Water Board staff will conduct water quality monitoring to evaluate mercury concentrations in Walker Creek and its tributaries as part of the Surface Water Ambient Monitoring Program (SWAMP). Marin Municipal Water District will conduct water quality monitoring to evaluate mercury concentrations in

Water Quality Control Plan for the San Francisco Bay Region

both Soulajule Reservoir and reservoir discharges to Arroyo Sausal Creek. All water quality monitoring (including quality assurance and quality control procedures) will be performed pursuant to the State Water Board’s Quality Assurance Management Plan for this program. The main objectives of the monitoring are:

- Assess attainment of TMDL targets and load allocations
- Evaluate spatial and temporal water quality trends
- Refine understanding of mercury loading in downstream depositional areas
- Refine understanding of methylmercury production and bioaccumulation in Soulajule Reservoir
- Collect sufficient data to prioritize implementation efforts and assess the effectiveness of source control actions

Table 7.3.2-3 presents locations in the Walker Creek watershed for baseline water quality monitoring. These sites will be monitored for suspended particulate, methyl- and total mercury concentrations during the wet and dry seasons. Fish tissue mercury concentrations will be monitored to aid in understanding mercury and the food web. Mercury concentrations in fish of the size typically consumed by wildlife and humans will be monitored in Soulajule Reservoir to assess progress towards attaining the wildlife and human health target. Wet season sampling will focus on characterizing conditions during peak flow events. SWAMP monitoring will be conducted based on availability of funds.

Walker Creek Ranch is considered an “integration” site for the watershed. Water quality data collected at Walker Creek Ranch integrates Salmon Creek background concentrations with loads from the Gambonini Mine Site, Soulajule Reservoir, and some downstream depositional features. Mercury levels in 5–15 cm fish in Walker Creek will be monitored every five years at Walker Creek Ranch to assess progress towards attaining the wildlife target. In addition, the Water Board, in cooperation with the United States Geological Survey, maintains a continuous data recorder at Walker Creek Ranch that monitors suspended sediment and particulate mercury concentrations in Walker Creek.

Five years after adoption of this TMDL, the Water Board will evaluate monitoring results and assess progress made toward attaining targets and load allocations. Beginning in 2012 and approximately every five years thereafter, the Water Board will evaluate site specific, sub-watershed-specific, and watershed-wide compliance with the trackable implementation measures specified in Table 7.3.2-2.

Table 7.3.2-3. Baseline Monitoring Sites

Salmon Creek, upstream of the Gambonini Mercury Mine Site
Walker Creek at Walker Creek Ranch
Walker Creek at Highway 1
Chileno Creek downstream of the inactive Chileno Mine
Soulajule Reservoir
Arroyo Sausal Creek downstream of Soulajoule Reservoir

Adaptive Implementation

Approximately every five years, the Water Board will review the Walker Creek Mercury TMDL and evaluate new and relevant information from monitoring, special studies, and the scientific literature. At a minimum, the following questions will be incorporated into the reviews. Additional questions will be developed in collaboration with stakeholders during each review cycle.

Water Quality Control Plan for the San Francisco Bay Region

- Are Walker Creek and its tributaries progressing toward TMDL targets as expected? If progress is unclear, how should monitoring efforts be modified to detect trends? If there has not been adequate progress, how should the implementation actions or allocations be modified?
- What are the pollutant loads for the various sources? Have these loads changed over time? How do they vary seasonally? How might source control measures be modified to improve load reduction?
- What wetland and creek restoration methods should be used to minimize mercury discharges and methylmercury production while enhancing and restoring habitat values?
- Are wildlife feeding in Soulajule Reservoir at risk? If so, how can the Reservoir be managed to reduce this risk?
- Does additional sediment, water column, or fish tissue total or methylmercury data support our understanding of linkages in the watershed or suggest an alternative allocation strategy?
- Is there new, reliable, and widely accepted scientific information that suggests modifications to targets, allocations, or implementation actions? If so, how should the TMDL be modified?

Reviews will be coordinated through the Water Board's continuing planning program, with stakeholder participation. Any necessary modifications to the targets, allocations, or implementation plan will be incorporated into the Basin Plan via an amendment process. In evaluating necessary modifications, the Water Board will favor actions that reduce sediment and nutrient loads, pollutants for which the Walker Creek is also impaired.

7.3.3 Lagunitas Creek Fine Sediment Reduction and Habitat Enhancement Plan

The following sections establish:

1. A sediment TMDL defining the allowable amount of sediment that can be discharged into the Lagunitas Creek watershed, expressed as a percentage of the natural background sediment delivery rate to channels; and
2. An implementation plan to achieve the TMDL and substantial habitat enhancement in channel reaches that support coho salmon, steelhead, and/or California freshwater shrimp.

The goals of the Lagunitas Creek Sediment Reduction and Habitat Enhancement Plan (Plan) are as follows:

- To restore an annual spawning run within the Lagunitas Creek watershed of 1300-or-more adult coho salmon, achieved for at least twelve consecutive years.
- For native fish and aquatic wildlife species to be in good condition at the individual, population, and community levels.
- To protect and enhance the aesthetic and recreational values of the creek and its tributaries.

The main focus of this Plan is habitat enhancement, because habitat loss and simplification appears to be a primary cause of the declines of watershed populations of coho salmon, steelhead, and California freshwater shrimp. The Plan also establishes a regulatory program to reduce sediment delivery to channels resulting from road-related erosion, a necessary condition to support recovery of listed species and achieve water quality objectives for sediment and settleable material. Other significant land-use

related sediment sources are already being reduced substantially through existing regulatory programs and/or natural recovery processes.

7.3.3.1 Problem Statement

Due to excess erosion and sedimentation in the Lagunitas Creek watershed, the narrative water quality objectives for sediment and settleable material are not being met, and cold freshwater habitat, wildlife habitat, fish spawning, recreation, and preservation of rare and endangered species beneficial uses are impaired. In addition, the narrative water quality objective for population and community ecology is not being met due to habitat simplification, which is a primary cause for the decline of coho salmon and steelhead trout populations.

Lagunitas Creek provides essential habitat for coho salmon, steelhead trout, and California freshwater shrimp, all of which are listed under the federal Endangered Species Act (coho salmon and California freshwater shrimp also are listed under the California Endangered Species Act). During the historical period - the mid-nineteenth century through present - there has been a precipitous decline in the abundance of coho salmon and steelhead in the Lagunitas Creek watershed. Coho salmon and steelhead runs once numbered in the several thousands. Up until the late 1960s, Lagunitas Creek was a popular destination for sport fisherman hoping to catch steelhead and coho salmon. In 1996, Lagunitas Creek's salmon and steelhead populations had dropped so low that they were listed under the Endangered Species Act.

The most important causes for coho salmon and steelhead population declines in the Lagunitas Creek watershed appear to be: a) the loss of about half of the potential habitat, which has been inundated and/or is no longer accessible as a result of dam construction; and b) in almost all the remaining habitat, the fact that channel incision has greatly simplified habitat and disconnected the channel from its floodplain.

Channel incision causes habitat simplification, which herein is defined as the progressive lowering over time of the streambed elevation as a result of net erosion. San Geronimo and Lagunitas creeks and alluvial reaches of their tributaries have incised substantially during the historical period. Channel incision obliterates the basic physical habitat structure of the channel, expressed by a substantial reduction in the frequency and area of gravel bars, riffles, and side channels. If a channel incises substantially, it will become disconnected from its surrounding floodplain, which further increases the rates of incision, streambed mobility, and scour depth. Another effect of incision has been a significant reduction in large woody debris input to Lagunitas Creek and its tributaries, which also greatly diminishes the capacity for these creeks to store, sort, and meter sediment.

Habitat conditions are degraded by elevated concentrations of fine sediment in the streambed (primarily sand) - caused by pervasive alteration of sediment supply, transport, and storage - which further reduces juvenile salmonid growth and survival in all freshwater life stages. As sediment supply increases or becomes finer, the streambed can respond by becoming finer and more mobile, as has been documented in tributaries to Lagunitas Creek. Streambed scour at spawning redds can be a significant source of mortality during incubation for coho salmon.

7.3.3.2 Numeric Targets

Increased rate and fining of the bed material supply, channel incision, and a reduction in the number and size of large fallen trees in channels, have all contributed to high to very high rates of streambed mobility and scour in tributaries to Lagunitas Creek that provide important spawning habitat for coho salmon and

steelhead, including Arroyo, Cheda, and San Geronimo creeks, and Devils Gulch. To restore properly functioning conditions, we call for actions to substantially reduce sand supply to Lagunitas Creek and its tributaries, to substantially increase the amount of large woody debris in channels, and, where safe and feasible, to reconnect the channel to its floodplain. As such we proposed the following targets for streambed mobility and redd scour.

Meeting the numeric targets listed in Table 7.3.3.1 will allow water quality in Lagunitas Creek and its tributaries to achieve the narrative water quality objectives for sediment, settleable material, and population and community ecology.

Table 7.3.3.1: Sediment and Habitat Targets for the Lagunitas Creek and its Tributaries

Sediment Condition Targets
Streambed Mobility (τ^*): $0.03 < \tau^* \leq 0.06$; this target applies to gravel-bedded channel reaches where the adjacent valley flat is a floodplain.
Watershed-wide median depth of redd scour (D_s) ≤ 12 cm
Habitat Condition Targets
Large Woody Debris (LWD) Loading ≥ 300 m ³ /ha in Redwood Channels ^c and ≥ 100 m ³ /ha in Hardwood Channels
<p>Explanatory notes:</p> <p>The numeric target for reach-average value of streambed mobility at bankfull stage, or Tau-Star (τ^*), is greater than 0.03 and less than or equal to 0.06, corresponding to a partially-to-fully mobile streambed. This is the natural range of mobility in most gravel-bedded channels. The target applies only to gravel-bedded channel reaches where the adjacent valley flat is a floodplain and where: a) the streambed slope is between 0.001 and 0.03, and b) actual or potential spawning habitat is provided for anadromous salmonid species. As defined by renowned geomorphologists Thomas Dunne and Luna B. Leopold: "The floodplain is the flat area adjoining a river channel constructed by the river in the present climate and overflowed at times of high discharge. It is inundated on the average once every one or two years."</p> <p>The watershed-wide median value for depth of scour (D_s) at actual or potential spawning sites for coho salmon and/or steelhead shall be ≤ 12 cm below the level of the overlying streambed substrate. This target applies for discharges \leq the 5-year recurrence interval event (annual maximum series). Channel reaches that provide actual or potential spawning habitat are as defined above. Potential spawning sites within those reaches can be identified based on the following characteristics: 1) median particle size diameter (D_{50}) in the surface layer of the streambed is between 16 and 64 mm; 2) surface area of the gravel deposit is ≥ 1.0 square meter; and 3) location at a riffle head, pool tail, pool margin, and/or a gravel deposit associated with a flow obstruction (e.g., woody debris, boulders, banks, etc.).</p> <p>Redwood channels are defined as those where the adjacent valley floor and/or hillslopes are vegetated primarily by coast redwood forest. Hardwood channels are defined as those where the adjacent valley flat is vegetated by a hardwood forest (typically some combination of willow species, white alder, California bay laurel, bigleaf maple, tan oak, and/or Oregon ash). The large woody debris loading targets apply to channel reaches that provide actual or potential spawning habitat for anadromous salmonids as defined above.</p>

7.3.3.3 Sediment Sources

Field inventories conducted throughout the Lagunitas Creek watershed provide credible estimates of the rates and sizes of sediment delivered to channels in the watershed during water years 1983 through 2008. Based on this work, the Water Board concludes:

1. Sediment supply to Lagunitas Creek was greater than or equal to two times natural background. Hillslope erosion processes, considered together with road-related erosion, accounted for about 40 percent of sediment delivery to Lagunitas Creek. Human-caused channel incision and associated bank erosion, primarily the result of historical land-use disturbances, accounted for about 60 percent of the supply.
2. Rates of sediment supply to channels in the Lagunitas Creek watershed varied substantially, from less than 100 to about 400 metric tons per km² per year. Variability is a function primarily of the location of dams, large alluvial valleys (where channels have become deeply incised), road density, and bedrock geology.
3. Channel incision rates were highest in headwater channel reaches, but incision also was active further downstream (at somewhat lower rates) in the reaches that provide habitat for anadromous salmonids and California freshwater shrimp.
4. Considering the significant exposure of hard bedrock in the streambed along San Geronimo Creek, and in the mainstem of Lagunitas Creek in the Shafter and State Park reaches, it is unlikely that streambed elevation will become much lower in these reaches. Absent intervention, complex habitat that now includes riffles and bars will likely decrease, and bedrock exposure will increase, which would further impair habitat condition.
5. While the primary driver for incision is a reduction in large woody debris loading, reduction in coarse sediment supply, following construction of Kent Lake and Nicasio Reservoir, and other historical and ongoing land-use activities also are factors.

In summary, the net result is an elevated amount of fine sediment in the streambed and substantial simplification of channel habitat structure.

The total sediment load in Lagunitas Creek is estimated to have been about 230 percent of natural background upstream of Devils Gulch and about 200 percent of natural background upstream of Olema Creek during the study period. Tables 7.3.3.2 and 7.3.3.3 break down the sediment sources to Lagunitas Creek based on an annual average rate.

Table 7.3.3.2: Mean Annual Sediment Delivery to Lagunitas Creek upstream of Devils Gulch (drainage area = 89 km²) during water years 1983 through 2008

Source	Estimated Mean Annual Delivery Rate (metric tons/yr)
Landslides, Gullies, and Soil Creep	2,600
Roads	3,600
Tributary Channels: Channel Incision and Bank Erosion	5,000
San Geronimo Creek and Lagunitas Creek: Channel Incision and Bank Erosion	2,900
Urban stormwater and wastewater discharges	100
TOTAL	14,200

Table 7.3.3.3: Mean Annual Sediment Delivery to Lagunitas Creek upstream of Olema Creek (drainage area = 213 km²) during water years 1983 through 2008

Source	Estimated Mean Annual Delivery Rate (metric tons/yr)
Landslides, Gullies, and Soil Creep	5,600
Roads	4,000
Tributary Channels: Channel Incision and Bank Erosion	8,500
San Geronimo Creek and Lagunitas Creek: Channel Incision and Bank Erosion	4,000
Urban stormwater, wastewater, and other point source discharges	100
TOTAL	22,200

7.3.3.4 Total Maximum Daily Load and Allocations

The sediment TMDL for Lagunitas Creek upstream of Devils Gulch is established at 7,500 metric tons per year, which corresponds to about 120 percent of natural background load during the water year 1983 through 2008 period. The sediment TMDL for Lagunitas Creek upstream of Olema Creek is established at 11,900 metric tons per year, which corresponds to about 110 percent of natural background load during the water year 1983 through 2008 period. Natural background load depends upon natural processes and varies significantly. Therefore, these TMDLs and associated allocations are expressed both in terms of sediment mass and percent of natural background. Sediment delivery needs to be reduced overall by about 50 percent from the current proportion of the total load to achieve these TMDLs. Tables 7.3.3.4, 7.3.3.5 and 7.3.3.6 contain the allocations for all sources of sediment in the watershed.

TMDL attainment will be evaluated: a) immediately upstream of the confluence of Lagunitas Creek with Devils Gulch, which approximates the mid-point along the primary spawning reach for coho salmon on Lagunitas Creek; and b) immediately upstream of the confluence of Lagunitas Creek with Olema Creek, which corresponds to the downstream boundary of the TMDL project area. Attainment of the TMDL will be evaluated over a 5-to-10-year averaging period.

Table 7.3.3.4: Load Allocations for Sediment Discharges for Lagunitas Creek Upstream of Devils Gulch

Source category	Load during 1983-2008		Estimated reductions needed (percentage)	Load allocations	
	Metric tons/year	Percentage of Natural Background		Metric tons/year	Percentage of Natural Background
Landslides, Gullies, and Soil Creep	2,600	42	50	1,300	21
Roads	3,600	58	50	1,800	29
Tributary Channels: Channel Incision and Bank Erosion	5,000	80	33	3,300	53
San Geronimo Creek and Lagunitas Creek: Channel Incision and Bank Erosion	2,900	47	67	1000	16
Total	14,100	227	48	7,400	119
Note: Natural background for Lagunitas upstream of Devils Gulch = 6200 metric tons/year					

**Table 7.3.3.5: Load Allocations for Sediment Discharges for Lagunitas Creek
Upstream of Olema Creek**

Source Category	Load during 1983-2008		Estimated reductions needed (percentage)	Load allocations	
	Metric tons/year	Percentage of Natural Background		Metric tons/year	Percent of Natural Background
Landslides, Gullies, and Soil Creep	5,600	53	50	2,800	26
Roads	4,000	38	50	2,000	19
Tributary Channels: Channel Incision and Bank Erosion	8,500	80	33	5,700	53
San Geronimo Creek and Lagunitas Creek: Channel Incision and Bank Erosion	4,000	38	67	1,300	12
Total	22,100	209	47	11,800	110
Note: natural background for Lagunitas upstream of Olema Creek = 10700 metric tons/year					

**Table 7.3.3.6: Wasteload Allocations for Stormwater for Lagunitas Creek
Upstream of Olema Creek**

Source Category	Current Load		Reductions needed (percentage)	Wasteload Allocations	
	Metric tons/year	Percentage of Natural Background		Metric tons/year	Percent of Natural Background
Construction Stormwater NPDES Permit No. CAS000002	30	0.3	0	30	0.3
Municipal Stormwater NPDES Permit No. CAS000004	70	0.7	0	70	0.7
TOTAL	100	1.0	0	100	1.0
Note: Above estimates for loads, percent reductions, and allocations are rounded to two significant figures. Natural background for Lagunitas upstream of Olema Creek = 10,700 metric tons/year.					

7.3.3.5 Implementation Plan

The actions described below, including those to control sediment discharges and enhance stream-riparian habitat complexity and connectivity, are to attain allocations and achieve numeric targets for sedimentation and habitat condition.

Regulatory Tools

The only known point sources of sediment are very small and associated with municipal and construction stormwater runoff, which are regulated under existing NPDES permits that include requirements to control erosion, sedimentation, and hydromodification. Table 7.3.3.7 shows implementation measures required of these sources. The State's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program requires regulation of nonpoint source discharges using the Water Board's administrative permitting authorities, including waste discharge requirements (WDRs), waiver of WDRs, Basin Plan Discharge Prohibitions, or some combination of these. Consistent with this policy, Tables 7.3.3.8 – 7.3.3.10 specify actions and performance standards by nonpoint source category to achieve TMDL sediment targets and allocations in the Lagunitas Creek watershed.

Control of Nonpoint Sources of Sediment

The only significant nonpoint source that is not effectively controlled through existing programs and/or natural recovery processes is sediment discharge from roads. This gap applies only to publicly-owned roads, primarily unpaved roads under the jurisdiction of the State Department of Parks and Recreation in S.P. Taylor State Park and/or the U.S. National Park Service within the Golden Gate National Recreation Area. Paved public roads, almost all under the jurisdiction of the County of Marin, also may contribute significant amounts of sediment to channels, although at lower rates.

With regard to the unpaved public roads, reasonable assurances are in place through a memorandum of understanding (MOU) - for the maintenance and management of unpaved roads – that has been agreed to by all of the public agencies within the project area with jurisdiction over roads. Through this MOU, substantial progress has been made to control and reduce sediment delivery to channels. The Marin Open Space District and the Marin Municipal Water District already achieve the performance standard for unpaved roads under their jurisdiction in the Lagunitas Creek watershed.

To ensure that effective sediment source controls are implemented on all public roads –unpaved and paved - consistent with the State Nonpoint Source Program, WDRs, or a conditional waiver of WDRs, are required to meet the road sediment delivery performance standard (Table 7.3.3.9). Whether through adoption of a conditional waiver of WDRs or adoption of WDRs, the required actions are as follows:

1. The County of Marin, Department of Public Works, within five years of TMDL adoption, must conduct an inventory of its paved roads within the project area to identify sediment delivery sites and produce a schedule for treatment, as needed, to achieve road sediment delivery performance standards listed in Table 7.3.3.9.
2. The State Department of Parks and Recreation within S.P. Taylor State Park and the U.S. National Park Service, within that portion of the Golden Gate National Recreation Area that is in the TMDL project area, must control sediment delivery sites on unpaved roads to achieve the performance standard for road-related sediment delivery (Table 7.3.3.9).

3. All public agencies with jurisdiction over roads within the project area must adopt and implement road maintenance guidelines to protect aquatic habitat, water quality, and salmonid fisheries; conduct a biennial training program for road maintenance staff, and biennially submit a report that documents implementation and/or recommends adaptive updates to the maintenance practices.

Actions to Enhance Stream-Riparian Habitat Complexity and Connectivity

Although future sediment delivery from channel incision is predicted to decline substantially as a result of natural process adjustments, absent implementation of a habitat enhancement program, stream-riparian habitat condition will remain substantially degraded. Stream habitat degradation in the channel reaches that remain accessible to populations of coho salmon and steelhead is a key factor in their decline. Floodplains and large woody debris jams provide essential high quality rearing habitats and enhance food production for coho salmon, steelhead, and California freshwater shrimp. These features also reduce streambed scour and sort, meter, and store fine sediment, thereby substantially enhancing the diversity of streambed substrate patches. Therefore, the primary focus of this Plan is a program of channel habitat enhancement, presented in Table 7.3.3.10, focused on actions to substantially increase the amount of large woody debris in channels and to develop focused technical studies to identify priorities and opportunities for floodplain restoration (in channel reaches where it is safe and feasible to do so). Goals for these actions are presented in Table 7.3.3.11. Continued implementation of the *Memorandum of Understanding for Woody Debris Management in Riparian Areas of the Lagunitas Creek Watershed* by the Marin Municipal Water District and other public agencies also will contribute to increased large woody debris loading.

Problems associated with channel incision reflect and integrate multiple historical and ongoing disturbances, some of which are local and direct, and others that are indirect and distal. Effectively addressing these issues will require cooperative and coordinated actions by multiple landowners, working with public agencies, over significant distances along Lagunitas Creek and its tributaries. The Water Board will emphasize cooperative programs to achieve the floodplain restoration and/or large woody debris enhancement goals acting in coordination with the State Water Board Division of Water Rights (Table 7.3.3.11).

The Water Board also encourages stakeholders along San Geronimo Creek and its tributaries to develop reach-based stewardship groups to implement channel habitat enhancement projects in this part of the watershed. Public funding for such efforts should be prioritized for reaches where both potential gains in habitat function are significant and necessary landowner support and participation can be achieved.

Table 7.3.3.7 TMDL Implementation Measures for Sediment Discharges Associated with Point Sources

Source Category	Actions	Implementing Parties
Municipal stormwater and construction stormwater	Comply with applicable NPDES permit	County of Marin and owners or operators of construction projects > 1 acre

Table 7.3.3.8: Required TMDL Implementation Measures for Sediment Discharges Associated with Grazing¹

Land Use Category	Performance Standards	Actions	Implementing Parties	Completion Dates
<p style="text-align: center;">Grazing</p>	<p>Surface erosion associated with livestock grazing: Attain or exceed minimum residual dry matter values consistent with University of California Division of Agriculture and Natural Resources Guidelines; and</p> <p>Roads: Road-related sediment delivery to channels ≤ 350 cubic yards per mile per 20-year period; and</p> <p>Minimize delivery of sediment to channels from unstable or potentially unstable areas: Manage existing grazing operations, stock ponds, and roads to prevent additional erosion of legacy sediment delivery sites, and/or delivery from other potentially unstable areas.</p>	<p>Comply with the existing Water Board regulatory program: conditional waiver of waste discharge requirements for grazing operations in the Tomales Bay watershed (R2-2013-0039), or</p> <p>Other applicable WDRs or waiver of WDRs, or</p> <p>Submit a Report of Waste Discharge to the Water Board that provides, at a minimum, the following: description of the property; identification of site-specific erosion control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified erosion control measures.</p>	<p>Landowner and/or ranch operator</p>	<p>As required by existing regulatory program under R2-2013-0039 or other applicable WDRs or waiver of WDRs. Individual waste discharge requirements also may be issued as needed, with the schedule to be determined.</p>
		<p>Report progress on implementation of site-specific erosion control measures.²</p>	<p>Landowner and/or ranch operator</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
<p>¹To achieve TMDL allocations, consistent with the State Nonpoint Source Program. ²These reports may be prepared individually or jointly or through a recognized third party.</p>				

Table 7.3.3.9: Required TMDL Implementation Measures for Sediment Discharges associated with Parks and Open Space and/or Municipal Public Works¹

Landowner Type	Performance Standards	Actions	Implementing Parties	Completion Dates
<p style="text-align: center;">PARKS AND OPEN SPACE AND PUBLIC WORKS</p>	<p>Roads: Road-related sediment delivery to channels \leq 350 cubic yards per mile per 20-year period; and</p> <p>Minimize delivery of sediment to channels from unstable or potentially unstable areas: Manage existing roads and other infrastructure to prevent additional erosion of legacy sediment delivery sites, and/or delivery from other potentially unstable areas.</p>	<p>Submit a Report of Waste Discharge to the Water Board that provides, at a minimum, the following required actions: a) description of the road network and/or segments; b) identification of erosion and sediment control measures to achieve performance standard(s) specified in this table; c) a schedule for implementation of identified control measures; and d) development and implementation of guidelines for road maintenance, as needed to protect water quality, stream-riparian habitat, and salmonid fisheries</p>	<p>County of Marin, Public Works Department</p> <p>State of California, Department of Parks and Recreation, S.P. Taylor State Park</p> <p>U.S. National Park Service, Golden Gate National Recreation Area</p>	<p>Submit a report of waste discharge within five years of Basin Plan amendment adoption.</p> <p>Achieve performance standards within twenty years of Basin Plan amendment adoption.</p>
		<p>Comply with applicable WDRs or waiver of WDRs.</p>	<p>As above</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
		<p>Report progress on development and implementation of best management practices to control road-related erosion.</p>	<p>As above</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
<p>¹To achieve TMDL allocations, consistent with the State Nonpoint Source Program.</p>				

Table 7.3.3.10: Actions to Enhance Habitat Complexity and Connectivity in Lagunitas Creek and its Tributaries

Stressor	Management Objective(s)	Actions	Implementing Parties	Completion Dates and Notes
<p>Habitat degradation as a result of incision of Lagunitas Creek and its tributaries.</p>	<p>Enhance channel habitat complexity and connectivity as needed to support self-sustaining populations of coho salmon and steelhead and to enhance the overall health of the native fish community.</p> <p>Reduce rates of sediment delivery (associated with incision and accelerated bank erosion) to channels by 67 percent in Lagunitas and San Geronimo creeks and by 33 percent in tributaries to both streams.</p>	<p>1. Develop and implement plans to enhance large woody debris loading and restore natural rates of recruitment to channels, as needed to achieve numeric targets for large woody debris loading (Table 1) and to achieve load allocations for sediment (Tables 3a and 3b). The above plan will include a survey to quantify baseline values for large woody debris loading.</p> <p>2. Develop detailed technical studies to characterize reach-specific opportunities and priorities for floodplain restoration.</p>	<p>Along San Geronimo Creek and its tributaries, local government agencies or non-profits in partnership with reach-based landowner stewardships will develop and implement projects to enhance habitat complexity and connectivity.</p> <p>Elsewhere in the Lagunitas Creek watershed, the Marin Municipal Water District will pursue partnerships to develop and implement projects to enhance habitat complexity and connectivity.</p>	<p>Targets for large woody debris loading will be achieved within 10 years of Basin Plan amendment adoption.</p> <p>Technical studies to characterize reach specific opportunities and priorities for floodplain restoration will be completed within 5 years of Basin Plan amendment adoption.</p> <p>Comply with conditions of Clean Water Act section 401 certifications in the implementation of projects to enhance large woody debris loading and recruitment.</p>

Table 7.3.3.11: Goals for Floodplain Restoration and/or Large Woody Debris Enhancement in Lagunitas Creek Watershed

1. To increase side channel plus alcove area, wetted during winter baseflow and higher flows, by 100 percent-or-more. Side channels and alcoves should be accessible, nearby or adjacent to debris jams and/or undercut banks in the main channel and/or tributary junctions.
2. To establish diverse vegetation and substrate patch types that are dynamically established, evolve, and deform through time: a complex and dynamic mosaic of stream-riparian habitats.
3. To store a substantial fraction of the fine sediment supply on the floodplain: 20 percent-or-more of the total sediment supply to a given channel reach.
4. To achieve the streambed mobility and redd scour targets in all reaches where floodplains are reconnected to channels.
5. To increase gravel storage volume and average residence time and to increase the variability in the thalweg profile in S.P. Taylor State Park, Tocaloma, and Lower Lagunitas reaches.
6. To restore natural rates of recruitment of large woody debris from riparian areas of channels located on public lands.
7. To achieve or exceed targets for large woody debris loading as specified in Table 1 within 10 years of Basin Plan amendment adoption.
8. To convert one-third-or-more of the plane bed habitat in channel reaches accessible to anadromous salmonids to forced pool-riffle habitat.
9. To expand the reach length occupied by California freshwater shrimp by two kilometers-or-more.
10. To produce 10,000-or-more coho salmon smolts, and 6,000-or-more steelhead smolts, on average, each year.

Agricultural Water Quality Control Program Costs

Implementation measures for grazing lands and roads located on those same properties constitute an agricultural water quality control program and, therefore, consistent with California Water Code requirements (Section 13141), the cost of this program is estimated herein. The Tomales Bay watershed pathogens TMDL that was adopted in 2005, which includes all ranches and grazing areas within the Lagunitas Creek watershed, estimates costs to ranch operators to implement best management practices to control pathogen discharges from rangelands including maintaining adequate amounts of residual dry matter in rangelands and the costs of excluding livestock from water courses by construction and maintenance of fences in these sensitive areas. Those actions also are expected to satisfy performance standards for control of surface erosion in rangelands and control of sediment discharge from unstable areas. As such, we do not consider these existing costs, associated with compliance with the previously adopted pathogens TMDL, in calculating the agricultural water quality control program costs associated with achieving compliance with the Lagunitas Creek sediment TMDL. The only new agricultural water quality control program costs are those related to attainment of performance standards and load allocations for sediment discharge from roads to channels. In the Lagunitas Creek watershed, we estimate that there are 20 miles of roads located on privately owned ranchlands. In estimating potential cost of compliance, we reference recently completed road erosion inventories conducted on unpaved roads located on ranches and/or parklands in the Lagunitas Creek watershed that include estimates of the costs for treating all significant sediment delivery sources from those roads. Relying on these data, we estimate that the maximum total cost to ranch operators, assuming no public funding is available to support this work, could cost \$420,000 over the 20-year implementation period associated with achievement of the TMDL, or about an average of \$21,000 per year. However, the actual cost to agricultural landowners should be lower because it is reasonable to conclude that some projects will qualify for grant funding from public agencies.

7.3.3.6 Evaluation and Monitoring

Three types of monitoring are specified to assess progress toward achievement of numeric targets and load allocations for sediment:

1. Implementation monitoring to document actions to reduce fine sediment discharge and enhance habitat complexity and connectivity;
2. Upslope effectiveness monitoring to evaluate effectiveness of sediment control actions in reducing rates of sediment delivery to channels; and
3. In-channel effectiveness monitoring (e.g., streambed mobility and redd scour) to evaluate channel response to management actions and natural processes.

Implementation monitoring will be conducted by landowners or designated agents. The purpose of this type of monitoring is to document that sediment control and/or habitat enhancement actions specified herein actually occur.

The Water Board, working in partnership with other government agencies, plans to conduct upslope effectiveness monitoring. This will include an update to all or part of the watershed sediment budget, to re-evaluate rates of sediment delivery to channels from land-use activities and natural processes (ten years subsequent to Basin Plan amendment adoption), in the fall of 2024, when sediment delivery associated with land-use activities are projected to be reduced by 25 percent-or-more.

In-channel effectiveness monitoring should be conducted by local government agencies with scientific expertise and demonstrated capability in working effectively with private property owners (to gain permissions for access), as needed to develop a representative sample of stream habitat conditions, in relation to sediment supply and transport within the watershed. In-channel effectiveness monitoring needs to include measurements of redd scour and streambed mobility to evaluate attainment of water quality objectives for settleable material. Water Board staff will work collaboratively with local partners to develop and refine the in-channel effectiveness monitoring program.

Streambed mobility (τ^*) should be measured in gravel-bedded channel reaches along Lagunitas Creek and in its tributaries where the adjacent valley flat is a floodplain.

Redd scour should be measured at 30-or-more potential spawning sites, with 4-or-more scour measurements per spawning site, as needed, to establish a high level of statistical confidence in estimated values. Redd scour sampling sites should be stratified based on estimated average annual sediment supply rate.

Large woody debris loading in channels also needs to be surveyed and assessed to evaluate attainment of the numeric targets for large woody debris loading and to guide development of reach-specific prescriptions for installation of engineered log jams and riparian management actions to maintain or exceed the target values in future years through natural recruitment.

Desired measurement frequency for streambed mobility, redd scour, and large woody debris is once every three years.

7.3.3.7 Adaptive Implementation

In concert with the monitoring programs, described above, the Water Board will adapt the Lagunitas Creek Sediment Reduction and Habitat Enhancement Plan and TMDL. In amending the Basin Plan amendment, the Water Board will consider, at a minimum, the results of validation monitoring conducted to confirm or reject hypotheses regarding effects of actions to enhance large woody debris loading and floodplain area on population dynamics of coho salmon, steelhead, and California freshwater shrimp. The Water Board will also consider the results of salmonid population monitoring programs including juvenile population estimates, adult spawner surveys, and smolt outmigration surveys performed to evaluate the status and trends of these populations and also related analyses of smolt population dynamics in response to changes in the quantity and quality of freshwater habitat. We note that Lagunitas Creek has been identified as a life-cycle monitoring station in the California Department of Fish and Wildlife's Coastal Monitoring Plan (CMP). The Lagunitas Creek Sediment TMDL will seek to dovetail with the CMP's evaluations of salmonid population status and trends in the watershed.

7.4 WATER QUALITY ATTAINMENT STRATEGIES AND TMDLS FOR THE SAN MATEO COASTAL BASIN (SEE [FIGURE 2-4](#))

7.4.1 San Pedro Creek and Pacifica State Beach Bacteria TMDL

The following sections establish the TMDL for bacteria in San Pedro Creek and at Pacifica State Beach. The numeric targets, load and wasteload allocations, and implementation plan are designed to support

and protect these water bodies' designated beneficial use of water contact recreation (e.g., swimming and fishing).

7.4.1.1 Problem Statement

San Pedro Creek and Pacific Ocean waters adjacent to Pacifica State Beach are impaired by bacteria. Bacteriological water quality objectives are exceeded based on elevated indicator bacteria densities, and thus, there is impairment of the water contact recreation (REC-1) beneficial use in these water bodies. Recreating in waters with elevated indicator bacteria densities has long been associated with adverse health effects. Specifically, national epidemiological studies demonstrate that there is a causal relationship between adverse health effects and recreational water quality, as measured by indicator bacteria densities.

7.4.1.2 Sources

Bacteria sources are identified based on the results of a bacterial source tracking study completed in 2009 and from documentation of inadequately treated human waste discharges from Pacifica's sanitary sewer system. If not properly managed, the following source categories have the potential to discharge bacteria to San Pedro Creek and Pacifica State Beach: sanitary sewer systems, horse facilities, and municipal stormwater runoff and dry weather flows.

7.4.1.3 Numeric Targets

This TMDL establishes a desired, or target, condition for the water contact recreation use in San Pedro Creek and at Pacifica State Beach based on the water quality objectives for indicator bacteria. The numeric targets for San Pedro Creek are based on the Basin Plan water quality objectives for coliform bacteria for water contact recreation use in fresh water (the *E.coli* targets are the U.S. EPA bacteriological criteria for water contact recreation in fresh waters that are also contained in the Basin Plan). The numeric targets for Pacifica State Beach are based on the Ocean Plan water quality objectives for water contact recreation use in marine waters. The water quality objectives for both marine and freshwater that form the basis of the numeric targets for this TMDL are listed in Table 7.4.1-1.

Water Quality Control Plan for the San Francisco Bay Region

Indicator Type	Pacifica State Beach (Marine REC-1) MPN/ 100 mL	San Pedro Creek (Freshwater REC-1) MPN/ 100 mL ¹
	Single Sample Maximum	90 th Percentile/No Sample Greater Than
<i>E. coli</i>	NA	235
Fecal Coliform	400	400
Enterococcus	104	NA
Total Coliform	10,000 ²	10,000
	Geometric Mean ³	Geometric Mean/Log Mean/Median
<i>E. coli</i>	NA	126
Fecal Coliform	200	200
Enterococcus	35	NA
Total Coliform	1,000	240

1. Based on a minimum of five consecutive samples equally spaced over a 30-day period.
2. Total coliform density shall not exceed 1,000/100 ml, if the ratio of fecal-to-total coliform exceeds 0.1.
3. Calculated based on the five most recent samples from each site during a 30-day period.

NA: not applicable.

It is not the intent of this TMDL to require treatment or diversion of water bodies or to otherwise require treatment of natural sources of indicator bacteria. Therefore, for this TMDL, a reference system and antidegradation approach has been incorporated in the numeric targets as an allowable number of times that the water quality objectives can be exceeded. The purpose of the allowable number of exceedances of the water quality objectives is to account for the natural, and largely uncontrollable sources of bacteria (e.g., birds and wildlife feces), which have been shown can, by themselves, cause exceedances of the REC-1 water quality objectives. Hence, the numeric targets for this TMDL are the allowable number of exceedances of the single-sample water quality objectives as listed in Table 7.4.1-2.

The number of allowable exceedances is based on two criteria: (1) bacteriological water quality at any site must be at least as good as at a designated reference system; and (2) there is no degradation of existing bacteriological water quality if historical water quality at a particular site is better than the designated reference system.

Table 7.4.1-2 Numeric Targets, TMDLs, and Allocations Based on Allowable Exceedances of Single-Sample Objectives for San Pedro Creek and Pacifica State Beach					
	San Pedro Creek		Pacifica State Beach		
	Dry Weather	Wet Weather ⁵	Summer Dry Weather (Apr. 1 to Oct. 31)	Winter Dry Weather (Nov. 1 to Mar. 31)	Wet Weather ⁵
Allowable Exceedances of Single-Sample Objectives (assuming daily sampling is conducted) ^{1,2,3}	4	26	0	2	30
Allowable Exceedances of Single-Sample Objectives (assuming weekly sampling is conducted) ⁴	1	4	0	1	5

1. Allowable exceedances are calculated by multiplying exceedance rates observed in the reference system(s) by the number of days during each respective period in the reference year (1994).
2. To end up with whole numbers, where the fractional remainder for the calculated allowable exceedance days exceeds 0.1, then the number of days is rounded up.
3. The calculated number of exceedance days assumes that daily sampling is conducted.
4. To determine the allowable number of exceedance events given a weekly sampling regime, as practiced for monitoring San Pedro Creek and Pacifica State Beach, the number of exceedance days was adjusted by solving for "X" in the following equation: $X = (\text{exceedance days} \times 52 \text{ weeks}) / 365 \text{ days}$.
5. Wet weather is defined as any day with 0.1 inches of rain or more and the following three days.

The numeric targets based on the allowable exceedances of single-sample objectives are also the bacteria TMDLs and load and wasteload allocations.

7.4.1.4 Total Maximum Daily Loads

The TMDLs for San Pedro Creek and Pacifica State Beach are the same as the numeric targets listed in Table 7.4.1-2 and are expressed in terms of allowable exceedances of single-sample objectives.

7.4.1.5 Load and Wasteload Allocations

Load allocations and wasteload allocations are the same as the numeric targets and TMDLs listed in Table 7.4.1-2 and are expressed in terms of allowable exceedances of single-sample objectives. Table 7.4.1-3 summarizes the allocations for discharges of bacteria in the San Pedro Creek watershed. Dischargers that discharge to San Pedro Creek have allocations based on allowable exceedances for San Pedro Creek. Dischargers that discharge to Pacifica State Beach have allocations based on allowable exceedances for Pacifica State Beach. The TMDLs, load allocations, and wasteload allocations for Pacifica State Beach shall be attained within 8 years of the effective date of the TMDL. The TMDLs, load allocations, and wasteload allocations for San Pedro Creek shall be attained within 15 years of the effective date of the TMDL.

All entities that discharge indicator bacteria or have jurisdiction over such dischargers are collectively responsible for meeting these allocations. Dischargers shall demonstrate achievement of allocations in the

Water Quality Control Plan for the San Francisco Bay Region

receiving water bodies (i.e., at the mouth of San Pedro Creek and at the existing San Mateo County shoreline water quality monitoring station #5 at the Pacifica State Beach).

Table 7.4.1-3 Load and Wasteload Allocations for Dischargers of Bacteria in San Pedro Creek Watershed			
Indicator Bacteria Sources			
	Sanitary Sewer Systems	Horse Facilities	Stormwater Runoff & Dry Weather Flows
Load Allocation	Not applicable	As listed in table 7.4.1-2	Not applicable
Wasteload Allocation	Zero	Not applicable	As listed in table 7.4.1-2
Compliance Point	Existing monitoring stations in receiving water bodies ¹	Existing monitoring stations in receiving water bodies ¹	Existing monitoring stations in receiving water bodies ¹
Responsible Parties	Pacifica; private home and business owners in the San Pedro Creek watershed ²	Existing and future horse facility owners/operators	Pacifica; San Mateo County; Caltrans
Applicable Permits	Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (Order No. 2006-0003-DWQ)	General Waste Discharge Requirements for Confined Animal Facilities (Order No. R2-2003-0093)	Municipal Regional Stormwater NPDES Permit (Order No. R2-2009-0074, NPDES Permit No. CAS612008) Caltrans Stormwater NPDES Permit (No. CAS000003)

1. Existing monitoring stations are located at the mouth of San Pedro Creek (i.e., "Creek Mouth" station) and at Pacifica State Beach (i.e., Station #5).
2. The private sewer lateral portion of the sanitary sewer system is the responsibility of private property owners.

7.4.1.6 Implementation Plan

The San Pedro Creek and Pacifica State Beach Bacteria TMDL implementation plan specifies actions needed to attain the TMDL and allocations. The implementation plan includes actions for which requirements are already in place, and some additional new actions. The new actions include requirements for horse facility owners and operators to obtain coverage under waste discharge requirements to ensure the clean operation of their facilities; and new requirements for stormwater management. Actions for which requirements are already in place, as of the TMDL effective date, include: 1) reduction of sanitary sewer discharges by the measures required under an existing Cease and Desist Order issued to the City of Pacifica and the general waste discharge requirements for sanitary sewer systems; and 2) a Cleanup and Abatement Order issued to one of the horse facilities in the watershed.

The required implementation actions are consistent with the following existing regulations and Orders:

Water Quality Control Plan for the San Francisco Bay Region

Water Board Orders and Discharge Prohibition

- Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (Order No. 2006-0003-DWQ)
- Statewide Construction Stormwater NPDES General Permit (Order No. 2009-0009-DWQ; NPDES Permit No. CAS000002)
- Municipal Regional Stormwater NPDES Permit (Order No. R2-2009-0074 and amendment Order No. R2-2011-0083; NPDES Permit No. CAS612008)
- General Waste Discharge Requirements for Confined Animal Facilities (Order No. R2-2003-0093)
- Basin Plan Discharge Prohibition No. 15 (Table 4.1), which states: “it shall be prohibited to discharge raw sewage or any waste failing to meet waste discharge requirements to any waters of the Basin.”

Water Board Enforcement Orders

- Cease and Desist Order for Pacifica’s Wastewater Discharges (Order No. R2-2011-0031)
- Cleanup and Abatement Order for Millwood Ranch (Order No. R2-2009-0045)

Local Regulations

- San Mateo County Confined Animal Ordinance (Section 7700)
- City of Pacifica Administrative Policy on “Standards for Keeping Animals”
- City of Pacifica Municipal Code for Animal Excreta (Section 6-1.301)
- City of Pacifica Municipal Code for Regulation of Sewer Laterals (Section 6-13.601)

Responsible Parties and Jurisdictions

Wasteload allocations for sanitary sewer systems will be implemented through the requirements and provisions of the Statewide General Waste Discharge Requirements Order for sanitary sewer systems as well as Cease and Desist Order No. R2-2011-0031 issued by the Water Board to Pacifica. Pacifica is the responsible party for implementing these requirements and provisions.

Load allocations for existing and any new horse facilities will be implemented through the requirements of the Water Board’s General Waste Discharge Requirements for Confined Animal Facilities. The owners of the three horse facilities within the San Pedro Creek watershed (i.e., Millwood Ranch, Park Pacifica Stables, and Shamrock Ranch Stables), as well as any new horse facilities within the watershed, must obtain coverage under and comply with requirements of the updated or existing General Waste Discharge Requirements for Confined Animal Facilities.

Wasteload allocations for municipal stormwater runoff and dry weather flows shall be implemented through the Municipal Regional Stormwater NPDES Permit, or a new stormwater NPDES permit, issued to Pacifica and San Mateo County. No later than six months prior to the expiration date of each NPDES permit, Pacifica and San Mateo County shall submit a plan to the Water Board that describes best management practices (BMPs) that are currently being implemented and the current level of implementation, and additional BMPs that will be implemented, and or an increased level of implementation of existing BMPs, to prevent or reduce discharges of bacteria from their storm drain systems that cause or contribute to exceedance of wasteload allocations. The plan shall include an implementation schedule to account for BMP implementation, and if necessary, trigger implementation of additional BMPs or increased level of implementation, to attain wasteload allocations.

The Water Board may establish permit requirements to implement wasteload allocations based on implementation of BMPs in lieu of numeric limits. The wasteload allocations are not designed to be

Water Quality Control Plan for the San Francisco Bay Region

implemented directly as numeric effluent limitations applicable to a discharger, Pacifica, or San Mateo County. The Water Board will not include numeric limits, based on the wasteload allocations, in NPDES permits if the discharger demonstrates that it has fully implemented technically feasible, effective, and cost efficient BMPs to control all controllable sources to and discharges from their storm drain systems.

Stormwater discharges from the California Department of Transportation's (Caltrans') stretch of Highway 1 crossing the northwestern edge of the San Pedro Creek watershed are not a significant source of indicator bacteria because that section of the highway does not include any typical bacteria-generating sources such as homeless encampments, restroom facilities, garbage bins, etc. Caltrans' existing BMPs and stormwater NPDES permit requirements, as of the effective date of the TMDL, are sufficient to attain and maintain its portion of the wasteload allocation.

Table 7.4.1-4 lists the implementation actions for each of the source categories and the phased implementation schedule. The implementation schedule allows time for the responsible parties to identify and implement measures that are necessary to control bacteria discharges resulting in exceedances of allocations.

Table 7.4.1-4 Implementation Plan Requirements and Schedule			
Source	Implementation Requirements	Responsible Party	Schedule
Sanitary Sewer Systems	Comply with Statewide General Waste Discharge Requirements for Sanitary Sewer Systems	Pacifica	Ongoing
	Comply with the Cease and Desist Order (CDO) for Pacifica's wastewater discharges.	Pacifica	As required by the CDO
	Ensure compliance with private sewer laterals ordinance	Pacifica	Ongoing
	Comply with Pacifica's private sewer laterals ordinance	Private home and business owners	Ongoing
Horse Facilities	Obtain coverage under and comply with Water Board's updated General Waste Discharge Requirements for Confined Animal Facilities, when the order is reissued (or the existing version, if an update to the order is not made within two years of the effective date of the TMDL).	Existing and future horse facility owners or operators	No later than two years after the TMDL effective date
	Comply with the Cleanup and Abatement Order (CAO) for	Millwood Ranch owners	As required by the CAO

Water Quality Control Plan for the San Francisco Bay Region

Table 7.4.1-4 Implementation Plan Requirements and Schedule			
Source	Implementation Requirements	Responsible Party	Schedule
	Millwood Ranch		
	Ensure compliance with: Pacifica’s administrative policy on “Standards for Keeping Animals” Pacifica’s municipal code on “Animal Excreta” San Mateo County’s ordinance for confined animals	Pacifica and San Mateo County	Ongoing
	Provide a report summarizing current efforts to ensure compliance with local regulations for proper management of horse waste at horse facilities	Pacifica and San Mateo County	Annually
Municipal Stormwater Runoff and Dry-Weather Flows	Submit a plan to the Water Board, acceptable to the Executive Officer, which describes BMPs being implemented and additional BMPs that will be implemented to prevent or reduce discharges of bacteria to storm drain systems to attain wasteload allocations. The plan shall include implementation methods, an implementation schedule and proposed milestones.	Pacifica and San Mateo County	As soon as possible and no later than June 2014
	Submit a bacteria water quality monitoring plan for the San Pedro Creek watershed to 1) better characterize their bacteria contributions; and 2) assess compliance with the wasteload allocations. The parties may submit plans separately, but are encouraged to collaborate on a single cooperative plan. The Plan(s) shall be acceptable to the Executive Officer.		As soon as possible and no later than June 2014

Table 7.4.1-4 Implementation Plan Requirements and Schedule			
Source	Implementation Requirements	Responsible Party	Schedule
	If wasteload allocations are not achieved by the end of a permit term, submit a plan acceptable to the executive officer, which describes additional BMPs or increased levels of existing BMPs that will be implemented to prevent or reduce discharges of bacteria to storm drain systems to attain wasteload allocations. The plan shall include implementation methods, an implementation schedule, and proposed milestones.		Not later than six months prior to permit expiration
	Provide a report on the status of the implementation activities		Annually

7.4.1.7 Water Quality Monitoring in San Pedro Creek and at Pacifica State Beach

Pacifica and San Mateo County shall, jointly or individually, develop and implement a comprehensive monitoring plan to 1) better characterize indicator bacteria contributions from their source; and 2) assess compliance with wasteload allocations. The monitoring plan shall include applicable bacteria water quality objectives and the sampling frequency shall be adequate to assess compliance with the 30-day geometric mean objectives. Responsible parties may build upon existing monitoring program(s) for San Pedro Creek and Pacifica State Beach when developing the bacteria water quality monitoring plan. At a minimum, in addition to the existing San Mateo County sampling stations at the mouth of San Pedro Creek and at Pacifica State Beach, which will be used to evaluate achievement of the designated load and wasteload allocations, at least one sampling station shall be located in each creek reach/subwatershed, such that bacteria contributions from each of the San Pedro Creek’s forks/subwatersheds are distinguished. In addition, indicator bacteria concentrations in the stormwater and dry weather discharges from the Linda Mar and Anza pump stations shall be monitored and characterized sufficient to determine their contribution to exceedances and the effects of any corrective actions. Lastly, monitoring of some of the stormwater outfalls within the watershed may be needed to characterize and identify indicator bacteria loadings from different land uses and locations and the effects of any corrective actions. Monitoring data shall be entered into the State Water Board’s “Beach Watch” database as appropriate.

7.4.1.8 Adaptive Implementation

The Water Board will adapt the TMDL and implementation plan to incorporate new and relevant scientific information such that effective and efficient measures can be taken to achieve the allocations. The Water Board staff will periodically, in coordination with the implementation schedule, at 5, 8 and 15 years, evaluate new and relevant information from implementation actions, water quality monitoring

results and the scientific literature, including any local reference system studies, U.S. EPA's revised recommended bacteria criteria, or new or revised State bacteria water quality objectives, and assess progress toward attaining TMDL targets and load allocations, and present that information to the Water Board. The Water Board will consider a Basin Plan amendment that reflects any necessary modifications to the targets or implementation plan.

7.4.2 Pescadero-Butano Watershed Sediment TMDL and Habitat Enhancement Plan

This sediment TMDL and habitat enhancement plan address the impairments to beneficial uses in Pescadero and Butano creeks. The following sections establish:

- The sediment TMDL, which identifies the allowable annual sediment load that can be discharged into the Pescadero-Butano watershed, expressed as a percentage of the natural background sediment delivery rate to channels; and
- An implementation plan to achieve the TMDL and habitat enhancement goals.

The goals of the Pescadero-Butano Watershed Sediment TMDL and Habitat Enhancement Plan are as follows:

- To restore water quality and attain beneficial uses.
- To conserve the steelhead trout population.
- To restore a self-sustaining coho salmon population.
- To improve water quality and habitat for native fish and aquatic wildlife species communities.

The TMDL and the implementation plan address the significant increases in sediment supply to channels, as well as simplification, loss, and/or reduction in the quality and quantity of instream habitat for listed populations of salmonids in the Pescadero-Butano watershed. To attain water quality objectives and restore properly functioning channels and habitat, the TMDL calls for actions throughout the watershed to substantially reduce sediment supply to channels and, where safe and feasible, reconnect the channels to their floodplains and enhance channel complexity by adding and retaining large woody debris in channels.

This TMDL focuses on the implementation actions within the channel network upstream of the Pescadero lagoon and marsh complex, located at the watershed-ocean interface, and does not address other water quality issues specific to the Pescadero lagoon and marsh complex. However, achievement of this TMDL is a necessary step to help restore water quality and beneficial uses throughout the watershed, including the lagoon and marsh.

7.4.2.1 Problem Statement

Populations of steelhead and salmon in the Pescadero-Butano watershed have declined substantially over the last century due to progressive changes in land use resulting in excess sediment in the channels and degradation of channel habitat. Land clearing, timber harvesting, legacy grazing and agricultural practices, channel modifications, and roads have: i) increased hillslope erosion; ii) doubled annual sediment supply to channels; iii) resulted in deep incision of Pescadero and Butano creeks and their tributaries; and iv) eliminated sediment storage along the channel and on the floodplains.

Pescadero and Butano creeks are impaired by excess erosion and sedimentation such that the narrative water quality objectives for sediment and settleable material are not being met, and cold freshwater

habitat, wildlife habitat, fish spawning and migration, contact and non-contact recreation, and preservation of rare and endangered species beneficial uses are impaired. In addition, the narrative water quality objective for population and community ecology is not being met due to channel incision, which is a significant sediment source and results in habitat simplification and floodplain disconnection. Channel incision and associated simplification of habitat are primary causes of the decline of coho salmon and steelhead trout populations and are controllable water quality factors.

Habitat conditions are degraded by elevated concentrations of fine sediment in the streambed (primarily sand) – caused by pervasive alteration of sediment supply, transport, and storage, which further reduces juvenile salmonid growth and survival in all freshwater life stages. Excess amounts of fine sediment have been deposited on the streambed at potential steelhead spawning and rearing sites. Excess fine sediment in the streambed can cause poor incubation for fish eggs, resulting in high mortality prior to emergence. Fine sediment has also compromised the quality of pools as rearing habitat and reduced winter rearing habitat by filling the spaces between cobbles and boulders.

Channel incision has severely impacted the basic physical habitat structure of the channel and has caused habitat simplification expressed by a substantial reduction in the frequency and area of gravel bars, riffles, and side channels. Channel incision has isolated channels from their floodplains: floodplains no longer function as sediment storage sites and are lost as excellent rearing and refuge habitats for juvenile salmon and steelhead. In addition, a substantial reduction in the amount of large woody debris in channels has greatly diminished the capacity for the creeks to store, sort, and meter sediment, as well as the quality and diversity of freshwater channel habitats. Lastly, significant and persistent increases in sediment supply and loss of floodplains have contributed to an order-of-magnitude increase in the sedimentation rate in the Pescadero lagoon and marsh, adversely impacting water quality.

7.4.2.2 Numeric Targets

The numeric targets for the TMDL to achieve the Basin Plan's water quality objectives for sediment, settleable material, and population and community ecology are listed in Table 7.4.2-1.

Table 7.4.2-1 Sediment TMDL and Habitat Targets for Pescadero and Butano Creeks and Their Tributaries

Sediment Condition Target	
Residual Pool Volume (V*) A unitless measure of the fraction of a pool's volume that is filled by fine sediment	Mean value ≤ 0.21 Maximum value ≤ 0.45
Substrate Composition	$\leq 14\%$ fines < 0.85 millimeter (mm), i.e., percent fines less than 0.85 mm in diameter is less than or equal to 14% of the total bulk core sample $\leq 30\%$ fines < 6.40 mm
Habitat Condition Target	
Large Woody Debris (LWD) loading in Redwood Channels	≥ 300 cubic meters per hectare of bankfull channel area (m ³ /ha)
LWD loading in Hardwood Channels	≥ 100 m ³ /ha
Redwood channels are defined as those where the adjacent valley floor and/or hillslopes are vegetated primarily by coast redwood forest. Hardwood channels are defined as those where the adjacent valley flat is vegetated by a hardwood forest (typically some combination of willow species, white alder, California bay laurel, bigleaf maple, tan oak, and/or Oregon ash). The large woody debris loading targets apply to channel reaches that provide actual or potential spawning habitat for anadromous salmonids as defined above.	

7.4.2.3 Sediment Sources

Field inventories and sediment modeling conducted throughout the Pescadero-Butano watershed provide credible estimates of the average rate of sediment delivery to channels between 1970 and 2010. Based on this work (Table 7.4.2-2), the Water Board concludes:

1. Sediment delivery to fish-bearing channels has doubled in the last 150 years as compared to the natural background rate. More than half of the fine sediment delivered to Pescadero and Butano creeks and their tributaries is associated with land use activities, including roads, human-caused channel incision, and legacy effects of intensive historical livestock grazing and timber harvesting.
2. The average annual rate of sediment supply to channels in the watershed is 1,200 tons per km² per year.
3. More than 40,000 tons of sediment that historically deposited annually on floodplains and alluvial valley (one third of the total sediment delivered from the watershed) is now transported downstream to the Pescadero lagoon and marsh complex due to channel incision. Therefore, not only has this significant storage function along the floodplains and alluvial valley been lost, but the valley itself is now a significant sediment source.
4. Contributions of sediment from municipal and construction stormwater runoff are small in comparison to other sources and are estimated to be about 500 tons per year.

Water Quality Control Plan for the San Francisco Bay Region

Table 7.4.2-2 Mean Annual Sediment Delivery to the Pescadero-Butano Watershed (tons/year)

Sediment Source Category	Natural Background Annual Delivery Rate (tons/year)	Current Mean Annual Delivery Rate (tons/year)
Sediment Sources		
▪ Natural Processes:	120,000	120,000
▪ Human Actions:		
• Roads		51,000
• Channel incision		30,000
• Gullying on grasslands		24,000
• Landslides and debris flows		23,000
• Surface erosion on grasslands		4,500
Total from Human Actions		132,500
TOTAL		252,500

7.4.2.4 Total Maximum Daily Load and Allocations

The Pescadero-Butano watershed sediment TMDL is 150,000 tons per year, or 125 percent of the estimated natural background load and applies to Pescadero and Butano creeks and their tributaries. In order to achieve the TMDL, controllable sediment delivery resulting from human actions needs to be reduced by approximately 78 percent (Table 7.4.2-3).

Attainment of the TMDL will be evaluated immediately downstream of the confluence of Pescadero and Butano creeks at the upstream boundary of the Pescadero marsh and lagoon complex. Attainment of the TMDL will be evaluated using a 10-year averaging period.

Table 7.4.2-3 Load Allocations

Source Category	Current Load	Estimated Percentage Reductions Needed	Load Allocations	
	tons/year	Percent	tons/year	Percent of Natural Background
▪ Natural processes	120,000	0	120,000	100
▪ Human actions:				
- Roads*	51,000	78	11,500	9.5
- Channel incision	30,000	78	6,600	5.5
- Gullies	24,000	78	5,300	4.4
- Landslides	23,000	78	5,100	4.2
- Surface erosion grasslands	4,500	78	1,000	0.8
TOTAL	252,500		149,500	124.4

*Approximately 15% of the allowable load for roads is allocated to San Mateo County

Table 7.4.2-4 Wasteload Allocations for Stormwater Runoff

Source Category	Current Load	Percent Reductions Needed	Wasteload Allocations	
	tons/year		tons/year	Percent of Natural Background
▪ San Mateo County Municipal Stormwater NPDES Permit No. CAS612008	300	0	300	0.3
▪ Construction Stormwater NPDES Permit No. CAS000002	150	0	150	0.3
▪ CalTrans Stormwater NPDES Permit No. CAS000003	<50	0	50	0
TOTAL	500	0	500	0.6

7.4.2.5 Implementation Plan

The actions described below are necessary to achieve TMDL targets, allocations, performance standards, and habitat enhancement goals within twenty years of the effective date of the Basin Plan amendment.

Stormwater Runoff

Stormwater runoff from State highways and municipal and construction stormwater runoff are the only known point sources of sediment to the Pescadero-Butano watershed and have small wasteload allocations (Table 7.4.2-4) relative to nonpoint sources of sediment. These sources are regulated under existing NPDES permits that include requirements to control erosion, sedimentation, and hydromodification from new development and requirements to maintain rural roads. Table 7.4.2-5 shows implementation measures required for these sources. Implementation to address reductions in loading for sediment discharges associated with roads under the jurisdiction of San Mateo County are included here.

Table 7.4.2-5 TMDL Implementation Measures for Sediment Discharges Associated with Stormwater Runoff and Roads

Source Category	Actions	Implementing Parties
<i>Stormwater Runoff</i> CalTrans, Construction	Comply with applicable NPDES permits	CalTrans Owners or operators of construction projects > 1 acre
<i>Stormwater Runoff and Roads</i> Municipal	Comply with applicable NPDES permits	San Mateo County

Nonpoint Sources

The State’s 2004 Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program provides for regulation of nonpoint source discharges using the Water Board’s administrative permitting authorities, including WDRs, waiver of WDRs, Basin Plan Discharge Prohibitions, or some combination of these. Consistent with this policy, Tables 7.4.2-6 through 7.4.2-11 specify actions and performance standards by nonpoint source category, as needed to achieve TMDL targets and allocations in the Pescadero-Butano watershed. The Water Board will consider adopting permits that apply to the nonpoint sources from roads, grazing lands, non-grazing agricultural lands, and/or timberlands listed in Tables 7.4.2-6 through 7.4.2-10. Individual landowners or coalitions may work with “third parties,” such as the San Mateo Resource Conservation District, to develop and implement sediment pollutant control programs.

Habitat Enhancement

Channel incision, loss of sediment storage function, and loss of essential habitat features are the result of multiple historical and ongoing disturbances. This implementation plan calls for habitat enhancement actions. A channel and habitat restoration program that increases woody debris and re-establishes width-to-depth ratios and a modest flood plain will be the most effective means of controlling channel incision and reducing related sediment delivery to the creeks. Floodplains and large woody debris jams would provide essential high-quality rearing habitats and enhance food production for coho salmon and steelhead. These features also help create pools, reduce scouring, store sediment, and diversify habitat types within the stream. The habitat enhancement program, presented in Table 7.4.2-11, will therefore focus on actions to: (1) to the extent safe and feasible, substantially increase the amount of large woody debris in channels that run through public lands and timber harvest lands; and (2) study safe and feasible opportunities for floodplain restoration in channel reaches on private lands. The effectiveness of

implementation of actions specified in Table 7.4.2-11 to enhance habitat will be evaluated as part of the adaptive implementation program.

7.4.2.6 Agricultural Water Quality Program Costs

The implementation measures in Tables 7.4.2-6 and 7.4.2-7 for grazing and agricultural land constitute an agricultural water quality control program and therefore, consistent with Water Code section 13141, the cost of this program is estimated herein. This cost estimate includes the cost of implementing all road-related and surface erosion-related sediment control measures specified in the implementation plan and is based on costs associated with technical assistance, project design, and implementation of actions needed to achieve the TMDL.

There are no other costs to farmers or ranchers associated with actions to enhance channel habitat complexity and floodplain connection, because participation by private landowners is voluntary, and almost all of the costs of these projects are expected to be paid for from grants by public agencies and/or non-profits. In estimating costs, the Water Board estimated that owners of grazing and non-grazing agricultural businesses own up to 20 percent of the total land area. The Water Board estimates that the total cost to agricultural businesses associated with efforts to reduce sediment supply to Pescadero and Butano creeks watershed is \$200,000 to \$300,000 per year.

7.4.2.7 Evaluation and Monitoring

Water Board staff, working in partnership with other entities, e.g., San Mateo County and the San Mateo County Resource Conservation District, will conduct baseline monitoring to document existing residual pool volumes (V^*), substrate composition, and woody debris loadings along representative reaches. In addition to baseline conditions monitoring, the following monitoring is necessary:

- 1) Implementation monitoring to document actions taken on individual properties to reduce fine sediment discharge and enhance habitat complexity and connectivity;
- 2) Upslope effectiveness monitoring to evaluate effectiveness of sediment control actions in reducing rates of sediment delivery to channels on a subwatershed basis; and
- 3) In-channel effectiveness monitoring (e.g., pool filling and substrate composition) to evaluate channel response to management actions and natural processes.

Implementation monitoring will be conducted by landowners or designated agents to document that sediment control actions, i.e., best management practices as specified herein, occur.

The Water Board anticipates working in partnership with the implementing parties to conduct upslope effectiveness monitoring to reevaluate rates of sediment delivered to channels from land use activities and natural processes.

In-channel effectiveness monitoring should be conducted by the Water Board and local partners with scientific expertise and demonstrated capability in working effectively with private property owners (to gain permissions for access), as needed to develop a representative sample of stream habitat conditions, in relation to sediment supply and transport within the watershed. In-channel effectiveness monitoring is needed to evaluate: a) progress toward achieving water quality targets, and b) channel response to

management measures and natural processes. The main parameters that will be monitored to assess progress toward achieving water quality targets are residual pool volume and substrate composition.

The Water Board, working in partnership with other entities, such as the San Mateo County Resource Conservation District and other organizations with scientific expertise, will assess large woody debris loading in channels to evaluate attainment of the numeric targets for large woody debris loading and to guide development of reach-specific prescriptions for installation of engineered log jams and riparian management actions to attain the target values in future years through natural recruitment.

Desired measurement frequency for pool filling, substrate composition, and large woody debris is once every five years.

7.4.2.8 Adaptive Implementation

Adaptive implementation entails taking actions commensurate with existing, available information, reviewing new information as it becomes available, and modifying actions as necessary based on the new information. Water Board staff will evaluate and report to the Water Board on the progress of implementation of the TMDL and habitat enhancement actions periodically and will evaluate the need for amending the TMDL within 10 years of the effective date of the TMDL.

Key questions to be considered in the course of adaptive implementation:

- What is the population status of steelhead and coho salmon in the watershed? Do numbers of steelhead and coho salmon increase as sediment reduction and habitat enhancement measures are implemented? An improved understanding of the status of steelhead and salmon populations in the Pescadero-Butano watershed is essential for guiding adaptive updates to the management actions recognized in this plan.
- Are Pescadero and Butano creeks and their tributaries progressing toward TMDL targets and performance standards as expected? If there is a lack of adequate progress, how might the implementation actions, targets, performance standards, or allocations be modified?
- Are the specified sediment reduction measures and recommended habitat enhancement measures resulting in an improving trend in channel habitat quantity and quality?
- Are there new data or information available that warrant revision of water quality targets, allocations, or implementation measures?

Table 7.4.2-6 Required TMDL Implementation Measures for Sediment Discharges Associated with Non-Grazing Agricultural Lands of 5 Acres or Greater

Land Use	Performance Standards	Actions	Implementing Parties	Completion Dates
<p>NON-GRAZING AGRICULTURAL LANDS</p>	<p>Roads: Design, construct, and maintain roads to i) reduce road-related sediment delivery to channels to ≤ 500 cubic yards per mile per 20-year period; and ii) limit the length of roads that are hydrologically connected to 25 percent of total road length; and iii) ensure culvert inlets have low plug potential; and iv) install critical dips at culverted crossings that have a diversion potential; and</p> <p>Stream corridors: Protect streambanks, wetlands, and riparian areas from degradation through vegetated buffers; and</p> <p>Gullies and/or shallow landslides: Manage non-grazing agricultural practices to allow for natural recovery of gullies and/or landslides, prevent human-caused increases in sediment delivery from unstable areas, and decrease connectivity of gullies to stream channels; and</p> <p>Effectively attenuate significant increases in storm runoff, so that the runoff from non-grazing agricultural lands shall not cause or contribute to downstream increases in rates of bank or bed erosion.</p>	<p style="text-align: center;">PLANNING AND PRIORITIZING</p> <p>Inventory and assess natural resources, agricultural lands, and management practices that may deliver sediment to streams. Evaluate stream and riparian corridors for opportunities for improving habitat. Develop and submit a report acceptable to the Executive Officer that includes a prioritized list and schedule of actions.</p> <p style="text-align: center;">EITHER</p> <p>Submit a Report of Waste Discharge (ROWD) to the Water Board that provides, at a minimum, the following: a description of the land; identification of site-specific erosion control measures needed to achieve performance standard(s) specified in this table; and a schedule for implementation of identified erosion control measures.</p> <p style="text-align: center;">OR</p> <p>Comply with applicable Waste Discharge Requirements (WDRs) or waiver of WDRs. Develop and begin implementing an erosion control plan that would be approved as part of WDRs or waiver of WDRs.</p>	<p>Non-grazing agricultural land owner and/or operator of properties ≥5 acres</p>	<p>3 years from effective date of this Basin Plan amendment</p> <p>5 years from effective date of this Basin Plan amendment</p> <p>As specified in applicable WDRs or waiver of WDRs</p>

Table 7.4.2-7 Required TMDL Implementation Measures for Sediment Discharges Associated with Grazing Lands of 50 Acres or Greater

Land Use	Performance Standards	Actions	Implementing Parties	Completion Dates
<p>GRAZING LANDS</p>	<p>Surface erosion associated with livestock grazing: Attain or exceed minimal residual dry matter (RDM) values consistent with University of California Division of Agriculture and Natural Resources Guidelines¹; and</p> <p>Stream corridors: Protect streambanks, wetlands, and riparian areas from degradation through grazing management, livestock access controls, and vegetated buffers; and</p> <p>Roads: Design, construct, and maintain roads to i) reduce road-related sediment delivery to channels to ≤ 500 cubic yards per mile per 20-year period; and ii) limit the length of roads that are hydrologically connected to 25 percent of total road length; and iii) ensure culvert inlets have low plug potential; and iv) install critical dips at culverted crossings that have a diversion potential; and</p> <p>Gullies and/or shallow landslides: Manage grazing practices to allow for natural recovery of gullies and/or landslides, prevent human-caused increases in sediment delivery from unstable areas, and decrease connectivity of gullies to stream channels.</p>	<p style="text-align: center;">PLANNING AND PRIORITIZING</p> <p>Inventory and assess natural resources, agricultural practices, and management practices that may deliver sediment to streams. Evaluate stream and riparian corridors and water bodies for opportunities for improving habitat. Develop and submit a report acceptable to the Executive Officer that includes a prioritized list and schedule of actions for farm owner(s).</p> <p style="text-align: center;">EITHER</p> <p>Submit a ROWD to the Water Board that provides, at a minimum, the following: description of the property/ranch and road network; identification of site-specific erosion control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified erosion control measures.</p> <p style="text-align: center;">OR</p> <p>Comply with applicable Waste Discharge Requirements (WDRs) or waiver of WDRs. Develop and begin implementing Grazing Management plan that would be approved as part of WDRs or waiver of WDRs.</p>	<p style="text-align: center;">Landowner and/or ranch operator of properties ≥50 acres</p>	<p style="text-align: center;">3 years from effective date of this Basin Plan amendment</p> <p style="text-align: center;">5 years from effective date of this Basin Plan amendment</p> <p style="text-align: center;">As specified in applicable WDRs or waiver of WDRs</p>
<p>¹University of California 2002, California guidelines for residual dry matter (RDM) management on coastal and foothill annual rangelands. Rangeland Monitoring Series Publication 8092.</p>				

Table 7.4.2-8 Required TMDL Implementation Measures for Sediment Discharges associated with San Mateo County

Landowner Type	Performance Standards	Actions	Implementing Parties	Completion Dates
SAN MATEO COUNTY	<p>Roads: Design, construct, and maintain roads to i) reduce road-related sediment delivery to channels to ≤ 500 cubic yards per mile per 20-year period; and ii) limit the length of roads that are hydrologically connected to 25 percent of total road length; and iii) ensure culvert inlets have low plug potential; and iv) install critical dips at culverted crossings that have a diversion potential; and</p> <p>Gullies and/or shallow landslides: Promote natural recovery and minimize human-caused increases in sediment delivery from unstable areas. Manage existing roads and other infrastructure to prevent additional erosion of legacy sediment delivery sites and/or delivery from potentially unstable areas.</p>	<p style="text-align: center;">PLANNING AND PRIORITIZING</p> <p>Comply with NPDES Permit No. CAS612008 (also referred to as the Municipal Regional Stormwater Permit).</p> <p style="text-align: center;">AND</p> <p>Create an inventory of roads that may contribute to sediment delivery to streams and develop a prioritized list and schedule of actions.</p> <p>Where performance standards are not achieved or where road-related sediment sources are not covered by NPDES Permit No. CAS612008, do one of the following:</p> <p style="text-align: center;">EITHER</p> <p>Submit a Report of Waste Discharge to the Water Board that provides, at a minimum, the following: description of the road network and/or segments; identification of erosion and sediment control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified control measures. For paved roads, erosion and sediment control actions could primarily focus on road crossings to meet the performance standard.</p> <p style="text-align: center;">OR</p> <p>Comply with applicable Waste Discharge Requirements (WDRs) or waiver of WDRs.</p>	San Mateo County	<p style="text-align: center;">3 years from effective date of this Basin Plan amendment</p> <p style="text-align: center;">5 years from effective date of this Basin Plan amendment</p> <p style="text-align: center;">As specified in applicable WDRs or waiver of WDRs</p>

Table 7.4.2-9 Required TMDL Implementation Measures for Sediment Discharges associated with Parks and Open Space Lands

Landowner Type	Performance Standards	Actions	Implementing Parties	Completion Dates
PARKS/OPEN SPACE LANDS	<p>Roads: Design, construct, and maintain roads to i) reduce road-related sediment delivery to channels to ≤ 500 cubic yards per mile per 20-year period; and ii) limit the length of roads that are hydrologically connected to 25 percent of total road length; and iii) ensure culvert inlets have low plug potential; and iv) install critical dips at culverted crossings that have a diversion potential; and</p> <p>Gullies and/or shallow landslides: Promote natural recovery and minimize human-caused increases in sediment delivery from unstable areas. Manage existing roads and other infrastructure to prevent additional erosion of legacy sediment delivery sites and/or delivery from potentially unstable areas.</p>	<p style="text-align: center;">PLANNING AND PRIORITIZING</p> <p>Adopt and implement best management practices for maintenance of unpaved (dirt/gravel) roads, conduct a survey of stream-crossings associated with unpaved public roadways, and develop a prioritized implementation plan and schedule for repair and/or replacement of high priority crossings/culverts to reduce road-related erosion and protect stream-riparian habitat conditions.</p> <p style="text-align: center;">EITHER</p> <p>Submit a Report of Waste Discharge to the Water Board that provides, at a minimum, the following: description of the road network and/or segments; identification of erosion and sediment control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified control measures. For paved roads, erosion and sediment control actions could primarily focus on road crossings to meet the performance standard.</p> <p style="text-align: center;">OR</p> <p>Comply with applicable Waste Discharge Requirements (WDRs) or waiver of WDRs.</p>	<p>State of California, Department of Parks and Recreation</p> <p>MidPeninsula Open Space District</p> <p>Peninsula Open Space Trust</p>	<p>3 years from effective date of this Basin Plan amendment</p> <p>5 years from effective date of this Basin Plan amendment</p> <p>As specified in in applicable WDRs or waiver of WDRs</p>

Table 7.4.2-10 Required TMDL Implementation Measures for Sediment Discharges Associated with Timber Lands of 100 acres or Greater

Land Use	Performance Standards	Actions	Implementing Parties	Completion Dates
<p>TIMBER LANDS</p>	<p>Roads: Design, construct, and maintain roads to i) reduce road-related sediment delivery to channels to ≤ 500 cubic yards per mile per 20-year period; and ii) limit the length of roads that are hydrologically connected to 25 percent of total road length; and iii) ensure culvert inlets have low plug potential; and iv) install critical dips at culverted crossings that have a diversion potential; and</p> <p>Gullies, shallow landslides, and/or unstable areas: Manage operations (e.g., tree removal (felling), hauling of trees, road construction, heavy equipment use) to prevent additional erosion of legacy sediment delivery sites, and/or delivery from other potentially unstable areas, and to decrease connectivity of gullies to stream channels.</p>	<p>Comply with California Forest Practice Rules, Anadromous Salmonid Protection Rules, and Road Rules or other requirements to control sediment sources from timber harvest operations that are provided by the Water Board.</p> <p style="text-align: center;">PLANNING AND PRIORITIZING</p> <p>Inventory and assess natural resources and management practices that may contribute to sediment delivery to streams. Evaluate stream and riparian corridors and water bodies for opportunities to improve habitat. Develop and submit a report acceptable to the Executive Officer that includes a prioritized list and schedule of actions for timberland owner(s).</p> <p style="text-align: center;">EITHER</p> <p>Submit a Report of Waste Discharge to the Water Board that provides, at a minimum, the following: description of the property road network; identification of site-specific erosion control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified erosion control measures.</p> <p style="text-align: center;">OR</p> <p>Comply with other applicable Waste Discharge Requirements (WDRs) or waiver of WDRs.</p>	<p>Landowner and/or timber lands operator of properties ≥100 acres</p>	<p>Ongoing</p> <p>3 years from effective date of this Basin Plan amendment</p> <p>5 years from effective date of this Basin Plan amendment</p> <p>As specified in applicable WDRs or waiver of WDRs</p>

Table 7.4.2-11 Recommended Actions to Reduce Sediment Load and Enhance Habitat Complexity in Pescadero and Butano Creeks and Their Tributaries

Stressor	Management Objective(s)	Actions	Implementing Parties	Completion Dates
<p>Habitat degradation as a result of incision along Pescadero and Butano creeks and their tributaries.</p>	<p>Reduce rates of sediment delivery (associated with incision) to channels, by 78 percent.</p> <p>Increase sediment storage in the channels and on the floodplains.</p> <p>Enhance channel habitat complexity and connectivity as needed to support self-sustaining run of steelhead and coho salmon and enhance the overall health of the native fish community.</p>	<p>Develop detailed technical studies to characterize reach-specific opportunities and priorities for floodplain restoration.</p> <p>Develop and implement plans to enhance stream-riparian habitat conditions and channel complexity.</p> <p>Comply with conditions of Clean Water Act section 401 certifications in the implementation of projects to increase channel-floodplain connectivity</p>	<p>State and local government agencies, landowners and/or designated agents, and reach-based stewardships</p>	<p>Technical studies to characterize reach specific opportunities and priorities for floodplain restoration will be completed within 5 years of Basin Plan amendment.</p>
<p>Habitat degradation as a result of reduction in large woody debris in stream channels.</p>	<p>Enhance quality of rearing habitat for juvenile salmonids.</p>	<p>Develop and implement plans to enhance large woody debris loading and restore natural rates of recruitment to channels, as needed to achieve numeric targets for large woody debris loading. This plan will include a survey to quantify baseline values for large woody debris loading.</p> <p>Comply with conditions of Clean Water Act section 401 certifications in the implementation of projects for large woody debris loading and recruitment.</p>	<p>State and local government agencies, landowners and/or designated agents, and reach-based stewardships</p>	<p>Targets for large woody debris loading will be achieved within 10 years of Basin Plan amendment adoption.</p>

7.5 WATER QUALITY ATTAINMENT STRATEGIES AND TMDLS FOR THE CENTRAL BASIN (SEE [FIGURE 2-5](#))

7.5.1 Richardson Bay Pathogens Total Maximum Daily Load (TMDL)

The following sections establish the TMDL for pathogens in Richardson Bay. The numeric targets, load allocations, and implementation plan are designed to support and protect the Bay’s designated beneficial uses, water contact recreation and shellfish harvesting. The TMDL includes actions for adaptive implementation to evaluate the effectiveness of implementation actions, monitor progress toward targets, and review the scientific understanding pertaining to pathogens, which may result in modifying the TMDL in the future.

7.5.1.1 Problem Statement

Richardson Bay is impaired by pathogens. Monitoring results indicate that the Bay exceeds bacteria water quality objectives for shellfish harvesting (e.g., clam, mussel, and oyster harvesting), and water contact recreation (swimming, fishing); Table 3-1). The presence of pathogens is inferred from high concentrations of fecal coliform bacteria, a commonly used indicator of human pathogenic organisms. Therefore, the beneficial uses of shellfish harvesting and recreational water contact are not fully supported.

7.5.1.2 Sources

Pathogen sources are identified based on elevated coliform bacteria (pathogen indicator) levels downstream or in the vicinity of identified land uses or facilities and from documentation of inadequately treated human waste discharges. If not properly managed, the following source categories have the potential to discharge pathogens to Richardson Bay: sanitary sewer systems, stormwater runoff, houseboats, and vessels.

- High coliform levels detected downstream of storm drains, and the increase in the number of wet season exceedances as compared to the number of dry season exceedances, point to stormwater runoff as a potential pathogen source.
- Documentation of sanitary sewer overflows in Richardson Bay area municipalities suggests that sanitary sewer systems are a potential source of pathogens to the Bay.
- Consistently high coliform levels in houseboat and vessel marinas indicate that houseboat and vessel marinas’ failing sewage collection systems are potential sources of pathogens.

Bacteria levels are low at monitoring sites that contain wildlife but are minimally impacted by human activities. This suggests that wildlife may not be a significant, widespread potential source of pathogens in Richardson Bay. Wildlife may be a significant source on an intermittent, localized basis.

7.5.1.3 Numeric Targets

The numeric targets (desired future long-term conditions) proposed for pathogen indicators in Richardson Bay are presented in Table 7.5.1-1.

Table 7.5.1-1. Numeric Targets for Richardson Bay ^a	
Beneficial Use	Numeric Target

Water Quality Control Plan for the San Francisco Bay Region

Shellfish Harvesting	Median fecal coliform density ^b < 14 (MPN ^c /100 mL) 90th percentile fecal coliform density < 43 (MPN/100 mL)
Water Contact Recreation	Geometric mean fecal coliform density < 200 90th percentile fecal coliform density < 400 Geometric mean Enterococci density < 35 CFU ^d /100 mL 90th percentile Enterococci density < 104 CFU/100 mL
<p>a. Based on a minimum of five consecutive samples equally spaced over a 30-day period</p> <p>b. “Density” refers to the number of bacteria in a given volume of water (U.S. EPA, 1986, 2002, 2003). The term is analogous to “concentration,” which refers to the mass of chemical pollutant in a given volume of water. “Bacterial density” and “bacterial concentration” are sometimes used interchangeably.</p> <p>c. Most Probable Number (MPN) is a statistical representation of the standard coliform test results.</p> <p>d. CFU stands for colony forming unit (e.g., as in number of bacterial colonies)</p>	

The bacterial density targets are based on the Basin Plan’s shellfish harvesting and water contact recreation water quality objectives for fecal coliform and on U.S. EPA’s recommended Enterococci criteria for water contact recreation in salt water.

7.5.1.4 Total Maximum Daily Load

Table 7.5.1-2 shows Richardson Bay’s density-based pathogens TMDL, expressed as fecal coliform bacteria concentrations.

Table 7.5.1-2. Total maximum daily load for pathogen indicators (fecal coliforms) for Richardson Bay	
Indicator Parameter	TMDL
Fecal coliform	Median ^a < 14 MPN/100 mL 90th Percentile ^b < 43 MPN/100 mL
<p>a. Based on a minimum five consecutive samples equally spaced over a 30-day period.</p> <p>b. No more than 10% of total samples during any 30-day period may exceed this number.</p>	

7.5.1.5 Load Allocations

Density-based fecal coliform allocations for each potential pathogen source category in Richardson Bay are presented in Table 7.5.1-3. Each discharger in the Richardson Bay watershed is responsible for meeting its source category allocation. All potential dischargers are also responsible for complying with applicable waste discharge requirements, or waste discharge prohibitions (Table 4-1, Prohibitions 5, 15, and 18).

All discharges of raw or inadequately treated human waste, including sewage from vessels, are prohibited. All sources of untreated or inadequately treated human waste have an allocation of zero.

Table 7.5.1-3 Density-Based Pollutant Wasteload and Load Allocations^a for Richardson Bay		
Categorical Pollutant Source	Wasteload and Load Allocations Fecal Coliform (MPN/100 mL)	
	For Direct Discharges to the Bay	
	Median ^b	90 th Percentile ^c
Stormwater Runoff ^d	<14	< 43
Wildlife ^e	<14	< 43
Sanitary Sewer Systems	0	0
Houseboats	0	0
Vessels (Recreational, Live-aboard, Anchor-out Boats)	0	0
^{a.} These allocations are applicable year-round. ^{b.} Based on a minimum of five consecutive samples equally spaced over a 30-day period. ^{c.} No more than 10% of total samples during any 30-day period may exceed this number. ^{d.} Wasteload allocation for discharges from municipal separate storm sewer systems (NPDES Permit Nos. CAS000004 and CAS000003). ^{e.} Wildlife is not believed to be a readily controllable source of pathogens; therefore, no management measures are required.		

7.5.1.6 Implementation Plan

The Richardson Bay Pathogens TMDL Implementation Plan builds upon previous and ongoing successful efforts to reduce potential pathogen loads in Richardson Bay and its tributaries. The plan requires actions consistent with the California Water Code (CWC 13000 et seq.), the state’s Nonpoint Source Pollution Control Program Plan (CWC Section 13369), the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program, and human waste discharge prohibitions (Table 4-1, Prohibitions 5, 15, and 18).

Table 7.5.1-4 lists the required implementation measures for the source categories listed in Table 7.5.1-3. These measures include evaluation of operating practices, identification of comprehensive, site-specific pathogens control measures and an associated implementation schedule, and submittal of progress reports to the Water Board documenting actions taken.

Table 7.5.1-4 Trackable implementation measures for the Richardson Bay pathogens TMDL

Source Category	Implementing Party	Action	Completion Dates
Sanitary Sewer Systems	Marin County Sanitary District No. 5, Sewerage Agency of Southern Marin, Tamalpais Community Services District, City of Mill Valley, Homestead Valley Sanitary District, Alto Sanitary District, Almonte Sanitary District, City of Sausalito, Sausalito Marin City Sanitary District, Richardson Bay Sanitary District	1. Comply with the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems.	As specified in applicable WDR permit
Stormwater Runoff	Marin County, City of Sausalito, City of Mill Valley, City of Tiburon, City of Belvedere, Caltrans	1. Implement applicable stormwater management plan.	As specified in approved stormwater management plan and in applicable NPDES permit
		2. Update/amend applicable stormwater management plans, as appropriate, to include specific measures to reduce pathogen loading, including additional education and outreach efforts, and installation of additional pet waste receptacles.	
		3. Report progress on implementation of pathogen reduction measures to Water Board.	

Table 7.5.1-4 Trackable implementation measures for the Richardson Bay pathogens TMDL			
Source Category	Implementing Party	Action	Completion Dates
Houseboats	RBRA; Marin County; local cities	1. Submit to the Executive Officer for approval a plan and schedule for 1) evaluating adequacy and performance of sewage collection systems (onboard sewage systems, pumps, sewer lines, etc.) for all houseboats in Richardson Bay, 2) biennial evaluation of sewage collection system operation and maintenance for all houseboats once they have been repaired/upgraded such that they do not discharge any sewage into the Bay.	July 2009
		2. Conduct evaluation per submitted plan.	July 2010
		3. Report progress on implementation of the plan to Water Board.	Annually
	Houseboat marina owners	1. Submit to the Executive Officer for approval a plan and schedule for 1) repairing/upgrading identified substandard/malfunctioning sewage collection systems (onboard sewage systems, pumps, sewer lines, etc.) such that they do not discharge any sewage into the Bay, 2) long-term operation and maintenance of the systems.	July 2011
		2. Report progress on implementation of the plan to Water Board.	Annually
	Houseboat owners, houseboat marina owners	1. Repair/Upgrade identified substandard/malfunctioning sewage collection systems (onboard sewage systems, pumps, sewer lines, etc.) such that they do not discharge any sewage into the Bay.	July 2013
		2. Operate and maintain sewage collection systems such that they do not discharge any sewage into the Bay.	Ongoing

Water Quality Control Plan for the San Francisco Bay Region

Source Category	Implementing Party	Action	Completion Dates
Vessels	RBRA; Marin County; local cities	1. Submit to the Executive Officer for approval a plan and implementation schedule for 1) evaluating adequacy and performance of sewage collection systems (sewage dump stations, sewage pumpout stations, onboard sewage systems, sewer lines, etc.) for all vessel marinas and vessels with toilet facilities in Richardson Bay, 2) biennial evaluation of sewage collection system operation and maintenance for all vessel marinas and vessels once they have been repaired/upgraded such that they do not discharge any sewage into the Bay.	July 2009
		2. Conduct evaluation per submitted plan.	July 2010
		3. Report progress on implementation of the plan to Water Board.	Annually
	Vessel marina owners	1. Submit to the Executive Officer for approval a plan and schedule for 1) installing, as needed, an adequate number of sewage pumpout and dump stations. If no new sewage pumpout and dump stations are needed, provide an explanation as why they are not needed, 2) repairing/upgrading identified leaky/malfunctioning sewage collection systems (sewage dump stations, sewage pumpout stations, onboard sewage systems, sewer lines, etc.) such that they do not discharge any sewage into the Bay, 3) long-term operation and maintenance of the systems such that they do not discharge any sewage into the Bay.	July 2011
		2. Report progress on implementation of the plan to Water Board.	Annually
	Vessel owners, vessel marina owners	1. Repair/upgrade identified leaky/malfunctioning sewage collection systems (sewage dump stations, sewage pumpout stations, onboard sewage systems, sewer lines, etc.) such that they do not discharge any sewage into the Bay.	July 2013
		2. Operate and maintain sewage collection systems such that they do not discharge any sewage into the Bay.	Ongoing
		3. Enroll in RBRA's mobile sewage collection and disposal service for all live-aboards (both anchor-outs and marina-berthed vessels).	July 2010

Regulatory Framework

The state’s Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program requires that current and proposed nonpoint source discharges be regulated under waste discharge requirements, waivers of waste discharge requirements, Basin Plan discharge prohibitions, or some combination of these tools. Municipal and highway stormwater runoffs are regulated under NPDES permits. Table 7.5.1-5 describes the regulatory mechanism by which dischargers in each source category will be regulated.

Table 7.5.1-5. Regulatory Framework	
Source Category	Regulatory Tool
Sanitary Sewer Systems	General WDR permit
Stormwater Runoff	NPDES permit
Houseboats	Existing prohibition of human waste discharge (Table 4-1, Prohibitions 5 and 15)
Vessels	Existing prohibition of human waste discharge (Table 4-1, Prohibitions 5, 15, and 18)

Ongoing Water Quality Monitoring in Richardson Bay

Water quality monitoring will be conducted to assess water quality improvements and obtain additional information for further refinement of the TMDL. The main objectives of the ongoing monitoring program are to:

- Assess attainment of TMDL targets
- Evaluate spatial and temporal water quality trends in the Bay
- Obtain additional information about significant potential pathogen source areas
- Collect sufficient data to prioritize implementation efforts and assess the effectiveness of source control actions

All water quality monitoring (including Quality Assurance and Quality Control procedures) will be performed pursuant to the State Water Board’s Quality Assurance Management Plan for the Surface Water Ambient Monitoring Program.

Adaptive Implementation

In 2013, the Water Board will evaluate monitoring results and assess progress toward attaining TMDL targets (Table 7.5.1-1) and load allocations (Table 7.5.1-3). The Water Board will also evaluate compliance with the trackable implementation measures specified in Table 7.5.1-4, as documented by submitted progress reports.

If evaluation and monitoring show that source control actions have been fully implemented throughout the watershed, but the TMDL targets (water quality objectives) are not attained, the Water Board may re-evaluate the attainability/applicability of designated water quality objectives.

The Water Board will review the Richardson Bay Pathogens TMDL and evaluate new and relevant information from monitoring, special studies, and scientific literature. At a minimum, these reviews will aim to find answers to the following questions. Additional questions may be developed in collaboration with stakeholders.

1. Is Richardson Bay progressing toward TMDL targets? If progress is unclear, how can monitoring efforts be modified to detect trends? If there has not been adequate progress, how might the implementation actions be modified?
1. What are the pollutant contributions for the various source categories? How have these contributions changed over time? How do they vary seasonally? How might source control measures be modified to improve load reduction? If the answers to these questions are not clear, how can monitoring efforts be modified to answer these questions?
2. Is there new, reliable, and widely accepted scientific information that suggests modifications to targets, or implementation actions? If so, how should the TMDL be modified?

Modifications to the targets or implementation plan will be incorporated into the Basin Plan via an amendment process.

7.6 WATER QUALITY ATTAINMENT STRATEGIES AND TMDLS FOR THE SOUTH BAY BASIN (SEE [FIGURE 2-6](#))

This section intentionally left blank.

7.7 WATER QUALITY ATTAINMENT STRATEGIES AND TMDLS FOR THE SANTA CLARA BASIN (SEE [FIGURE 2-7](#))

7.7.1 Total Maximum Daily Loads for Mercury in Waters of the Guadalupe River Watershed

The following sections establish TMDLs for mercury in impaired waters of the Guadalupe River watershed. These TMDLs and associated allocations implement the mercury water quality objectives in waters of the Guadalupe River watershed listed in Table 3-4A.

These TMDLs address seven mercury-impaired waters: five waters on the 2006 303(d) list of impaired waters, Guadalupe Reservoir, Calero Reservoir, Guadalupe Creek, Alamitos Creek, and the Guadalupe River upstream of tidal influence; and two additional waters, Almaden Reservoir and Lake Almaden, which are also impaired by mercury.

These TMDLs are closely integrated with the San Francisco Bay mercury TMDL, which addresses the lower portion of the watershed (from tidal influence to open Bay water, including the Guadalupe River below about Highway 237, both Guadalupe and Alviso sloughs, and the former salt ponds adjacent to these sloughs). Implementation actions in the Guadalupe River watershed TMDLs implementation plan implement the legacy mercury allocation of the San Francisco Bay mercury TMDL to the Guadalupe River watershed.

7.7.1.1 Problem Statement

Fish downstream of the New Almaden Mining District have extremely high concentrations of mercury in their tissues. As of 2004, Guadalupe Reservoir had the highest recorded fish mercury concentrations in California—about 20 times higher than the U.S. EPA methylmercury criterion. To protect the health of humans who consume fish that may be contaminated by mercury, in 1987 Santa Clara County issued a fish consumption advisory warning people not to eat any fish from Guadalupe, Almaden and Calero reservoirs, Guadalupe and Alamitos creeks, the Guadalupe River, and percolation ponds along the river and creeks.

Terrestrial wildlife that primarily or exclusively eat fish (such as piscivorous birds, the most sensitive wildlife species in the watershed) are at risk from mercury. Because mercury concentrations in fish in waters downstream of the New Almaden Mining District exceed both the narrative bioaccumulation objective (see

Section 3.3.21) and the numeric aquatic organism and wildlife mercury water quality objectives (Table 3-4A) the health of piscivorous birds is threatened. Beneficial uses of waters in the watershed that are impaired by mercury are water contact recreation (due to human consumption of fish), wildlife habitat, and preservation of rare and endangered species.

7.7.1.2 Sources

Mercury mining waste is the largest source of mercury to waters of the Guadalupe River watershed and San Francisco Bay. Mercury is a legacy pollutant from the California Gold Rush, when cinnabar mines in the Central Coast Ranges produced the mercury used to extract gold from the Sierra Nevada. The world's fifth-largest mercury mine was the historic New Almaden Mercury Mining District, located in the headwaters of the Guadalupe River watershed.

Current sources of mercury in the Guadalupe River watershed include 1) mercury mining waste, 2) reservoirs, lakes, and shallow impoundments, where mercury is converted to methylmercury, 3) urban stormwater runoff, 4) nonurban stormwater runoff, and 5) atmospheric deposition.

1) Mercury mining waste

Mercury mining waste is found at historic mine sites and downstream of them, at three categories of locations:

a) New Almaden Mining District and Guadalupe Mine. The New Almaden Mining District includes the following mines and their associated processing areas and mining wastes:

- New Almaden Mine (Mine Hill, Cora Blanca, Harry, Velasco, Central stope, Victoria, North Randol, South Randol, San Francisco, Santa Mariana, and San Pedro-Almaden mines)
- America Mine
- Providencia Mine
- Enriquita Mine
- San Antonio Mine
- San Mateo Mine
- Senador Mine
- Deep Gulch placer cinnabar deposit

Guadalupe Mine is located on Los Capitancillos Ridge contiguous with the New Almaden Mining District, but because of separate ownership, it has retained a distinct name. Because mining waste was not contained on these mine sites, the wastes continue to erode and discharge large quantities of mercury-laden sediments to streams in the watershed.

b) Santa Teresa and Bernal mercury mines. These much smaller, less productive mercury mines are located within the Guadalupe River watershed outside of the New Almaden Mining District. These mines include the mine sites, their associated processing areas, and mining wastes.

c) Depositional areas. Depositional areas downstream of mercury mines accumulate mercury mining waste and include creek beds, banks, and floodplains, percolation ponds, and shallow impoundments. Impoundments are slow-moving water bodies that form behind engineered structures and anthropogenic alterations to the landscape that pond water. Depositional areas also accumulate mercury from other sources, such as urban stormwater runoff and atmospheric deposition. Depositional areas discharge mercury mining waste (in the form of mercury-laden sediment) to surface waters during periods of erosive flows.

2) Reservoirs and lakes. Reservoirs and lakes (deep impoundments) undergo thermal stratification in the dry season. Thermal stratification increases the conversion of inorganic mercury to methylmercury, a

bioaccumulative toxin, in the deep, cold waters of a reservoir or lake’s hypolimnion. In the dry season, reservoirs and lakes discharge elevated methylmercury concentrations to downstream waters.

3) Urban stormwater runoff. Urban stormwater runoff contains mercury from controllable urban sources, such as improperly discarded fluorescent lamps, electrical switches, thermostats, thermometers, and other mercury-containing devices; historical and ongoing industrial activities; and naturally occurring mercury in soil. Mercury in urban stormwater runoff also results in part from atmospheric deposition to the land surface.

4) Nonurban stormwater runoff. Nonurban stormwater runoff contains mercury from atmospheric deposition to the land surface, and from naturally occurring mercury in soil.

5) Atmospheric deposition. Mercury emissions from many industrial processes are widely dispersed in the atmosphere and deposit directly on the land and water surface. Mercury deposition from the atmosphere is minimal relative to other loads in the watershed.

7.7.1.3 Targets

The numeric TMDL targets are the fish-tissue water quality objectives from Table 3-4A designed to protect aquatic organisms and wildlife. They are also protective of human health. The targets are:

- 0.05 mg methylmercury per kg fish, average wet weight concentration measured in whole trophic level 3 fish 5–15 cm in length, and
- 0.1 mg methylmercury per kg fish, average wet weight concentration measured in whole trophic level 3 fish >15–35 cm in length.

7.7.1.4 Total Maximum Daily Loads

The TMDLs, shown in Table 7.7.1-1, are expressed as methylmercury and mercury concentrations in water and sediment.

Table 7.7.1-1: Total Maximum Daily Loads	
Waters	TMDLs
Creeks and river: <ul style="list-style-type: none"> • Guadalupe Creek • Alamos Creek • Guadalupe River 	0.2 mg mercury per kg suspended sediment (dry wt., annual median)
Reservoirs and lakes: <ul style="list-style-type: none"> • Guadalupe Reservoir • Almaden Reservoir • Calero Reservoir • Lake Almaden 	1.5 ng total methylmercury per liter water (seasonal maximum, hypolimnion)

7.7.1.5 Load and Wasteload Allocations

Concentration-based pollutant allocations by source category, equal to the TMDLs in Table 7.7.1-1, are shown in Table 7.7.1-2.

Table 7.7.1-2: Load and Wasteload Allocations

Source	Load Allocation	Wasteload Allocation
Total Mercury Sources:		
Mercury mining waste discharged from the New Almaden Mining District, and Guadalupe, Santa Teresa, and Bernal mercury mines	0.2 mg mercury per kg erodible mercury mining waste (dry wt., median) ^{a, b, c}	
Mercury-laden sediment discharged from depositional areas in Alamitos Creek, Guadalupe Creek, Los Gatos Creek downstream of Vasona Dam ^d , Canoas Creek, Ross Creek, Guadalupe River, tributaries to these creeks that drain mercury mines, and percolation ponds along these creeks	0.2 mg mercury per kg erodible sediment (dry wt., median) ^{a, b}	
Urban stormwater runoff discharges ^e : Santa Clara Valley Water District, County of Santa Clara, Town of Los Gatos, cities of Campbell, Monte Sereno, San José, Santa Clara, and Saratoga		0.2 mg mercury per kg suspended sediment (dry wt., annual median) ^f
Nonurban stormwater runoff discharges ^g	0.1 mg mercury per kg suspended sediment (dry wt., annual median) ^h	
Atmospheric deposition	0.02 mg mercury per square meter of water surface (per year) ⁱ	
Methylmercury production in reservoirs and lakes:^j		
Guadalupe Reservoir, Almaden Reservoir, Calero Reservoir, and Lake Almaden	1.5 ng total methylmercury per liter water (seasonal maximum, hypolimnion) ^b	

Notes continued on next page

Water Quality Control Plan for the San Francisco Bay Region

Notes:

- ^a Allocations to mercury mining waste and mercury-laden sediment are not cleanup standards. These allocations are equal to the mercury suspended sediment TMDLs in Table 7.7.1-1.
- ^b "Erodible" means material readily available for transport by stormwater runoff to surface waters.
- ^c The mercury mining waste allocation shall be measured in fines less than 63 microns in diameter.
- ^d This allocation applies to the Los Gatos Creek watershed between Vasona Dam and Lenihan Dam.
- ^e Urban stormwater runoff is subject to an NPDES permit. At the time of adoption, the permit no. was CAS029718
- ^f The urban stormwater runoff allocation is proportionally equivalent to the mass allocation (7.2 kg mercury per year) in the San Francisco Bay mercury TMDL. The urban stormwater runoff allocation is the fraction of the Santa Clara Valley Urban Runoff Pollution Prevention Program allocation attributed to the Guadalupe River watershed. The urban stormwater runoff allocation implicitly includes all current and future permitted discharges within the geographic boundaries of municipalities and unincorporated areas including, but not limited to, California Department of Transportation (Caltrans) roadways and non-roadway facilities and rights-of-way, atmospheric deposition, public facilities, properties proximate to stream banks, industrial facilities, and construction sites.
- ^g This allocation applies to waters that do not drain areas mined for mercury upstream of Lenihan Dam, Guadalupe Reservoir, Almaden Reservoir, and Calero Reservoir.
- ^h The nonurban stormwater runoff allocation is proportionally equivalent to the mass allocation (0.5 kg mercury per year) in the San Francisco Bay mercury TMDL. The nonurban stormwater runoff allocation is the fraction of the regionwide allocation attributed to the Guadalupe River watershed. The background mercury concentration in non-urban and non-mined areas is equal to the nonurban stormwater runoff allocation (0.1 mg mercury per kg suspended sediment), and includes mercury from both naturally occurring mercury in soil and atmospheric deposition.
- ⁱ The atmospheric deposition allocation to water surfaces in the Guadalupe River watershed is equal to the rate in the San Francisco Bay mercury TMDL.
- ^j The methylmercury allocation to reservoirs and lakes is equal to the methylmercury TMDL in Table 7.7.1-1.

7.7.1.6 Implementation Plan

This implementation plan:

- Implements these TMDLs, allocations, and the water quality objectives in Table 3-4A
- Builds upon past and ongoing successful efforts to reduce mercury loads both in the Guadalupe River watershed and to San Francisco Bay, and anticipates the development of new and innovative methylmercury control methods
- Encourages a coordinated watershed approach
- Reduces mercury loads in the watershed and simultaneously to the South Bay Salt Pond Restoration Project adjacent to Alviso Slough and to San Francisco Bay
- Reduces methylmercury production in the watershed, and reduces the risks from methylmercury exposure to both humans and wildlife.

The Guadalupe River watershed mercury TMDLs implementation plan will proceed in two phases, beginning [effective date of the amendment], with targets to be attained before 2029. The goals for the first phase include implementing effective source control measures for mining waste at mine sites; completing studies to reduce discharge of mining waste accumulated in Alamitos Creek; and completing studies of methylmercury and bioaccumulation controls in reservoirs and lakes, by December 31, 2018. The goal for the second 10-year phase of implementation is the attainment of the watershed fish tissue targets and the San Francisco Bay mercury TMDL allocations to urban stormwater runoff and legacy mercury sources in the Guadalupe River watershed, by December 31, 2028.

This plan establishes requirements for responsible parties to reduce or control mercury loads using available technology (see Mercury Source Control Actions). If methods under development to reduce methylmercury production and bioaccumulation prove feasible and effective, this plan also requires responsible parties to implement proven methods in Phase I (see Methylmercury Production Control Actions). Monitoring of mercury loads, mercury and methylmercury concentrations in water and suspended sediments, and bioaccumulation will occur throughout both phases to ensure that mercury and methylmercury levels have declined and fish targets are attained (see Coordinated Watershed Monitoring Program). The adaptive implementation section describes the approach and schedule for evaluating and adapting the TMDLs and implementation plan as needed to assure water quality standards are attained.

Mercury Source Control Actions

Actions are required to control mercury mining waste and urban runoff sources. This section specifies actions required to control discharges from sources to surface waters.

Mercury mining waste control actions are phased so that mercury discharges from upstream will be eliminated or significantly reduced before downstream projects are undertaken. Erosion control actions at mercury mines shall be completed within the first 10 years (Phase 1). Water Code Chapter 5.7 contains a program for public agencies and cooperating private parties, who are not otherwise legally responsible for abandoned mine lands, to reduce the threat to water quality caused by these lands without becoming responsible for completely remediating mining waste from abandoned mines. The Water Board encourages these parties to participate in the program.

Downstream erosion control actions shall be completed within the second 10 years (Phase 2). Implementation actions that reduce loads of mercury mining waste and/or mercury-laden sediment to the waters of the Guadalupe River watershed downstream of dams will also count towards achieving the

San Francisco Bay mercury TMDL allocation to legacy mercury sources in the Guadalupe River watershed.

The implementation plan for urban stormwater runoff, nonurban stormwater runoff, and atmospheric deposition source categories is contained in the San Francisco Bay mercury TMDL. Monitoring required in the Bay mercury TMDL for urban stormwater runoff is similar to the monitoring requirements herein. Consequently, the urban stormwater runoff permittees may find it is advantageous to participate in coordinated watershed monitoring. Urban stormwater runoff implementation actions in the Guadalupe River watershed that reduce loads of mercury to San Francisco Bay will also count towards achieving the Guadalupe TMDL allocation to the urban stormwater runoff source.

Implementation Actions for Mercury Mines

The Water Board will implement load allocations for mercury mining waste discharged from the New Almaden Mining District and the Guadalupe, Santa Teresa, and Bernal mercury mines through Water Code §§ 13267 and 13304 orders to compel investigation, clean up and monitoring, as well as through Basin Plan Section 4.21.4 (*Mining Program Description*) to the extent applicable. Parties responsible for investigation, cleanup, and monitoring include, but are not limited to, current mine site property owners and prior mine owners and/or operators that have caused or permitted, or threaten to cause or permit, mercury to be discharged or deposited where it will probably be discharged into waters of the State and create a condition of pollution or nuisance. Except for the cleanup and restoration projects at Hacienda Furnace Yard (including immediately adjacent reaches in Alamitos Creek); Mine Hill; San Francisco Open Cut; Senador, Enriquita and San Mateo mines; Jacques Gulch; and Deep Gulch; the Water Board will issue the § 13267 no later than [six months from the effective date] and the § 13304 orders by June 30, 2011.

These orders will collectively require the responsible parties to:

1. Conduct a site investigation evaluating the erosion potential of mercury mining waste and the potential for seeps to discharge mercury from mining waste to surface waters. Submit the site investigation report for review and approval by the Executive Officer within the first two years of Phase 1, but no later than [two years from the effective date].
2. Develop plans and schedules to control mercury mining waste discharges to surface waters. Submit plans and schedules for review and approval by the Executive Officer within 6 months of approval of the investigation report. Implement the approved plans in accordance with the approved schedule.
3. Cleanup and abate discharges of mercury mining waste within the 10-year duration of Phase 1. Submit a cleanup report for review and approval by the Executive Officer no later than December 31, 2018.
4. Monitor to evaluate the following:
 - a) effectiveness of erosion control measures
 - b) mercury loads discharged annually to waters of the State at the points of discharge
 - c) fish bioaccumulation of mercury in waters downstream of the discharge
 - d) mercury loads discharged annually to San Francisco Bay, and
 - e) answer the questions posed by special study 3b

Alternatively, the responsible parties may participate in a coordinated watershed monitoring program to address above monitoring requirements c) to e); see Coordinated Watershed Monitoring Program. The

Water Board may consider waiving or reducing monitoring requirement b), on an individual basis, based on progress on abating discharges of mining waste and participation in an approved coordinated watershed monitoring program.

Implementation Actions for Depositional Areas

The Water Board will implement load allocations to depositional areas, as defined above, in creeks and the Guadalupe River downstream of mercury mines through Clean Water Act § 401 certifications and/or waste discharge requirements to minimize discharge of mercury-laden sediment. Specifically, when projects are proposed in depositional areas that may result in sediment discharges and/or require § 401 certifications, the Water Board will require projects designed for channel stability and implementation of measures to minimize erosion. Additionally, it will impose monitoring and reporting requirements to demonstrate the effectiveness of erosion control measures in floodplains, creek banks, creek beds, and shallow impoundments.

Examples of projects subject to these requirements include riparian habitat restoration and creek bank stability projects by the District and creekside property owners. The District may also propose projects in shallow impoundments, which will be regulated through the existing § 401 certifications and waste discharge requirements for the District's Stream Maintenance Program. The Water Board will issue § 401 certifications and/or waste discharge requirements to the District for percolation pond operations and maintenance activities unless actions are satisfactorily undertaken on a voluntary basis.

The Water Board's strategy for Alamitos Creek, which is highly polluted with mercury mining waste, is to encourage a cooperative effort among the District, local agencies, and creekside property owners to undertake a comprehensive creek bank stability and habitat restoration project. The Water Board encourages the District to be the technical lead for this project, and to seek funding for it. The Water Board will identify mercury cleanup as a grant funding priority for the San Francisco Bay Region. Where necessary, the Water Board will invoke its cleanup authority to compel upstream dischargers who initially discharged mercury mining waste into depositional areas, to cleanup and abate mercury mining waste. Creekside property owners are responsible to provide reasonable access to the creek for project studies, construction, and monitoring, and to not take actions on their property that worsen the discharge of mercury mining waste into the creek. The Water Board urges the District and its partners to complete studies by December 31, 2016; submit plans and schedules for review and approval by the Executive Officer by December 31, 2018; and complete and report on the project within the 10-year duration of Phase 2, by December 31, 2028.

Implementation Actions for Urban Stormwater Runoff

The San Francisco Bay mercury TMDL and urban stormwater NPDES permit require control programs for mercury and monitoring (mercury is a pollutant of concern). The stormwater permit allows for a coordinated and collaborative watershed monitoring program. Urban runoff permittees may participate in a coordinated watershed monitoring program to a) determine fish bioaccumulation of mercury in waters downstream of the discharge ("studies aimed at better understanding the fate, transport, and biological uptake of mercury discharged in urban runoff to San Francisco Bay and tidal areas"), and b) determine the loads of mercury discharged annually to San Francisco Bay; see Coordinated Watershed Monitoring Program. Additionally, if the Water Board determines that special study 3b is necessary, urban runoff permittees shall participate in special study 3b during the second 10-year phase of implementation (see "Special Studies" section below), to determine whether urban stormwater runoff contributes to methylmercury production and bioaccumulation. If special study 3b is necessary and it is not undertaken voluntarily, the Water Board will compel permittees and others (see Special Studies) to undertake special study 3b through Water Code § 13267 requirements.

Methylmercury Production Control Actions

The Santa Clara Valley Water District is a leading researcher in methods of controlling methylmercury production and bioaccumulation in reservoirs and lakes. This TMDL project anticipates that before the end of the implementation period (20 years), new methylmercury production controls in reservoirs and lakes will reduce methylmercury bioaccumulation both in the reservoirs and lakes, and downstream. However, if implementation actions in the reservoirs and lakes do not result in attaining targets downstream, the District shall evaluate and test additional methods of controlling methylmercury production and bioaccumulation in shallow impoundments.

Implementation Actions for Reservoirs and Lakes

The District shall voluntarily conduct or cause to be conducted technical studies of methylmercury production and control. As necessary, the Water Board will compel the District to undertake technical studies of methylmercury production and control through Water Code § 13267 requirements. The responsible party for these studies and subsequent implementation actions is the owner and operator of the reservoirs and lakes, the District. Without methylmercury controls, construction and operation of reservoirs and lakes create nuisance conditions and discharges of methylmercury, which pollutes downstream waters.

The District shall continue to operate, maintain and improve the performance of, or replace with newer technology, existing methylmercury controls already in place on Lake Almaden, Almaden Reservoir, and Guadalupe Reservoir. The District shall install methylmercury controls in Calero Reservoir, if necessary, by December 31, 2017. The District shall report to the Water Board, by December 31 of odd years until directed to stop, on the operation and effectiveness of the methylmercury controls.

Where the Water Board finds it is feasible to reduce methylmercury production and/or bioaccumulation, the Water Board will issue cleanup and abatement orders to the District to undertake actions to reduce fish mercury concentrations to attain the targets.

The Water Code § 13267 requirements and/or cleanup and abatement orders will also require the District to a) determine the loads of mercury discharged annually to waters of the State at the points of discharge, b) monitor mercury in fish tissue, c) determine the loads of mercury discharged annually to San Francisco Bay, and to d) conduct the special studies described in the Monitoring Program below. Alternatively, the District may participate in a coordinated watershed monitoring program to address monitoring requirements b and c, and to address special study 3b); see Coordinated Watershed Monitoring Program. The Water Board may consider waiving or reducing monitoring requirement a), based on participation in an approved coordinated watershed monitoring program.

The Water Board will consider the need to control methylmercury production and bioaccumulation in shallow impoundments in the reviews described below under “Adaptive Implementation.”

Monitoring Program

The monitoring program encompasses:

1. Monitoring to ensure continued effectiveness of erosion control measures to reduce discharges of mercury mining wastes, including mercury-laden sediment (applicable to mercury mines and depositional areas)
2. Monitoring of mercury load at the points of discharge to demonstrate progress in reducing loads (applicable to mercury mines, and reservoirs and lakes)
3. Fish tissue mercury monitoring to assess progress in attaining targets (applicable to mercury mines, and reservoirs and lakes)

Water Quality Control Plan for the San Francisco Bay Region

4. Monitoring of mercury load to San Francisco Bay to assess progress in attaining the legacy and urban stormwater runoff mass load allocations assigned by the Bay mercury TMDL (applicable to mercury mines, urban stormwater runoff, and reservoirs and lakes)
5. Special studies to inform adaptive implementation of these TMDLs (applicable to mercury mines, urban stormwater runoff, and reservoirs and lakes)

The Water Board will compel the responsible parties to conduct monitoring through NPDES stormwater permits, Water Code § 13267 requirements, and/or cleanup and abatement orders, as described above, which will require the responsible parties to submit a (individual or coordinated watershed) monitoring plan no later than [one year from the effective date] for review and approval by the Executive Officer. Although the responsible parties are required to satisfy the monitoring requirements individually, the Water Board encourages a coordinated watershed approach particularly for mercury in fish tissue and loads to San Francisco Bay. The Water Board will collaborate with other resource agencies to coordinate fish monitoring, to leverage their expertise and, where possible, to achieve multiple objectives.

Prey fish (i.e., fish that wildlife consume) methylmercury concentrations shall be estimated as a) one hundred percent of the total mercury in eviscerated fish, or b) ninety-five percent of the total mercury in whole fish, or c) a percentage of methylmercury (as total mercury) in fish tissue based on scientific studies and upon approval of the Executive Officer of the Water Board. Large predator fish (i.e., fish that humans consume) methylmercury concentrations shall be estimated as one hundred percent of the total mercury in skinless filet samples. Water quality shall be monitored at the same time and location as fish collection for mercury species, nutrients, and general water quality parameters.

Coordinated Watershed Monitoring Program

The responsible parties may satisfy monitoring requirements 2–5 through a coordinated effort. Fish mercury monitoring is best undertaken in a coordinated effort, because fish integrate methylmercury over time and space. Monitoring of legacy (i.e., mercury mining waste) and urban stormwater runoff mercury discharges to San Francisco Bay is best undertaken in a coordinated effort, because this load to the Bay is from a combination of sources and responsible parties. The Water Board encourages a coordinated watershed approach to monitoring, and will consider reducing or waiving monitoring requirement 2 (mercury load at the points of discharge), based on progress in implementation and participation in coordinated watershed monitoring. To participate in the coordinated watershed monitoring program, participating parties shall submit a coordinated watershed monitoring plan no later than [one year from the effective date], for review and approval by the Executive Officer.

Special Studies

Additional studies may be needed to provide information to improve understanding of mercury cycling in the watershed, and to verify assumptions used in developing these TMDLs. Results of the studies will inform adaptive implementation of these TMDLs and the implementation plan. The special studies should address the following questions.

1. How do the reservoirs and lakes in the Guadalupe River watershed differ from one another? Factors to consider include, but are not limited to, area of connected wetlands, food web, water chemistry (phosphorus, pH, acid neutralizing capacity, and dissolved organic carbon), water level fluctuations, and infrastructure (outlet structure). Do outlet samples adequately represent hypolimnetic methylmercury concentrations for each reservoir? How significant are these differences?
2. Is it possible to increase the assimilative capacity for methylmercury in reservoirs and lakes? Is it feasible? If it is feasible, will this help to attain the fish tissue targets? How does increasing the

Water Quality Control Plan for the San Francisco Bay Region

assimilative capacity affect the food web: Is the resulting food chain multiplier from large (>15 cm) trophic level 3 (TL3) to large TL4 fish significantly different from 2? If it is significantly different, where and at what frequency should large predator fish (i.e., fish that humans consume) be monitored?

If the monitoring program has not already provided the information to answer these questions, the District shall voluntarily conduct or cause to be conducted studies 1 and 2, or equivalent or alternative studies with prior approval of the Water Board Executive Officer. As necessary, the Water Board will compel the District to undertake these studies in accordance with Water Code § 13267 requirements (see “Implementation Actions for Reservoirs and Lakes”). Completing study 1 within the first five years of Phase 1 (by December 31, 2013), and completing study 2 within the 10-year duration of Phase 1 (by December 31, 2018), would meet the following goal for the first phase of implementation: “completing studies of methylmercury and bioaccumulation controls in reservoirs and lakes”.

3a. What effect do the reservoir and lake control measures have on methylmercury bioaccumulation downstream? Are the fish targets attained downstream?

3b. If not, what factors contribute to methylmercury production and bioaccumulation in creeks and rivers? Factors to consider include, but are not limited to, shallow impoundments, excess nutrients, stagnant pools, shade cover, and aquatic vegetation.

If the monitoring program has not already provided the information to answer these questions, the District shall voluntarily conduct or cause to be conducted study 3a, or equivalent or alternative studies with prior approval of the Water Board Executive Officer. As necessary, the Water Board will compel the District to undertake these technical studies in accordance with Water Code § 13267 requirements (see “Implementation Actions for Reservoirs and Lakes”). If the fish targets are not attained downstream by methylmercury controls in the reservoirs and lakes, the District together with the New Almaden Mining District and the Guadalupe, Santa Teresa and Bernal mercury mines responsible parties, and the urban stormwater runoff permittees shall conduct or cause to be conducted study 3b, or equivalent or alternative studies with prior approval of the Water Board Executive Officer, either voluntarily or in accordance with Water Code § 13267 or NPDES stormwater permit requirements (see above). Completing studies 3a and 3b within the first 5 years of Phase 2 (by December 31, 2023) would support the Water Board’s effort to identify whether methylmercury production and bioaccumulation controls are necessary in shallow impoundments, in accordance with the adaptive implementation program.

4. Where the TL3 50–150 mm target is attained, is methylmercury in fish that Forster’s terns consume (fish less than 50 mm in length), at or below 0.05 mg/kg? Where the TL3 >150–350 mm target is attained, is methylmercury in fish that ospreys consume (TL4 >150–350 mm target), at or below 0.20 mg/kg? If these assumptions pertaining to proportional bioaccumulation are not valid for this watershed, what monitoring should be conducted to support a revised water quality objective and target to protect piscivorous wildlife?

5. Where the larger TL3 target is attained (in fish >150–350 mm), is the smaller TL3 target also attained (fish 50–150 mm)? If so, how should the monitoring frequency for the smaller TL3 target be reduced?

If the monitoring program has not already provided the information to answer these questions, the Water Board will conduct studies 4 and 5. Completing study 4 within the 10-year duration of Phase 1 (by December 31, 2018), would provide timely information to support whether the water quality objectives require revision through the adaptive implementation process. The timing for study 5 is contingent upon the effectiveness of methylmercury controls.

Adaptive Implementation

Adaptive implementation entails taking actions commensurate with the existing, available information, reviewing new information as it becomes available, and modifying actions as necessary based on the new information. Taking action allows progress to occur while more and better information is collected and the effectiveness of current actions is evaluated. Accordingly, these TMDLs will be implemented in phases starting with source controls at mine sites so that upstream mercury discharges will be eliminated or significantly reduced before downstream projects are undertaken.

The Water Board will adapt these TMDLs and the implementation plan to incorporate new and relevant scientific information, so that effective and efficient actions can be taken to attain TMDL allocations and targets. The Water Board recognizes that attaining the methylmercury allocation may be especially difficult because of the need for new and innovative control methods. The Water Board staff will present an annual progress report to the Water Board on implementation of the TMDL that includes evaluation of new and relevant information that becomes available through implementation actions, monitoring, special studies, and current scientific literature. Within ten years of the effective date of this TMDL project (by December 31, 2018), the Water Board will consider amending this TMDL project and implementation plan as necessary to ensure attainment of fish targets in a timely manner.

Reviews will be coordinated through the Water Board's continuing planning program and will provide opportunities for stakeholder participation. Water Board staff will propose modifications to the targets, allocations, implementation plan actions, or the schedule in this Basin Plan amendment. At a minimum, answers to the following questions will be included in the reviews. Water Board staff will develop additional questions in collaboration with stakeholders during each review.

- Is there new, reliable, and widely accepted scientific information that suggests modifications to targets, allocations, or implementation actions? If so, how should this TMDL project be modified?
- Is the watershed progressing toward TMDL targets as expected? If progress is unclear, how should monitoring efforts be modified to detect trends? If there has not been adequate progress, how should the implementation actions or allocations be modified?
- Does additional sediment, water column, or fish tissue mercury or methylmercury data support our understanding of linkages and food webs in the watershed? Does new data suggest an alternative allocation or implementation strategy?
- What are the current pollutant loads from the various sources? Have these loads changed over time? Are they meeting the allocations? How might source control measures be modified to further reduce loads?
- Are Water Board strategies to encourage and compel implementation actions effective? If not, how should the Water Board revise its strategies to reach the goal of attaining fish tissue targets within 20 years?
- Can the assimilative capacity for mercury in reservoirs and lakes be increased? If so, how can reservoirs and lakes be managed to reduce bioaccumulation? Should the implementation actions or allocations be modified? If so, how?
- Are capital projects like the Lower, Downtown, and Upper Guadalupe Flood Control Projects helping to meet TMDL allocations or are these projects causing increasing loads of mercury and methylmercury to the Guadalupe River and San Francisco Bay? If the loads are increased over pre-project conditions, how might the loads be reduced or their effects be mitigated?

7.8 WATER QUALITY ATTAINMENT STRATEGIES AND TMDLS FOR THE SAN PABLO BASIN (SEE [FIGURE 2-8](#))

7.8.1 Sonoma Creek Pathogens Total Maximum Daily Load (TMDL)

Sonoma Creek and its tributaries are impaired by pathogens. The overall goal of this TMDL is to minimize human exposure to waterborne disease-causing pathogens and to protect uses of water for recreational activities such as wading, swimming, fishing, and rafting.

The most common sources of pathogens are wastes from warm-blooded animals, including humans, livestock, domestic pets, and wildlife. The following sections establish a density-based pathogen TMDL for Sonoma Creek and its tributaries, and identify actions and monitoring necessary to implement the TMDL. The TMDL defines allowable density-based bacteria concentrations and prohibits discharge of raw or inadequately treated human waste. The implementation plan specifies actions necessary to protect and restore water contact recreation beneficial uses.

This TMDL strives to achieve a balance that allows ongoing human activities including agriculture and recreation to continue, while restoring and protecting water quality. As outlined in the adaptive implementation section, the effectiveness of implementation actions, results of monitoring to track progress toward targets, and the scientific understanding of pathogens will be reviewed periodically, and the TMDL may be adapted to future conditions as warranted.

In addition to pathogens, both animal and human wastes contain nutrients that in excess pose a threat to aquatic ecosystem beneficial uses; Sonoma Creek is also listed as impaired by excess nutrients. By eliminating the discharge of human waste and controlling the discharge of animal waste, this TMDL will also protect the beneficial uses of the Sonoma Creek watershed's aquatic ecosystem, such as cold and warm freshwater habitat, and wildlife habitat. Controlling human and animal wastes discharges will also reduce risks from other harmful constituents such as steroids and pharmaceuticals.

7.8.1.1 Problem Statement

Due to the presence of pathogens in Sonoma Creek and its tributaries, the beneficial uses of water contact and noncontact recreation are impaired. Waterborne pathogens pose a risk to human health. In ambient waters, the presence of human and animal fecal waste and associated pathogens is inferred from high concentrations of fecal coliform and *E. coli* bacteria. Bacteria levels in Sonoma Creek and its tributaries are higher than the bacteria water quality objectives established to protect people who swim, wade, and fish in these waters (Tables 3-1 and 3-2). Consequently, humans who recreate in Sonoma Creek and its tributaries are at risk of contracting waterborne disease.

7.8.1.2 Sources

The following source categories have the potential to discharge pathogens to surface waters in the Sonoma Creek watershed:

- On-site sewage disposal systems (septic systems)
- Sanitary sewer systems
- Municipal runoff
- Grazing lands
- Dairies
- Municipal wastewater treatment facility

- Wildlife

Water quality monitoring data indicate that on-site sewage disposal systems are potentially a significant pathogen source to Sonoma Creek downstream of the community of Kenwood. Municipal runoff and sanitary sewer lines are the primary pathogen sources in the urban areas. Livestock grazing and dairies are potentially significant pathogen sources in the more rural portions of the watershed.

Discharger monitoring reports from 2001-2005 indicate that the one municipal wastewater treatment facility is not a significant pathogen source. This facility is considered a potential source due to the possibility of spills or treatment system malfunction.

Wildlife are not a significant, widespread pathogen source, as evidenced by low indicator bacteria levels at sites that contain wildlife but are minimally impacted by human activities. Wildlife may be a significant source on a limited, localized basis.

7.8.1.3 Numeric Targets

The numeric water quality targets listed in Table 7.8.1-1 are derived from water quality objectives for coliform bacteria in contact recreational waters, and from U.S. EPA’s bacteriological criteria (Tables 3-1 and 3-2). The last target, “zero discharge of untreated or inadequately treated human waste,” is consistent with Discharge Prohibition 15 (Table 4-1). The zero human waste discharge target is necessary because human waste is a significant source of pathogenic organisms including viruses; and attainment of fecal coliform targets alone may not be sufficient to protect human health. These bacteria targets, in combination with the human waste discharge prohibitions, are the basis for the TMDL and load allocations, and fully protect beneficial uses.

Table 7.8.1-1 Water Quality Targets^a for Sonoma Creek
<i>E. coli</i> density: Geometric mean < 126 CFU/100 mL ^b ; 90 th percentile < 409 CFU/100 mL ^c
Fecal coliform density ^d : Geometric mean < 200 CFU/100 mL ^b ; 90 th percentile < 400 CFU/100 mL ^c
Total coliform density ^d : Median < 240 CFU/100 mL ^b ; no sample to exceed 10,000 CFU/100 mL
Zero discharge of untreated or inadequately treated human waste
^a These targets are applicable year-round. ^b Based on a minimum of five consecutive samples collected at approximately equal intervals over a 30-day period ^c No more than 10 percent of total samples during any 30-day period may exceed this number. ^d The water quality targets for total and fecal coliform shall sunset and shall no longer be effective upon the replacement of the total and fecal water quality objectives in the Basin Plan with <i>E. coli</i> based water quality objectives for contact recreation.

7.8.1.4 Total Maximum Daily Load

The TMDL, as indicated in Table 7.8.1-2, is expressed as density-based total coliform, fecal coliform, and *E. coli* bacteria limits.

Table 7.8.1-2 Total Maximum Daily Loads of Pathogen Indicators for Sonoma Creek	
Indicator	TMDL (CFU/100 mL)
<i>E. coli</i>	Geometric mean < 126 ^a 90 th percentile < 409 ^b

Water Quality Control Plan for the San Francisco Bay Region

Fecal coliform ^c	Geometric mean < 200 ^a 90 th percentile < 400 ^b
Total coliform ^c	Median < 240 ^a No sample to exceed 10,000
^a Based on a minimum of five consecutive samples collected at approximately equal intervals over a 30-day period. ^b No more than 10 percent of total samples during any 30-day period may exceed this number. ^c The Total Maximum Daily Loads for total and fecal coliform shall sunset and shall no longer be effective upon the replacement of the total and fecal water quality objectives in the Basin Plan with <i>E. coli</i> -based water quality objectives for contact recreation.	

7.8.1.5 Load Allocations

Density-based pollutant allocations for pathogen source categories are presented in Table 7.8.1-3. This table also presents the wasteload allocation for the single municipal wastewater discharger in the watershed, Sonoma Valley County Sanitation District, and for municipal runoff. Due to the inherent uncertainty in estimating pathogen loading from nonpoint sources and municipal runoff, allocations for these source categories incorporate a 10 percent margin of safety. Each entity in the watershed is responsible for meeting its source category allocation. All facilities are also responsible for meeting the requirements of applicable waste discharge requirements, waivers, or prohibitions.

All discharges of raw or inadequately treated human waste are prohibited. All sources of untreated or inadequately treated human waste have an allocation of zero.

Discharging entities will not be held responsible for uncontrollable discharges originating from wildlife. If wildlife contributions are found to be the cause of exceedances, the TMDL targets and allocation scheme will be revisited as part of the adaptive implementation program.

Table 7.8.1-3 Density-Based Pollutant Load and Wasteload Allocations^a for Dischargers of Pathogens in the Sonoma Creek Watershed						
Load Allocations^a						
Categorical Pollutant Source	E. coli		Fecal coliform ^b		Total coliform ^b	
	Geometric mean ^c	90 th percent-ile ^d	Geometric mean ^c	90 th percent-ile ^d	Median ^c	Single sample maximum
On-site sewage disposal systems	0	0	0	0	0	0
Sanitary sewer systems	0	0	0	0	0	0
Grazing lands	< 113	< 368	< 180	< 360	< 216	9,000
Dairies	<113	<368	<180	<360	<216	9,000
Wildlife ^e	< 113	< 368	< 180	< 360	< 216	9,000
Wasteload Allocations^a						
Categorical Pollutant Source	E. coli		Fecal coliform ^b		Total coliform ^b	
	Geometric mean ^c	90 th percent-ile ^d	Geometric mean ^c	90 th percent-ile ^d	Median ^c	Single sample maximum
Sonoma Valley County Sanitation District NPDES Permit No. CA0037800	<126	<409	<200	<400	<240	10,000
Municipal runoff (NPDES Permit No. CAS00004) ^f	<113	<368	<180	<360	<216	9,000

^aThese allocations are applicable year-round. Wasteload allocations apply to any sources (existing or future) subject to regulation by a NPDES permit. Load allocations and the wasteload allocation for municipal runoff reflect a 10 percent Margin of Safety.

^b The allocations for total and fecal coliform shall sunset and shall no longer be effective upon the replacement of the total and fecal water quality objectives in the Basin Plan with E.coli based water quality objectives for contact recreation.

^cBased on a minimum of five consecutive samples collected at approximately equal intervals over a 30-day period.

^d No more than 10 percent of total samples during any 30-day period may exceed this number.

^e Wildlife are not believed to be a significant source of pathogens and their contribution is considered natural background; therefore, no management measures are required.

^f Municipal runoff permittees are: Sonoma County Water Agency, County of Sonoma, City of Sonoma, Sonoma Developmental Center, and any other entities designated per the criteria specified in NPDES General Permit No. CAS00004.

7.8.1.6 Implementation Plan

This implementation plan builds upon previous and ongoing successful efforts to reduce pathogen loads in Sonoma Creek and its tributaries, and requires actions consistent with the California Water Code (CWC Section 13000 et seq.); the state’s Nonpoint Source Pollution Control Program Plan (CWC Section 13369) and its Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program; and the human waste discharge prohibition.

Table 7.8.1-4 contains the required implementation measures for each of the source categories listed in Table 7.8.1-3. These measures include evaluation of operating practices: development of comprehensive, site-specific pathogen control measures and a corresponding implementation schedule; and submittal of

Water Quality Control Plan for the San Francisco Bay Region

progress reports documenting actions undertaken. Progress reports may be submitted directly to the Water Board or to third parties if designated. These progress reports will serve as documentation that source reduction measures are being implemented.

It is important to note that the numeric targets and load allocations in the TMDL are not directly enforceable. To demonstrate attainment of applicable allocations, responsible parties must demonstrate that they are in compliance with specified implementation measures and any applicable waste discharge requirements (WDRs) or waiver conditions.

The state's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program requires that current and proposed nonpoint source discharges be regulated under (WDRs), waiver of WDRs, Basin Plan prohibitions, or some combination of these tools. Table 7.8.1-5 specifies the regulatory framework for each discharger source category. The Water Board intends to work with stakeholders to develop conditions for waiving WDRs for grazing lands by 2009.

Table 7.8.1-4 Trackable Implementation Measures for the Sonoma Creek Pathogen Total Maximum Daily Load

Source Category	Action	Implementing Party	Completion Dates
On-Site Sewage Disposal Systems (Septic Systems)	Submit to the Water Board Executive Officer for approval a plan and implementation schedule to evaluate septic system performance and correct deficiencies in septic systems identified as potentially discharging to surface waters. Priority should be given to systems identified as posing water quality risks	Sonoma County Permit and Resource Management Department	January 2008
	Report progress on implementation of septic system evaluation and repair program, as related to pathogen reduction		January 2011 and biennially thereafter
	Comply with applicable County, Water Board, or State Board requirements	Septic system owners	As specified in applicable requirement
	Apply for coverage under the State Water Board's general WDRs for sanitary sewer systems. Comply with provisions of WDRs.	Sonoma Valley County Sanitation District	As specified in general WDRs
	Report progress on inspection and evaluation of sewer systems ^a . Priority should be given to areas identified as posing water quality risks.		Annually
Grazing Lands	Submit a Report of Waste Discharge ^b to the Water Board that provides the following: a description of the facility; identification of necessary site-specific grazing management measures to reduce animal waste runoff; and an implementation schedule for identified management measures	Ranchers (landowners and lessees). These Reports may be submitted individually or jointly or through a third party ^c .	January 2010
	Comply with applicable WDRs, waiver conditions, or prohibitions	Ranchers (landowners and lessees).	As specified in applicable WDRs or waiver conditions
	Report progress on implementation of grazing-management measures that reduce animal waste runoff.	Ranchers (landowners and leasees). These reports may be submitted individually or jointly through a third party ^c .	As specified in applicable WDRs or waiver of WDRs

Water Quality Control Plan for the San Francisco Bay Region

Source Category	Action	Implementing Party	Completion Dates
Dairies	Comply with applicable WDRs or waiver of WDRs.	Dairy Facility Owners	As specified in applicable WDRs or waiver of WDRs.
	Report progress on implementation of management measures that reduce animal waste runoff		As specified in applicable WDRs or waiver of WDRs
Municipal Runoff	Comply with approved stormwater management plans and update/amend stormwater management plans as needed to include specific measures to reduce discharge of human and animal wastes	Sonoma County Water Agency, County of Sonoma, City of Sonoma, Sonoma Developmental Center, and any other entities designated per the criteria specified in NPDES General Permit No. CAS00004.	As specified in approved stormwater management plan and in applicable NPDES permit
	Report progress on implementation of human and animal waste runoff reduction measures		
Municipal Wastewater Discharges	Comply with applicable NPDES permit.	Sonoma Valley County Sanitation District Facility	As specified in applicable NPDES permit
a) Reports may be incorporated into annual SSMP audit reports. b) WDRs waiver conditions may allow for other submittals in lieu of a Report of Waste Discharge. c) While third parties may provide valuable assistance in TMDL implementation, the discharger is the entity responsible for compliance with the specified regulations and regulatory controls			

Table 7.8.1-5 Regulatory Framework for Discharges by Source Category	
Source Category	Regulatory Tool
On-site sewage disposal systems (septic systems)	General waste discharge requirements (WDRs), individual WDRs, or waiver WDRs, as appropriate ^a Prohibition of human waste discharge
Sanitary sewer systems	General WDRs or individual WDRs, as appropriate Prohibition of human waste discharge
Grazing lands	Waiver of WDRs ^b
Dairies	Waiver of WDRs or individual WDRs, as appropriate
Municipal runoff	NPDES permit
Municipal wastewater discharges	NPDES permit
^a Regulatory tool(s) employed will be consistent with State Board regulatory actions.	
^b The Water Board retains the option of requiring general or individual waste discharge requirements or compliance with a discharge prohibition, as appropriate.	

Cost estimate: Agricultural Water Quality Control Program

Because the implementation measures for grazing lands constitute an agricultural water quality control plan, the cost of that program is estimated below, consistent with California Water Code requirements (Section 13141).

The average annual program implementation cost to agricultural dischargers is estimated to range from \$35,000 to \$134,000 for the next ten years. These costs will be shared by Sonoma Creek watershed grazing land operators (approximately 10). This estimate includes the cost of implementing animal waste control and grazing management measures, and is based on costs associated with technical assistance and evaluation, installation of water troughs, and livestock control fencing along up to 25 percent of streams in grazing lands. Besides fencing, other acceptable methods of managing livestock access to streams are not included in this cost estimate due to variability in costs and site-specific applicability. In addition to private funding, potential sources of financing include federal and state water quality grants and federal agricultural grants.

Evaluation and Monitoring

Beginning in 2011 and approximately every five years thereafter, the Water Board will evaluate site specific, subwatershed-specific, and watershed-wide compliance with the trackable implementation measures specified in Table 7.8.1-4. In evaluating compliance with the trackable implementation measures, the Water Board will consider levels of participation for each source category as well as for individual dischargers (as documented by Water Board staff or third parties).

In addition to the programmatic monitoring described above, Water Board staff, in collaboration with stakeholders, will conduct water quality monitoring to evaluate *E. coli* concentration trends in Sonoma Creek and its tributaries. Five years after TMDL adoption, the Water Board will evaluate monitoring results and assess progress made toward attaining TMDL targets (Table 7.8.1-1) and load allocations (Table 7.8.1-3). The main objectives of the Monitoring Program are to:

- Assess attainment of TMDL targets
- Evaluate spatial and temporal water quality trends
- Further identify significant pathogen source areas

Water Quality Control Plan for the San Francisco Bay Region

- Collect sufficient data to prioritize implementation efforts and assess the effectiveness of source control actions.
- Collect sufficient data to evaluate the costs of pathogen source control measures and the existence of other pollutant reduction benefits (e.g., nutrients or sediments), if any.

Table 7.8.1-6 presents locations for baseline water quality monitoring. Each site will be sampled for *E. coli* ten times each year. Five samples will be collected weekly during one 30-day period in each wet season (November through March) and one 30-day period in each dry season (May through September). All water quality monitoring (including quality assurance and quality control procedures) will be performed pursuant to the State Water Board's Quality Assurance Management Plan for the Surface Water Ambient Monitoring Program. Additional monitoring will be conducted as needed if funds are available.

Sonoma Creek at Highway 12
Sonoma Creek Below Kenwood
Sonoma Creek at Sonoma Developmental Center
Sonoma Creek at Maxwell Park
Sonoma Creek at Watmaugh Road
Nathanson Creek at Nathanson Park
Nathanson Creek at Watmaugh Road
Schell Creek at Highway 121

If source control actions are fully implemented throughout the watershed and the TMDL targets are not met, the Water Board may consider whether the TMDL targets are attainable, and re-evaluate or revise the TMDL and allocations as appropriate. Alternatively, if the required actions are not implemented or are only partially implemented, the Water Board may consider regulatory or enforcement action against dischargers not in compliance.

Adaptive Implementation

Approximately every five years, the Water Board will review the Sonoma Creek Pathogen TMDL and evaluate new and relevant information from monitoring, special studies, and the scientific literature. At a minimum, the following questions will be used to conduct the reviews. Additional questions will be developed in collaboration with stakeholders during each review cycle.

- Are the Creek and the tributaries progressing toward TMDL targets as expected? If progress is unclear, how should monitoring efforts be modified to detect trends? If there has not been adequate progress, how might the implementation actions or allocations be modified?
- What are the pollutant loads for the various source categories (including naturally occurring background pathogen contributions and the contribution from open space lands), how have these loads changed over time, how do they vary seasonally, and how might source control measures be modified to improve load reduction?
- Is there new, reliable, and widely accepted scientific information that suggests modifications to targets, allocations, or implementation actions? If so, how should the TMDL be modified?

Reviews will be coordinated through the Water Board's continuing planning program, with stakeholder participation. Any necessary modifications to the targets, allocations, or implementation plan will be incorporated into the Basin Plan via an amendment process. In evaluating necessary modifications, the

Water Board will favor actions that reduce sediment and nutrient loads, pollutants for which the Sonoma Creek watershed is also impaired.

7.8.2 Napa River Pathogens Total Maximum Daily Load (TMDL)

The Napa River and its tributaries are impaired by pathogens. The overall goal of this TMDL is to minimize human exposure to waterborne disease-causing pathogens and to protect uses of water for recreational activities such as wading, swimming, fishing, and rafting.

The most common sources of pathogens are wastes from warm-blooded animals, including humans, livestock, domestic pets, and wildlife. The following sections establish a density-based pathogen TMDL for the Napa River and its tributaries, and identify actions and monitoring necessary to implement the TMDL. The TMDL defines allowable density-based bacteria concentrations and prohibits discharge of raw or inadequately treated human waste. The implementation plan specifies actions necessary to protect and restore water contact recreation beneficial uses.

This TMDL strives to achieve a balance that allows ongoing human activities including agriculture and recreation to continue, while restoring and protecting water quality. As outlined in the adaptive implementation section, the effectiveness of implementation actions, results of monitoring to track progress toward targets, and the scientific understanding of pathogens will be reviewed periodically, and the TMDL may be adapted to future conditions as warranted.

In addition to pathogens, both animal and human wastes contain nutrients that in excess pose a threat to aquatic ecosystem beneficial uses; the Napa River is also listed as impaired by nutrients. By eliminating the discharge of human waste and controlling the discharge of animal waste, this TMDL will also protect the beneficial uses of the Napa River watershed's aquatic ecosystem, such as cold and warm freshwater habitat, and wildlife habitat. Controlling human and animal waste discharges will also reduce risks from other harmful constituents such as pharmaceuticals and steroids.

7.8.2.1 Problem Statement

Due to the presence of pathogens in the Napa River and its tributaries, the beneficial uses of water contact and noncontact recreation are impaired. Waterborne pathogens pose a risk to human health. In ambient waters, the presence of human and animal fecal waste and associated pathogens is inferred from high concentrations of fecal coliform and *E. coli* bacteria. Bacteria levels in the Napa River and its tributaries are higher than the bacteria water quality objectives established to protect people who swim, wade and fish in these waters (Tables 3-1 and 3-2). Consequently, humans who recreate in the Napa River and its tributaries are at risk of contracting waterborne disease.

7.8.2.2 Sources

The following source categories have the potential to discharge pathogens to surface waters in the Napa River watershed:

- On-site sewage disposal systems (septic systems)
- Sanitary sewer systems
- Municipal runoff
- Grazing lands
- Confined animal facilities
- Municipal wastewater treatment facilities

- Wildlife

Water quality monitoring data indicate that on-site sewage disposal systems are potentially a significant pathogen source, primarily in the Murphy Creek, Browns Valley Creek, and Salvador Channel subwatersheds. Sanitary sewer lines are a likely source, primarily in the Browns Valley Creek and Salvador Channel sub watersheds. Municipal runoff is a significant source in all urban areas, and livestock grazing and confined animal facilities are considered to be potential sources throughout the watershed.

Both discharger monitoring reports and in-stream water quality monitoring indicate that municipal wastewater treatment facility discharges are not significant pathogen sources in the Napa River watershed. These facilities are considered potential sources due to the possibility of spills or treatment system malfunction.

Wildlife are not a significant, widespread pathogen source, as evidenced by low indicator bacteria levels at sites that contain wildlife but are minimally impacted by human activities. Wildlife may be a significant source on a limited, localized basis.

7.8.2.3 Numeric Targets

The numeric water quality targets listed in Table 7.8.2-1 are derived from water quality objectives for coliform bacteria in contact recreational waters, and from U.S. EPA’s bacteriological criteria (Tables 3-1 and 3-2). The last target, “zero discharge of untreated or inadequately treated human waste,” is consistent with Discharge Prohibition 15 (Table 4-1). The zero human waste discharge target is necessary because human waste is a significant source of pathogenic organisms including viruses; and attainment of fecal coliform targets alone may not be sufficient to protect human health. These bacteria targets, in combination with the human waste discharge prohibitions, are the basis for the TMDL and load allocations, and fully protect beneficial uses.

Table 7.8.2-1 TMDL Water Quality Targets^a for the Napa River
<i>E. coli</i> density: Geometric mean < 126 CFU/100 mL ^b ; 90 th percentile < 409 CFU/100 mL ^c
Fecal coliform density ^d : Geometric mean < 200 CFU/100 mL ^b ; 90 th percentile < 400 CFU/100 mL ^c
Total coliform density ^d : Median < 240 CFU/100 mL ^b ; no sample to exceed 10,000 CFU/100 mL
Zero discharge of untreated or inadequately treated human waste
^a These targets are applicable year-round. ^b Based on a minimum of five consecutive samples collected at approximately equal intervals over a 30-day period. ^c No more than 10 percent of total samples during any 30-day period may exceed this number. ^d The numeric targets for total coliform and fecal coliform shall sunset and shall no longer be effective upon the replacement of the total and fecal coliform water quality objectives in the Basin Plan with <i>E.coli</i> -based water quality objectives for contact recreation.

7.8.2.4 Total Maximum Daily Load

The TMDL, as indicated in Table 7.8.2-2, is expressed as density-based total coliform, fecal coliform, and *E. coli* bacteria limits.

Table 7.8.2-2 Total Maximum Daily Loads of Pathogen Indicators for the Napa River	
Indicator	TMDL (CFU/100 mL)
<i>E. coli</i>	Geometric mean < 126 ^a 90 th percentile < 409 ^b
Fecal coliform ^c	Geometric mean < 200 ^a 90 th percentile < 400 ^b
Total coliform ^c	Median < 240 ^a No sample to exceed 10,000
^a Based on a minimum of five consecutive samples collected at approximately equal intervals over a 30-day period. ^b No more than 10 percent of total samples during any 30-day period may exceed this number. ^c The Total Maximum Daily Loads for total coliform and fecal coliform shall sunset and shall no longer be effective upon the replacement of the total and fecal coliform water quality objectives in the Basin Plan with <i>E. coli</i> -based water quality objectives for contact recreation.	

7.8.2.4 Load Allocations

Density-based pollutant allocations for pathogen source categories (except wastewater treatment facilities) are shown in Table 7.8.2-3. Table 7.8.2-4 presents wasteload allocations for individual municipal wastewater dischargers. Due to the inherent uncertainty in estimating pathogen loading from nonpoint sources and municipal runoff (Table 7.8.2-3), allocations for these source categories incorporate a 10 percent margin of safety. Each entity in the watershed is responsible for meeting its source category allocation.

All discharges of raw or inadequately treated human waste are prohibited. All sources of untreated or inadequately treated human waste have an allocation of zero.

Discharging entities will not be held responsible for uncontrollable discharges originating from wildlife. If wildlife contributions are found to be the cause of exceedances, the TMDL targets and allocation scheme will be revisited as part of the adaptive implementation program.

Table 7.8.2-3 Density-Based Pollutant Load Allocations and Wasteload Allocations^a for Pathogen Dischargers in the Napa River Watershed						
Categorical Pollutant Source	<i>E. coli</i>		Fecal coliform ^b		Total coliform ^b	
	Geometric mean ^c	90 th percent-ile ^c	Geometric mean ^c	90 th percent-ile	Median ^c	Single sample maximum
On-site sewage disposal systems	0	0	0	0	0	0
Sanitary sewer systems	0	0	0	0	0	0
Municipal runoff	< 113	< 368	< 180	< 360	< 216	9,000
Grazing lands	< 113	< 368	< 180	< 360	< 216	9,000
Confined animal facilities	< 113	< 368	< 180	< 360	< 216	9,000
Wildlife^d	< 113	< 368	< 180	< 360	< 216	9,000

^a These allocations are applicable year-round. Wasteload allocations apply to any sources (existing or future) subject to regulation by a NPDES permit. Allocations reflect a 10% margin of safety. Wasteload allocations for wastewater treatment facilities are shown in Table 7.8.2-4.

^bThe allocations for total coliform and fecal coliform shall sunset and shall no longer be effective upon the replacement of the total and fecal coliform water quality objectives in the Basin Plan with *E.coli*-based water quality objectives for contact recreation.

^cBased on a minimum of five consecutive samples collected at approximately equal intervals over a 30-day period.

^dWildlife are not believed to be a significant source of pathogens and their contribution is considered natural background; therefore, no management measures are required.

Table 7.8.2-4 Density-Based Wasteload Allocations^a for Municipal Wastewater Treatment Facilities							
Facility	<i>E. coli</i> Density (CFU/100 mL)						NPDES Permit #
	<i>E. coli</i>		Fecal coliform ^b		Total coliform ^b		
	Geometric mean ^c	90 th %ile ^c	Geometric mean ^c	90 th %ile	Median ^c	Single sample max	
Napa Sanitation District	< 126	< 409	< 200	< 400	< 240	10,000	CA0037575
Town of Yountville	< 126	< 409	< 200	< 400	< 240	10,000	CA0038121
City of St. Helena	< 126	< 409	< 200	< 400	< 240	10,000	CA0038016
City of Calistoga	< 126	< 409	< 200	< 400	< 240	10,000	CA0037966
City of American Canyon	< 126	< 409	< 200	< 400	< 240	10,000	CA0038768
Napa River Reclamation District #2109	< 126	< 409	< 200	< 400	< 240	10,000	CA0038644

^aThese allocations are applicable year-round. Wasteload allocations apply to any sources (existing or future) subject to regulation by a NPDES permit.

^bThe allocations for total coliform and fecal coliform shall sunset and shall no longer be effective upon the replacement of the total and fecal coliform water quality objectives in the Basin Plan with *E.coli*-based water quality objectives for contact recreation.

^cBased on a minimum of five consecutive samples collected at approximately equal intervals over a 30-day period.

7.8.2.5 Implementation Plan

This plan builds upon previous and ongoing successful efforts to reduce pathogen loads in the Napa River and its tributaries, and requires actions consistent with the California Water Code (CWC Section 13000 et seq.); the state's Nonpoint Source Pollution Control Program Plan (CWC Section 13369) and its Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program; and the human waste discharge prohibition.

Table 7.8.2-5 contains the required implementation measures for each of the source categories listed in Table 7.8.2-3 and 7.8.2-4. These measures include evaluation of operating practices; development of comprehensive, site-specific pathogen control measures and a corresponding implementation schedule; and submittal of progress reports documenting actions undertaken. Progress reports may be submitted directly to the Water Board or to third parties if designated. These reports will serve as documentation that source reduction measures are being implemented.

It is important to note that the numeric targets and load allocations in the TMDL are not directly enforceable. To demonstrate attainment of applicable allocations, responsible parties must demonstrate that they are in compliance with specified implementation measures and any applicable waste discharge requirements (WDRs) or waiver conditions.

The state's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program requires that current and proposed nonpoint source discharges be regulated under WDRs, waivers of WDRs, Basin Plan prohibitions, or some combination of these tools. Table 7.8.2-6 specifies the regulatory framework for each discharger source category. The Water Board intends to work with stakeholders to develop conditions for waiving WDRs for grazing lands by 2009.

Table 7.8.2-5 Trackable Implementation Measures for the Napa River Pathogen Total Maximum Daily Load

Source Category	Action	Implementing Party	Completion Dates
On-Site Sewage Disposal Systems (OSDS)	Submit to the Water Board Executive Officer for approval a plan and implementation schedule for evaluating OSDS performance and correcting deficiencies in OSDSs identified as potentially discharging to surface waters. Priority should be given to the Browns Valley Creek, Murphy Creek, and Salvador Channel subwatersheds	Napa County	January 2008
	Report progress on implementation of OSDS evaluation and repair program		January 2011 and biennially thereafter
	Comply with applicable County, Water Board, or State Water Board requirements	Septic system owners	As specified in applicable requirements
Sanitary Sewer Systems	Apply for coverage under the State Water Board's general WDRs for sanitary sewer systems Board (Order No. 2006-0003). Comply with provisions of WDRs.	Napa Sanitation District, City of Calistoga, City of St. Helena, Yountville Joint Treatment Plant, City of American Canyon, Napa River Reclamation District #2109	As specified in general WDRs
	Report progress on inspection and evaluation of sewer systems ^a		Annually
Grazing Lands	Submit a Report of Waste Discharge ^c to the Water Board that provides the following: a description of the facility; identification of necessary site-specific grazing management measures to reduce animal waste runoff; and an implementation schedule for identified management measures	Ranchers (landowners and lessees). These reports may be submitted individually or jointly or through a third party ^{dc} .	January 2010
	Comply with applicable WDRs, waiver conditions, or prohibitions	Ranchers (landowners and lessees)	As specified in WDRs or waiver conditions
	Report progress on implementation of grazing management measures that reduce animal waste runoff	Ranchers (landowners and lessees). These reports may be submitted individually or jointly or through a third party ^c .	As specified in applicable WDRs or waiver of WDRs

Water Quality Control Plan for the San Francisco Bay Region

Source Category	Action	Implementing Party	Completion Dates
Confined Animal Facilities	Submit a Report of Waste Discharge ^b to the Water Board that provides the following: a description of the facility; identification of necessary site-specific management measures to reduce animal waste runoff; and a schedule for implementation of identified management measures	Confined animal facilities. These reports may be submitted individually or jointly or through a third party.	January 2010
	Comply with applicable WDRs or waiver conditions	Confined animal facilities	As specified in applicable WDRs or waiver of WDRs.
	Report progress on implementation of management measures that reduce animal waste runoff	Confined animal facilities. These reports may be submitted individually or jointly or through a third party.	As specified in applicable WDRs or waiver of WDRs
Municipal Runoff	Comply with approved stormwater management plans. Update/amend storm water management plans as needed to include specific measures to reduce discharge of human and animal wastes	Napa County, City of Napa, Town of Yountville, City of St. Helena, City of Calistoga, City of American Canyon	As specified in approved stormwater management plan and in applicable NPDES permit
	Report progress on implementation of human and animal waste runoff reduction measures		
Municipal Wastewater Discharges	Comply with applicable NPDES permits	Napa Sanitation District, City of Calistoga, City of St. Helena, Yountville Joint Treatment Plant, City of American Canyon, Napa River Reclamation District #2109	As specified in applicable NPDES permits
<p>^a. Reports may be incorporated into annual SSMP audit reports.</p> <p>^b. WDRs waiver conditions may allow for other submittals in lieu of a Report of Waste Discharge.</p> <p>^c. While third parties may provide valuable assistance in TMDL implementation, the discharger is the entity responsible for compliance with the specified regulations and regulatory controls.</p>			

Table 7.8.2-6 Regulatory Framework for Discharges by Source Category

Source Category	Regulatory Tool
On-site Sewage Disposal Systems	General Waste Discharge Requirements (WDRs), Individual WDRs, or Waiver of WDRs, as appropriate ^a Prohibition of Human Waste Discharge
Sanitary Sewer Systems	General WDRs or Individual WDRs, as appropriate Prohibition of Human Waste Discharge
Grazing Lands	Waiver of WDRs ^b
Confined Animal Facilities	Waiver of WDRs ^b
Municipal Runoff	NPDES Permit
Municipal Wastewater Treatment Facilities	NPDES Permit
^a Regulatory tool(s) employed will be consistent with State Water Board regulatory actions.	
^b Water Board retains the option of requiring general or individual waste discharge requirements or compliance with a discharge prohibition, as appropriate.	

Cost estimate: Agricultural Water Quality Control Program

Because the implementation measures for grazing lands constitute an agricultural water quality control program, the cost of that program is estimated below, consistent with California Water Code requirements (Section 13141).

The average annual program implementation cost to agricultural dischargers is estimated to range between \$60,000 and \$250,000 for the next 10 years. These costs will be shared by Napa River watershed grazing lands operators (approximately 20). This estimate includes the cost of implementing animal waste controls and grazing management measures, and is based on costs associated with technical assistance and evaluation, installation of water troughs, and livestock control fencing along up to 25 percent of streams in grazing lands. Besides fencing, other acceptable methods of managing livestock access to streams are not included in this cost estimate due to variability in costs and site-specific applicability. In addition to private funding, potential sources of financing include federal and state water quality grants and federal agricultural grants.

Evaluation and Monitoring

Beginning in 2011 and approximately every five years thereafter, the Water Board will evaluate site-specific, subwatershed-specific, and watershed-wide compliance with the trackable implementation measures specified in Table 7.8.2-5. In evaluating compliance with the trackable implementation measures, the Water Board will consider levels of participation for each source category as well as for individual dischargers (as documented by Water Board staff or third parties).

In addition to the programmatic monitoring described above, Water Board staff, in collaboration with stakeholders, will conduct water quality monitoring to evaluate *E. coli* concentration trends in the Napa River and its tributaries. Five years after TMDL adoption, the Water Board will evaluate monitoring results and assess progress made toward attaining TMDL targets (Table 7.8.2-1) and load allocations (Table 7.8.2-3). The main objectives of the Monitoring Program are to:

- Assess attainment of TMDL targets
- Evaluate spatial and temporal water quality trends
- Further identify significant pathogens source areas

Water Quality Control Plan for the San Francisco Bay Region

- Collect sufficient data to prioritize implementation efforts and assess the effectiveness of source control actions
- Collect sufficient data to evaluate the costs of pathogen source control measures and the existence of other pollutant reduction benefits (e.g., nutrients or sediment), if any

Table 7.8.2-7 presents locations for baseline water quality monitoring. Each site will be sampled for *E. coli* ten times each year. Five samples will be collected weekly during one 30-day period in each wet season (November through March) and one 30-day period in each dry season (May through September). All water quality monitoring (including quality assurance and quality control procedures) will be performed pursuant to the State Water Board’s Quality Assurance Management Plan for the Surface Water Ambient Monitoring Program. Additional monitoring will be conducted as needed if funds are available. In lieu of the monitoring plan described in Table 7.8.2-6, one or more implementing parties may submit an alternative monitoring plan for Executive Officer approval.

Table 7.8.2-7 Baseline Monitoring Sites
Napa River at Third Street, Napa
Napa River at Zinfandel Lane
Napa River at Calistoga Community Center
Browns Valley Creek at Browns Valley Road
Browns Valley Creek at Borrette Lane
Murphy Creek at Coombsville Road
Murphy Creek at upstream location to be determined ^a
Salvador Channel at Solano Avenue
Salvador Channel at Dry Creek Road
Four additional tributaries to be determined ^a , rotated each year
^a Sites will be determined by Water Board staff in coordination with stakeholders.

If source control actions are fully implemented throughout the watershed and the TMDL targets are not met, the Water Board may consider whether the TMDL targets are attainable, and re-evaluate or revise the TMDL and allocations as appropriate. Alternatively, if the required actions are not implemented or are only partially implemented, the Water Board may consider regulatory or enforcement action against dischargers not in compliance.

Adaptive Implementation

Approximately every five years, the Water Board will review the Napa River Pathogen TMDL and evaluate new and relevant information from monitoring, special studies, and the scientific literature. At a minimum, the following questions will be included in the reviews. Additional questions will be developed in collaboration with stakeholders during each review cycle.

1. Are the river and the tributaries progressing toward TMDL targets as expected? If progress is unclear, how should monitoring efforts be modified to detect trends? If there has not been adequate progress, how might the implementation actions or allocations be modified?
2. What are the pollutant loads for the various source categories (including naturally occurring background pathogen contributions and the contribution from open space lands)? How have these loads changed over time, how do they vary seasonally, and how might source control measures be modified to improve load reduction?

3. Is there new, reliable, and generally accepted scientific information that suggests modifications to targets, allocations, or implementation actions? If so, how should the TMDL be modified?

Reviews will be coordinated by the Water Board's continuing planning program, with stakeholder participation. Any necessary modifications to the targets, allocations, or implementation plan will be incorporated into the Basin Plan via an amendment process. In evaluating necessary modifications, the Water Board will favor actions that reduce sediment and nutrient loads, pollutants for which the Napa River watershed is also impaired.

7.8.3 Sonoma Creek Watershed Sediment TMDL and Habitat Enhancement Plan

The goals of the Sonoma Creek Watershed Sediment TMDL and Habitat Enhancement Plan (Plan) are to:

- Conserve the steelhead trout population
- Restore water quality to meet water quality standards, including attaining beneficial uses
- Enhance the overall health of the native fish community
- Protect and enhance habitat for native aquatic species
- Enhance the aesthetic and recreational values of the creek and its tributaries

To achieve these goals, specific actions are needed to:

1. Reduce sediment loads, and fine sediment in particular, to Sonoma Creek and its tributaries
2. Attain and maintain suitable gravel quality in freshwater reaches of Sonoma Creek and its tributaries
3. Reduce and prevent channel incision
4. Reduce erosion and sedimentation
5. Repair large sources of sediment supply (e.g., landslides)
6. Enhance channel complexity (e.g., by adding and encouraging retention of large woody debris and restoring riparian vegetation)

The following sections establish:

1. A sediment total maximum daily load (TMDL) defining the allowable amount of sediment that can be discharged into Sonoma Creek, expressed as mass, and as a percentage of the natural background sediment delivery rate to channels
2. An implementation plan to achieve the TMDL and related habitat enhancement goals

7.8.3.1 Problem Statement

Steelhead populations in the Sonoma Creek watershed have declined substantially since the late 1940s. Results of recent analyses of fisheries and sediment sources indicate that:

1. Excessive amounts of fine sediment have been deposited in the streambed at potential steelhead spawning and rearing sites. Excess fine sediment in the streambed can cause poor incubation conditions for fish eggs, resulting in high mortality prior to emergence. Fine sediment also compromises the quality of pools as rearing habitat, and reduces winter rearing habitat by filling the spaces between cobbles and boulders.
2. Changes in physical habitat structure that appear to be caused by erosion of bed and banks (incision) in Sonoma Creek are resulting in significant adverse changes to steelhead habitat. Analysis of in-stream shelter in Sonoma Creek yielded a low score when considering the watershed-wide average

Water Quality Control Plan for the San Francisco Bay Region

(38, which is 13 percent of the maximum score), indicating low quality of rearing habitat for juvenile steelhead. A steelhead census performed in 2002 indicates only 10 percent of steelhead are surviving past the juvenile rearing stage. These conditions are limiting the success of steelhead fish in Sonoma Creek.

3. Stressful water temperatures, low summer flows, and migration barriers also impact the health of Sonoma Creek’s coldwater fishery.

Due to excess erosion and sedimentation in the Sonoma Creek Watershed, the narrative water quality objectives for sediment and settleable material are not being met and cold freshwater habitat, wildlife habitat, fish spawning, recreation, and preservation of rare and endangered species beneficial uses are impaired. In addition, channel incision has caused habitat simplification, which has reduced and quantity and quality of spawning and rearing habitat for salmonids and other native aquatic species. Channel incision is a controllable water quality factor that is contributing to a violation of the narrative water quality objective for population and community ecology.

7.8.3.2 Numeric Targets and Desired Condition

Meeting the numeric targets and desired condition listed in Table 7.8.3-1 will allow water quality in Sonoma Creek and its tributaries to achieve the Basin Plan’s narrative water quality objectives for sediment, settleable material, and population and community ecology.

Table 7.8.3-1 TMDL Sediment Targets for Sonoma Creek and its Tributaries

Spawning gravel permeability	Median value \geq 7000 cm/hr ^a
Pool filling	Decreasing trend in the volume of fine sediment deposited in pools
Substrate Composition- Percent Fines	Percent of fine sediment less than 0.85 mm in diameter is less than or equal to 14 percent of the total bulk core sample (\leq 14% fines < 0.85 mm) ^b
	Percent of fine sediment less than 6.40 mm in diameter is less than or equal to 30 percent of the total bulk core sample (\leq 30% fines < 6.40 mm) ^b
^a Target applies to all potential spawning sites for steelhead and salmon in Sonoma Creek and its tributaries. ^b Target applies to wadeable streams and rivers with gradient less than 3 percent. A wadeable stream is one which an average human can safely cross on foot during the summer, low flow season while wearing chest waders.	

7.8.3.3 Sources

Field assessments and sediment load modeling provide credible estimates of average rates of sediment delivery to Sonoma Creek. As shown in Table 7.8.3-2, the average annual sediment load to the freshwater reach of Sonoma Creek is estimated to be 117,000 tons per year, or 360 tons per km² per year. The natural background sediment delivery rate to Sonoma Creek is 52,000 tons per year, or 160 tons per km² per year. Therefore, the current sediment delivery rate is estimated to be 225 percent of the natural background rate.

Table 7.8.3-2. Average Annual Sediment Delivery to Sonoma Creek (tons/year)^a

Source Categories	Estimated Rate ^c (tons/year)
-------------------	--

Water Quality Control Plan for the San Francisco Bay Region

Source Categories		Estimated Rate ^c (tons/year)
Natural Processes	Channel Erosion, Incision ^b	25,400
	Colluvial Bank Erosion (Soil Creep)	16,600
	Surface Erosion ^b	6,200
	Landslides ^b	4,100
	Total- Natural Processes	52,300
Human Actions	Channel Incision and Gully Erosion ^b	43,300
	Roads and Stream Crossings	11,200
	Surface Erosion ^b from vineyards, other row crops, and rangelands	8,600
	Urban Stormwater Runoff	1,100
	Landslides ^b	900
	Total- Human Actions	65,100
GRAND TOTAL		117,400
^a Sediment delivery rates are rounded to the nearest hundred. ^b Channel erosion and incision, surface erosion, and landslides are occur due to both Natural Processes and Human Actions. For these sources, each component (natural processes vs. human actions) is displayed separately. ^c The timeframe associated with the average annual rate varies from long-term average rates which were estimated for landslides, channel incision, and gully erosion to those for urban stormwater, surface erosion, and road-related erosion, which are estimated based on current/contemporary conditions.		

7.8.3.4 Total Maximum Daily Load and Allocations

The Sonoma Creek sediment TMDL is established at 65,400 tons per year, which is approximately 125 percent of natural background load. Natural background load depends upon natural processes, and varies significantly. Therefore, the TMDL and allocations are expressed both in terms of sediment mass and percent of natural background. The percentage based TMDL, 125% of natural background, applies throughout the watershed. In order to achieve the TMDL, controllable sediment delivery resulting from human actions needs to be reduced by approximately 80 percent from current proportion of the total load (Table 7.8.3-3). TMDL attainment will be evaluated at the limit of tidal influence in the Sonoma Creek watershed, which approximates the downstream boundary of freshwater habitat for steelhead. Sonoma Creek has several tributaries that join the mainstem below the tidal limit; therefore, several points will be used to evaluate TMDL attainment. These points are: mainstem Sonoma Creek just downstream of the Fowler/Carriger Creek confluence, and the freshwater portions (above tidal influence) of Schell, Ramos, Carneros, and Merazo Creeks. Attainment of the TMDL will be evaluated over a 5-to-10-year averaging period. The TMDL equal to 125 percent of natural background load, can be achieved if human-related sources are reduced to the level of the allocations shown in Table 7.8.3-3.

Water Quality Control Plan for the San Francisco Bay Region

Table 7.8.3-3. Sonoma Creek Sediment Load and Wasteload Allocations (tons/year)^a

	Source Category	Current (2005) Load ^b	Estimated Reductions Needed (Percentage)	Allocation	
				tons/year	Percent Natural Background
Load Allocations	Natural Processes				
	Channel Erosion, Incision	25,400	0	25,400	49
	Colluvial Bank Erosion (Soil Creep)	16,600	0	16,600	32
	Surface Erosion	6,200	0	6,200	12
	Landslides	4,100	0	4,100	8
	Human Actions				
	Channel Erosion, Incision	43,300	81	8,100	15
	Roads and Stream Crossings	11,200	81	2,100	4
	Surface Erosion, including vineyards, grazed lands, unmanaged areas, and minor agriculture	8,600	81	1,600	3
	Landslides	900	81	200	0.4
	TOTAL	116,300		64,300	123
Wasteload Allocations ^c	Municipal Stormwater - NPDES Permit No. CAS000004	600	0	600	1
	Construction Stormwater - NPDES Permit No. CAS000002	300	0	300	0.6
	Industrial Stormwater – NPDES Permit No. CAS000001	100	0	100	0.2
	Caltrans Stormwater – NPDES Permit No. CAS000003	100	0	100	0.2
	TOTAL	1,100		1,100	2
TOTAL ALLOCATIONS = TMDL = 125 % of Natural Background				65,400	125

^a Sediment loads and allocations are rounded to the nearest hundred. Some totals may not appear to add up due to rounding.
^b Table 7.8.3-2 also displays the estimated current (2005) sediment loads. Total current (2005) estimated sediment load = 117,400 tons/year.
^c Source categories included in the wasteload allocations (e.g., municipal stormwater) are described as “urban stormwater” in Table 7.8.3-2. The term “urban stormwater” in Table 7.8.3-2 incorporates municipal, construction, industrial, and Caltrans stormwater.

7.8.3.5 Implementation Plan

The implementation actions described below are to achieve TMDL targets and allocations and habitat enhancement goals. In addition, actions specified in this plan are expected to enhance steelhead population. It is important to note that the allocations in the TMDL are not directly enforceable. To demonstrate attainment of applicable allocations, responsible parties must demonstrate that they are in compliance with required implementation measures and any applicable waste discharge requirements (WDRs), WDR waiver conditions, or NPDES permits.

Regulatory Tools

The State's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program requires regulation of nonpoint source discharges using the Water Board's administrative permitting authorities, including WDRs, waivers of WDRs, Basin Plan Discharge Prohibitions, or some combination of these. Consistent with this policy, Tables 7.8.3-4 – 7.8.3-7 specify actions and performance standards by nonpoint source category, as needed to achieve TMDL sediment targets and allocations in the Sonoma Creek watershed. The Water Board will consider adopting conditions for waiving WDRs that apply to the nonpoint sources (vineyards, grazing, roads, etc.) listed in Tables 7.8.3-4 – 7.8.3-7, address all pollutants of concern, protect all beneficial uses, and balance the agricultural, environmental, recreational, and residential needs of the watershed.

The wasteload allocations contained in Table 7.8.3-3 apply to point sources of sediment that are regulated by NPDES permits. Table 7.8.3-8 shows implementation measures required of these sources, which include municipal stormwater, runoff from state highways, and from industrial and construction sites.

Problems associated with channel incision, related rapid bank erosion, and loss of essential habitat features, reflect and integrate multiple historical and ongoing disturbances, some of which are local and direct, and others that are indirect and distal. Effectively addressing these issues will require cooperative and coordinated actions by multiple landowners, working with public agencies, over significant distances along the creek. The most effective means of controlling channel incision and reducing related fine sediment delivery to the creek is a channel restoration program that re-establishes width-to-depth ratios and sinuosity values conducive to formation of alternate bars and a modest flood plain. The Water Board will work with stakeholders along Sonoma Creek, through local stewardship groups, to implement such channel restoration/habitat enhancement projects. Tables 7.8.3-9 to 7.8.3-11 (Recommended Measures to Protect or Enhance Habitat), specify actions to address adverse impacts of channel incision on salmonid habitat quantity and quality, and to accomplish habitat enhancement goals for flow, temperature, and fish passage for steelhead.

Individual landowners or coalitions may work with "third parties" to develop and implement sediment pollutant control programs. With regard to achievement of actions to protect or enhance baseflow, fish passage, habitat complexity, and stream temperature, the effectiveness of the recommended actions specified in Tables 7.8.3-9 through 7.8.3-11, will be evaluated as part of the adaptive implementation program.

Agricultural Water Quality Control Program Costs

Implementation measures for grazing lands and vineyards constitute an agricultural water quality control program and therefore, consistent with California Water Code requirements (Section 13141), the cost of this program is estimated herein. This cost estimate includes the cost of implementing all actions to reduce sediment discharges and enhance habitat complexity as specified in the implementation plan, and is based on costs associated with technical assistance and evaluation, project design, and implementation of actions needed to achieve the TMDL. In estimating costs, the Water Board has assumed that owners of agricultural businesses own 75 percent of total land area on hillside parcels, and

95 percent of the land along Sonoma Creek and lower reaches of its tributaries. Based on these assumptions, the estimated total cost for program implementation for agricultural sources is \$1.3-to-2.3 million per year throughout the 20-year implementation period. More than three-quarters of these potential costs are associated with addressing channel incision and enhancing habitat conditions (to reverse the impacts of channel incision) in Sonoma Creek and its tributaries. Considering potential benefits to the public in terms of ecosystem functions, aesthetics, recreation, and water quality, it is anticipated that at least 75 percent of the cost of these actions will be paid for with public funds. Therefore, the total cost to agricultural businesses associated with efforts to reduce sediment supply and enhance habitat in Sonoma Creek is \$300,000-\$600,000 per year over the 20-year implementation period.

Evaluation and Monitoring

In collaboration with stakeholders in the watershed, Water Board staff will develop a detailed monitoring program to assess progress of TMDL attainment and provide a basis for reviewing and revising TMDL elements or implementation actions. As an initial milestone, by fall 2011, the Water Board and watershed partners will complete monitoring plans to evaluate: a) attainment of water quality targets; and b) suspended sediment and turbidity conditions. Initial data collection, based on the protocols established in these monitoring plans is anticipated to begin in the winter of 2011-2012.

As a whole, the monitoring program will be designed to:

1. *Assess channel response and progress towards achieving water quality targets.* In-channel effectiveness monitoring will be conducted to evaluate: a) progress toward achieving water quality targets, and b) channel response to management measures and natural processes. Parameters that will be monitored to assess progress toward achieving water quality targets are streambed permeability, pool filling, and percent fines composition of the substrate. The number of sites to be monitored will be selected based on availability/presence of the applicable habitat feature (i.e., spawning gravels and pools), as well as the number of samples needed to have a high degree of statistical confidence in estimated values. Frequency of monitoring should be once every five years, at a minimum, for streambed permeability and pool filling. If resources are available, desired monitoring frequency for all TMDL target parameters is once every two to three years. Pool filling should be monitored every two to three years to allow a trend analysis. The Water Board may establish alternative water quality parameters and/or numeric target values at a future date as part of the adaptive implementation process, when/if information becomes available to conclude with a high degree of confidence that one or more alternative parameters or target values provide a superior basis for determining attainment of water quality objectives for sediment, and the protection of fisheries-related beneficial uses.
2. *Further evaluate potential impacts of suspended sediment and related turbidity.* To further study potential impacts of suspended sediment and related turbidity, monitoring of turbidity should continue. The Sonoma Ecology Center maintains a continuous and automated monitoring station at the Sonoma Valley Watershed Station in Eldridge, CA. Monitoring of suspended sediment should continue to further understanding of turbidity and suspended sediment concentrations in ambient conditions, and during and after storms. Turbidity/suspended sediment data should be analyzed to determine the length of time it takes for turbidity levels to drop to pre-storm levels after a storm event.

It is expected that as sediment reduction and habitat enhancement measures (including reducing channel incision) are undertaken, suspended sediment concentrations and turbidity levels will decrease. This expectation should be confirmed with continued turbidity monitoring. In addition, turbidity monitoring can provide information regarding the effectiveness of sediment reduction measures because it is a sensitive measure of the effects of land use on streams.

Water Quality Control Plan for the San Francisco Bay Region

3. *Assess whether required sediment reduction measures are undertaken.* Implementation monitoring will be conducted by landowners or designated agents, per the compliance monitoring and reporting provisions of applicable waivers of WDRs, WDRs, and NPDES permits.
4. *Evaluate effectiveness of selected sediment reduction measures (both structural and management-related).* The Water Board will conduct upslope effectiveness monitoring to evaluate sediment delivery to channels from land use activities and natural processes. The first sediment source analysis update will occur by 2020, when sediment delivery associated with human activities may be reduced by 25 percent or more. A subsequent update may occur, assuming the water quality targets for sediment are not already achieved, by 2025, when sediment supply associated with human activities may be reduced by 40 percent or more. An additional goal for future updates of the source analysis is to reduce uncertainty associated with estimates of sediment delivery rates.
5. *Evaluate effectiveness of recommended habitat enhancement measures and assess progress towards goals of the Habitat Enhancement Plan.* The Water Board and local partners should monitor habitat complexity-related water quality indicators to assess progress towards achievement of a balanced sediment budget (where the amount of fine and coarse sediment input to a given channel reach is equal to the amount that is transported downstream).

Monitoring should occur to determine whether there is an increasing trend in the percent of the length of mainstem of Sonoma Creek, and in the lower alluvial reaches of its tributaries, that attain the following conditions:

- a. The bankfull channel width-to depth ratio is $\geq 12:1$.
- b. The average spacing between alluvial and/or forced gravel bars within the active channel is ≤ 7 times the width of the bankfull channel.
- c. Available shear stress at bankfull flow does not exceed the amount required to initiate motion of the streambed by more than approximately 20 percent.
- d. Floodplain width is ≥ 4 times bankfull channel width.

Monitoring should also assess whether there is:

- e) An increasing trend through time in the mean area and frequency of riffles and gravel bars within the mainstem channel; and
- f) A decreasing trend through time in the percent of the length of the mainstem of Sonoma Creek, and in the lower alluvial reach of its tributaries, where banks or bed are hardened, and/or where constructed levees contribute to channel instability.

The information gained from monitoring will guide adaptive implementation.

7.8.3.6 Adaptive Implementation

In concert with the monitoring program, described above, the Sonoma Creek Watershed Sediment TMDL and Habitat Enhancement Plan will be regularly updated. Results of in-progress or anticipated studies that enhance understanding of the population status of steelhead trout in the Sonoma Creek watershed, and/or factors controlling those populations, may also trigger changes to the plan and TMDL. At a minimum, data in response to the following questions will be considered to guide research and monitoring efforts and focus each subsequent update of the TMDL.

Key Questions to be considered in the course of Adaptive Implementation:

- What is the population status of steelhead in the watershed? Is there an increase in the number or percentage of steelhead that survive past the juvenile rearing life stage as sediment reduction and habitat enhancement measures are implemented? An improved understanding of the current status of steelhead populations in the Sonoma Creek watershed is essential for guiding adaptive updates to the management actions recognized in this plan. Two types of monitoring data may be needed to evaluate the current population status in the watershed: 1) “smolt” production and sizes, and 2) adult spawning run-size. Smolt refers to the life stage when juvenile salmonids migrate from freshwater to the ocean. These two types of monitoring would provide a basis for assessing the influences of ocean and freshwater rearing habitat on steelhead run-size.
- Are Sonoma Creek and its tributaries progressing toward TMDL targets as expected? If there has not been adequate progress, how might the implementation actions, targets or allocations be modified?
- What are expected benefits of various actions to enhance habitat for steelhead? Which actions, and in which locations, would enhancement measures have the most benefit and be the most cost-effective?
- Are the specified sediment reduction measures and recommended habitat enhancement measures resulting in an improving trend in channel stability?
- What effect will climate change have on hydrology, sediment transport, and habitat for the watershed’s aquatic species? Is there evidence that TMDL implementation actions, together with climate change, may affect Bay tidal habitats? How will climate change effect the outcome of required and recommended measures, and how should these measures be adjusted in response?
- Are there new data or information available that warrants revision of water quality targets, allocations, or implementation measures?

Table 7.8.3-4 Required and Trackable TMDL Implementation Measures for Sediment Discharges Associated with Vineyards¹

Performance Standards	Actions	Implementing Parties	Completion Dates	
<p>Surface Erosion associated with vineyards: Comply with the Sonoma County Vineyard Erosion and Sediment Control Ordinance (Sonoma County Code, Chapter 30, Article V) and minimize erosion from existing vineyards; and</p> <p>Roads: Design, construct, and maintain rural roads to minimize road-related sediment delivery to stream channels; and</p> <p>Gullies and/or shallow landslides: Promote natural recovery and minimize human-caused increases in sediment delivery from unstable areas; and</p> <p>Effectively attenuate significant increases in storm runoff. Runoff from vineyards shall not cause or contribute to downstream increases in rates of bank or bed erosion.</p>	<p>Submit a Report of Waste Discharge² to the Water Board that provides, at a minimum, the following: a description of the vineyard; identification of site-specific erosion control measures needed to achieve performance standard(s) specified in this table; and a schedule for implementation of identified erosion control measures.</p> <p>OR</p> <p>Implement farm plan certified under Fish Friendly Farming Environmental Certification Program or other farm plan certification program approved as part of a WDR waiver policy. All dischargers applying for coverage under a WDR waiver policy also will be required to file a notice of intent (NOI) for coverage, and to comply with all conditions of the WDR waiver policy⁴.</p>	<p>Vineyard owner and/or operator</p>	<p>June 2014</p>	
	<p>Comply with applicable waste discharge requirements (WDRs) or waiver of WDRs.</p>		<p>Vineyard owner and/or operator</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
	<p>Report progress on implementation of site specific erosion control measures.³</p>		<p>Vineyard owner and/or operator</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
<p>¹As needed to achieve TMDL allocations and consistent with the State Board's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program</p> <p>²Or compliance with applicable conditional waivers of WDRs that may be adopted by the Water Board.</p> <p>³ Reports may be submitted individually or jointly through a recognized third party.</p> <p>⁴ This Basin Plan amendment recognizes farm plans certified under the Fish Friendly Farming Environmental Certification Program as effective with regard to control of pollutant discharges associated with vineyards. Additional conditions will be required under a General WDR and/or waiver program consistent with the State Board's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program, and/or as needed to avoid potentially significant environmental impacts.</p>				

Table 7.8.3-5 Required TMDL Implementation Measures for Sediment Discharges Associated with Grazing

Source(s) and Performance Standard(s)	Actions	Implementing Parties	Completion Dates
<p>Surface erosion associated with livestock grazing: Attain or exceed minimal residual dry matter values consistent with University of California Division of Agriculture and Natural Resources guidelines; and</p> <p>Roads: Design, construct, and maintain rural roads to minimize road-related sediment delivery to stream channels; and</p> <p>Gullies and/or shallow landslides: Promote natural recovery and minimize human-caused increases in sediment delivery from unstable areas.</p>	<p>Submit a Report of Waste Discharge¹ to the Water Board that provides, at a minimum, the following: description of the property; identification of site-specific erosion control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified erosion control measures.</p>	<p>Landowner and/or ranch operator</p>	<p>June 2014</p>
	<p>Comply with applicable waste discharge requirements (WDRs) or waiver of WDRs.</p>	<p>Landowner and/or ranch operator</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
	<p>Report progress on implementation of site specific erosion control measures.²</p>	<p>Landowner and/or ranch operator</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
<p>¹ Or compliance with applicable conditional waivers of WDRs that may be adopted by the Water Board. ²These reports may be prepared individually or jointly or through a recognized third party.</p>			

Table 7.8.3-6 Required TMDL Implementation Measures for Sediment Discharges Associated with Rural Lands¹

Sources and Performance Standards	Actions	Implementing Parties	Completion Dates
<p>Roads: Design, construct, and maintain rural roads to minimize road-related sediment delivery to stream channels ; and</p> <p>Gullies and/or shallow landslides: Promote natural recovery, and minimize human caused increases in sediment delivery from unstable areas.</p>	<p>Submit a Report of Waste Discharge² to the Water Board that provides, at a minimum, the following: description of the property; identification of site-specific erosion control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified erosion control measures.</p>	<p>Landowners</p>	<p>June 2014</p>
	<p>Comply with applicable Waste Discharge Requirements (WDRs) or waiver of WDRs.</p>	<p>Landowners</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
	<p>Report progress on implementation of site specific erosion control measures.³</p>	<p>Landowners</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
<p>1. Rural lands include: non-farmed and non-grazing portions of parcels >10 acres that contain one or more residences, and/or a winery; vacant residential parcels >10 acres; and/or portions of 10-acres or larger parcels with secondary vineyard, orchard, and/or grazing. Parcels smaller than 10 acres, but that are identified by Water Board staff as posing a threat to water quality, may also be required to implement the specified actions.</p> <p>2. Or compliance with applicable conditional waivers of WDRs that may be adopted by the Water Board</p> <p>3. These reports may be prepared individually or jointly or through a recognized third party.</p>			

Table 7.8.3-7 Required TMDL Implementation Measures for Sediment Discharges associated with Parks and Open Space, and/or Municipal Public Works

Landowner Type	Sources and Performance Standards	Actions	Implementing Parties	Completion Dates
PARKS AND OPEN SPACE AND PUBLIC WORKS	<p>Roads: Design, construct, and maintain rural roads to minimize road-related sediment delivery to stream channels; and</p> <p>Gullies and/or shallow landslides: Promote natural recovery, and minimize human caused increases in sediment delivery from unstable areas.</p>	<p>Submit a Report of Waste Discharge¹ to Water Board that provides, at a minimum, the following: description of the road network and/or segments; identification of erosion and sediment control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified control measures. For paved roads, erosion and sediment control actions could primarily focus on road crossings to meet the performance standard.</p> <p>Adopt and implement best management practices for maintenance of unimproved (dirt/gravel) roads, and conduct a survey of stream-crossings associated with paved public roadways, and develop a prioritized implementation plan for repair and/or replacement of high priority crossings/culverts to reduce road-related erosion and protect stream-riparian habitat conditions.</p>	<p>Sonoma County Stormwater Management Program (SWMP)</p> <p>State of California, Department of Parks and Recreation</p> <p>State of California, Department of Transportation</p> <p>County of Sonoma Transportation and Public Works</p>	June 2014
		<p>Comply with applicable Waste Discharge Requirements (WDRs) or waiver of WDRs.</p>	Landowners	As specified in applicable WDRs or waiver of WDRs, and/or the SWMP
		<p>Report progress on development and implementation of best management practices to control road-related erosion.²</p>	Landowners	As specified in applicable WDRs or waiver of WDRs, and/or SWMP
<p>¹ Or compliance with applicable conditional waivers of WDRs that may be adopted by the Water Board.</p> <p>²These reports may be prepared individually or jointly or through a recognized third party.</p>				

Table 7.8.3-8 Required TMDL Implementation Measures for Sediment Discharges associated with Urban Land Uses

Source	Performance Standards	Actions	Implementing Parties	Completion Dates
<i>Construction Stormwater Runoff</i>	Control and minimize sediment and erosion from construction sites through appropriate use of Best Management Practices.	<p>Comply with the requirements of the General Permit for Discharges of Storm Water Associated with Construction Activity (NPDES Permit No. CAS000002) or updated versions of the Construction General Permit.</p> <p>Develop, maintain, and implement a Storm Water Pollution Prevention Plan (SWPPP) that describes BMPs to be used to control erosion and sedimentation.</p> <p>Develop and implement a sediment monitoring plan if the construction site discharges directly to Sonoma Creek or its tributaries.</p>	Owners or Operators of Sites under Construction	As specified in the Construction General Permit (NPDES Permit No. CAS000002)
<i>Industrial Stormwater Runoff</i>	Control discharges from industrial facilities to the standard of “best available technology economically achievable” and the “best conventional pollutant control technology”.	<p>Comply with the requirements of the General Permit for Discharges of Stormwater Associated with Industrial Activities (NPDES Permit No. CAS000001).</p> <p>Develop a SWPPP and monitoring plan to identify sources of pollutants (including sediment) and the means to control them to reduce stormwater pollution.</p>	Owners or Operators of Industrial Facility Sites	As specified in the Industrial Stormwater General Permit (NPDES Permit No. CAS000001)

Water Quality Control Plan for the San Francisco Bay Region

<i>Municipal Stormwater Runoff</i>	Reduce discharge of pollutants, including sediment, to the maximum extent practicable (MEP) ¹	Comply with approved stormwater management plans. Comply with Municipal Stormwater Permit (NPDES Permit No. CAS000004).	Sonoma County Water Agency, County of Sonoma, City of Sonoma, Sonoma Developmental Center, and any other designated entities	As specified in approved stormwater management plan and in applicable NPDES permit (NPDES Permit No. CAS000004).
	Attenuate peak flows and durations from new and redevelopment projects to MEP standards.	Amend and implement stormwater management plans to control peak flow rates and durations	Sonoma County Water Agency, County of Sonoma, City of Sonoma, Sonoma Developmental Center, and any other designated entities	No later than June 2014
<i>State Highways Stormwater Runoff</i>	Control runoff from state highways and associated construction activities.	Comply with the Caltrans Statewide Stormwater Permit (NPDES Permit No. CAS000003).	California Department of Transportation (Caltrans)	As specified in applicable NPDES permit (NPDES Permit No. CAS000003).
<p>¹ MEP is the performance standard specified in Section 402(p) of the Clean Water Act. What constitutes MEP evolves with technology and feasibility, and therefore may change in the future. As of 2008, we consider MEP to be those standards specified in the Phase I Municipal Regional Stormwater Permit Revised Tentative Order (NPDES Permit No. CAS612008, provision C.3).</p>				

Table 7.8.3-9 Recommended Actions to Reduce Sediment Load and Enhance Habitat Complexity in Sonoma Creek and its Tributaries

Recommended Action	Management Objective(s)	Actions	Implementing Parties	Completion Dates and Notes
Prevent and Reduce Channel Incision	<p>Reduce rates of sediment delivery (associated with incision and associated bank erosion) to channels, by 80 percent.</p> <p>Enhance channel habitat as needed to support self-sustaining run of steelhead and enhance the overall health of the native fish community.</p> <p>Stabilize channel banks and riparian areas to reduce sediment loads from landslides.</p>	<p>Develop and prioritize channel restoration projects to address unstable areas, based on level of incision and/or landslide instability.</p>	<p>Landowners and/or designated agents, and reach-based stewardships</p>	<p>Comply with conditions of Clean Water Act Section 401 certifications</p>
Enhance Physical Habitat Structure	<p>Enhance quality of rearing habitat for juvenile salmonids by increasing riparian canopy, large woody debris, and frequency and depth of pool habitat.</p>	<p>Develop, prioritize, and implement plans to increase channel complexity, including increasing riparian canopy, pool habitat, and large woody debris.</p>	<p>Landowners and/or designated agents, and reach-based stewardships</p>	

Table 7.8.3-10 Recommended Actions to Protect or Enhance Baseflow

Recommended Action	Management Objective	Action(s)	Implementing Parties	Schedule/Notes
Enhance Summer Base Flows	Maintain suitable conditions for juvenile rearing, and smolt migration to Sonoma Creek estuary.	<p>Implement a groundwater management plan to: 1) maintain groundwater levels for the support of beneficial uses, 2) increase water recycling and conservation in order to enhance summer base-flows, 3) identify and protect groundwater recharge areas, 4) enhance the recharge of groundwater where appropriate; and 5) protect against adverse interactions between groundwater and surface water flows.</p> <p>Identify potential groundwater recharge areas and develop pilot projects.</p>	Sonoma County Water Agency, Valley of the Moon Water District, City of Sonoma, Basin Advisory Panel ¹ , and interested collaborators	The Sonoma Valley Groundwater Management Plan ² was adopted by the Sonoma County Water Agency in November 2007. The plan includes an implementation schedule to achieve recommended actions to protect or enhance baseflow.

¹The Basin Advisory Panel was formed to act as the groundwater management plan stakeholder group for the Sonoma Valley Basin

² The Sonoma Valley Groundwater Management Plan (developed by the Sonoma County Water Agency, Valley of the Moon Water District, and City of Sonoma) is a non-regulatory plan aimed at locally managing, protecting, and enhancing groundwater resources.

Table 7.8.3-11 Recommended Actions to Restore to Fish Passage

Recommended Action	Management Objective(s)	Action(s)	Implementing Parties	Schedule/Notes
Address Fish Passage Barriers	No significant structural impediments to salmonid migration or passage in mainstem or key tributaries.	Design, replace or retrofit road crossings to allow fish passage according to fish-friendly guidance such as those developed by FishNet 4C, Department of Fish and Game, or other appropriate entity with expertise in salmonid habitat restoration.	Local public agencies, watershed groups and landowners	
	Reduce the number of stream miles inaccessible to fish.	Develop, prioritize, and implement plans to remove identified barriers to fish passage.	Local public agencies, watershed groups, and landowners	

7.8.4 Napa River Sediment Reduction and Habitat Enhancement Plan

The goals of the Napa River Sediment Reduction and Habitat Enhancement Plan (Plan) are to:

- Conserve the steelhead trout population
- Establish a self-sustaining Chinook salmon population
- Enhance the overall health of the native fish community
- Enhance the aesthetic and recreational values of the river and its tributaries

To achieve these goals, specific actions are needed to:

- Attain and maintain suitable gravel quality and diverse streambed topography in freshwater reaches of Napa River and its tributaries
- Protect and/or enhance base flows in tributaries and the mainstem of the Napa River
- Reduce the number and significance of human-made structures in channels that block or impede fish passage
- Maintain and/or decrease summer water temperatures in tributaries to the Napa River

The following sections establish:

1. A sediment total maximum daily load (TMDL) defining the allowable amount of sediment that can be discharged into the Napa River, expressed as a percentage of the natural background sediment delivery rate to channels
2. An implementation plan to achieve the TMDL and related habitat enhancement goals

7.8.4.1 Problem Statement

Steelhead and salmon populations in the Napa River and its tributaries have declined substantially since the late 1940s. Results of recent analyses of fisheries and sediment sources indicate that:

- 1. Spawning and juvenile rearing habitat for salmon and steelhead are adversely affected by high concentrations of fine sediment (primarily sand) deposited in the bed of the Napa River and its tributaries.**

Successful reproduction by salmon and steelhead depends on adequate flow through streambed gravels (permeability) in order for eggs to hatch and larvae to grow. As the concentration of fine sediment (primarily sand) in the streambed increases, permeability decreases, which in turn increases egg and larval mortality, and ultimately causes a decrease in the number of young fish that emerge from the streambed. Similarly, as the concentration of sand in the streambed increases, the frequency and extent of streambed scour is intensified, further increasing mortality between spawning and emergence by washing eggs and/or larvae out of the bed during common high flow events.

Even small increases in the concentration of fine sediment in the streambed may degrade the quality of rearing habitat for juvenile steelhead and salmon. Young steelhead need open spaces between clusters of large cobbles and boulders in order to escape high flows and predation during the winter. Similarly, as the concentration of fine sediment in the streambed increases, growth and survival of juvenile steelhead and salmon decreases as a consequence of lower biomass of aquatic insect prey species, and increasing activity level, aggressive behavior, and attacks between juvenile salmon and steelhead as they compete for food.

2. Channel incision has greatly reduced the quantity and quality of spawning and rearing habitat for Chinook salmon in Napa River watershed. Habitat losses as a result of incision exert a significant negative influence on freshwater growth and survival of juvenile salmon, and therefore, on the number of Chinook salmon that ultimately return to spawn.

Channel incision, the progressive lowering over time of streambed elevation as a result of net erosion, has lowered the streambed of the mainstem of the Napa River by more than two meters since the start of the current episode of incision, which began sometime after 1965. As a result, habitat is being degraded. The channel has become isolated from its flood plain and there has been a large reduction in the size and frequency of riffles, gravel bars, side channels, and sloughs. These habitats provide essential spawning and juvenile rearing habitat for Chinook salmon. Human activities that have contributed to channel incision in the River, including (but not necessarily limited to) levee building, development projects that have increased peak runoff during storms, construction of large tributary dams, straightening of some mainstem channel reaches, filling of side channels, historical gravel mining, dredging to reduce flood risk, and intensive removal of large woody debris.

3. Low flows and stressful water temperatures during the spring and dry season, and fish migration barriers exert a significant negative influence on the number (and fitness) of juvenile steelhead that migrate to the ocean from the watershed, and as such, on the number of adults that successfully return to spawn.

Drifting aquatic insects produced in riffles often are the primary source of food for juvenile steelhead. Low or no flow over riffles during the spring and dry season greatly reduces this food source. An association between low and/or negative growth rates in juvenile steelhead and poor baseflow persistence was documented in the summer and fall of 2001 in Napa River watershed. Summer water temperatures in tributaries also are often stressful to juvenile steelhead, likely contributing to poor growth rates that were documented. If low growth rates in summer are not mitigated by high rates of growth during other times of the year, significant reductions in survival rates during all subsequent life stages may result.

Poor access to and from potential spawning and rearing habitat due to man-made structures built in channels (e.g., dams, road crossings, weirs, etc.) and human water uses have reduced the size of the steelhead run in the Napa River watershed. For example, approximately 30 percent of the land area in the Napa River watershed drains into over 400 on-channel reservoirs.

Due to excess erosion and sedimentation in the Napa River watershed, the narrative water quality objectives for sediment and settleable material are not being met, and cold freshwater habitat, wildlife habitat, fish spawning, recreation, and preservation of rare and endangered species beneficial uses are impaired. In addition, channel incision has reduced the quantity of gravel bars, riffles, side channels, and sloughs, which threatens Chinook salmon and other fish and aquatic wildlife species. Channel incision is a controllable water quality factor that is contributing to a violation of the narrative water quality objective for population and community ecology.

7.8.4.2 Numeric Targets

Meeting the numeric targets listed in Table 7.8.4-1 will allow water quality in the Napa River and its tributaries to achieve the Basin Plan's narrative water quality objectives for sediment, settleable material, and population and community ecology.

Table 7.8.4-1. TMDL sediment targets for the Napa River and its Tributaries

Spawning gravel permeability	Median value \geq 7000 cm/hr ^a
Streambed scour	Mean depth of scour \leq 15 cm ^b
<p>^a Target applies to all potential spawning sites for steelhead and salmon in the Napa River and its tributaries, excluding those upstream of municipal water supply reservoirs.</p> <p>^b Target applies to the response of the streambed to peak flows less than the bankfull event at all potential spawning sites for salmon in gravel-bedded reaches of: 1) mainstem Napa River; and 2) alluvial reaches of tributaries where streambed slope is between 0.001 and 0.02. Potential spawning sites can be identified based on the following: 1) dominant substrate size in the streambed surface layer is between 8 and 128 mm; 2) minimum surface area of gravel deposit is 0.2 square meters in tributaries and 1.0 square meter in mainstem Napa River; or 3) located within mainstem Napa River at a riffle head, pool tail, and/or pool margin or in tributary reaches where streambed slope $<$ 0.03, or in tributary reaches where streambed slope $>$ 0.03 in pool tails, backwater pools, and/or in gravel deposits associated with flow obstructions (e.g., woody debris, boulders, banks, etc.).</p>	

7.8.4.3 Sources

Field inventories conducted throughout the watershed provide credible estimates of the rates and sizes of sediment delivered to Napa River watershed channels between 1994 and 2004. Based on this work, and application of channel and reservoir mapping, the Water Board concludes that:

- More than half of fine sediment delivered to Napa River during the 1994–2004 period is associated with land use activities, including roads, human-caused channel incision, vineyards, intensive historical livestock grazing, and urban stormwater runoff.
- In addition to its prominence in the sediment budget, channel incision is the primary agent for isolation of the channel from its flood plain and a reduction in the quantity and frequency of spawning and rearing habitat for salmon and steelhead in Napa River and the lower reaches of its tributaries.
- Channel sediment loads vary greatly depending upon nature of underlying bedrock or sediment deposits, land use activities, and the location of dams.
- Thirty percent of the watershed drains into reservoirs constructed in tributary channels. These reservoirs capture all of the gravel and sand, and most of the finer sediment input to upstream channels. Nonetheless, anthropogenic activities, downstream of dams, are contributing enough sediment such that the fine sediment load is substantially elevated in the Napa River downstream of the reservoirs.

Mean annual sediment delivery rate to channels is estimated to have been 272,000 metric tons per year during the period from 1994 to 2004, which when considered in relation to the land area draining into the Napa River at Soda Creek (e.g., 584 km²), equals 466 metric tons per km² per year (Table 7.8.4-2). The natural background rate of sediment delivery during this period, absent dams and human-caused erosion is estimated to have been 252 metric tons per km² per year, which is calculated from Table 7.8.4-2 as follows:

Water Quality Control Plan for the San Francisco Bay Region

48,000 metric tons/year—sediment deposited in tributary reservoirs
 7,000 metric tons/year—sediment discharged through dams on tributaries
 92,000 metric tons/year—input to channels downstream of reservoirs
 147,000 metric tons/year

147,000 metric tons/584 km²—land area draining to Napa R. at Soda Creek
 =252 metric tons/km²/year

Therefore total sediment load in the Napa River at Soda Creek is estimated to have been 185 percent of natural background (e.g., 466/252 = 185%) during 1994-2004. Table 7.8.4-2 breaks down the sediment sources to the Napa River, with annual average rate calculated at Soda Creek over the 10-year study period.

Table 7.8.4-2. Mean Annual Sediment Delivery to Napa River at Soda Creek (1994-2004)

Source	Estimated Mean Annual Delivery Rate (metric tons/yr)
Land areas upstream of dams (fine sediment discharged from reservoirs)	
▪ Natural Processes	7,000
▪ Human Actions	11,000
Land areas downstream of dams	
▪ Natural Processes:	92,000
▪ Human Actions:	
○ Channel incision and associated bank erosion	37,000
○ Road-related sediment delivery (all processes)	55,000
○ Surface erosion associated with vineyards and/or livestock grazing	37,000
○ Gullies and shallow landslides associated with vineyards, and/or intensive historical grazing	30,000
○ Urban stormwater runoff and wastewater discharges	2,500
TOTAL	272,000
Notes: Drainage area for Napa River at Soda Creek = 584 km ² . Estimates above do not include sediment deposited and retained in tributary reservoirs, which includes all gravel and sand, and most of the finer sediment input to channels located upstream of the reservoirs. Approximately 104,000 metric tons per year of sediment are deposited in tributary reservoirs, 48,000 metric tons per year of which is derived from natural processes (Above estimates are rounded to the nearest thousand).	

7.8.4.4 Total Maximum Daily Load and Allocations

The Napa River sediment TMDL is established at 185,000 metric tons per year, which is approximately 125 percent of natural background load (based on sediment load estimates from the 1994-2004 period) calculated at Soda Creek. Natural background load depends upon natural processes, and varies significantly. Therefore, the TMDL and allocations are expressed both in terms of sediment mass and percent of natural background. The percentage based TMDL, 125% of natural background, applies throughout the watershed. In order to achieve the TMDL, controllable sediment delivery resulting from human actions needs to be reduced by approximately 50 percent from current proportion of the total load (Tables 7.8.4-3a and 7.8.4-3b). TMDL attainment will be evaluated at the confluence of Napa River with Soda Creek, which approximates the downstream boundary of freshwater habitat for salmon and steelhead. Attainment of the TMDL will be evaluated over a 5-to-10-year averaging period.

Because dams trap almost all upstream sediment inputs to channels, natural sediment input to channels downstream of dams equals only 62 percent of the total natural background load (e.g., amount that would have been input to Napa River absent dams and human caused erosion). Almost 50 percent of the TMDL can be allocated to human-caused sources. The TMDL equal to 125 percent of natural background load, can be achieved if human-related sources are reduced to the level of the allocations shown in Tables 7.8.4-3a and 7.8.4-3b).

Water Quality Control Plan for the San Francisco Bay Region

Table 7.8.4-3a. Load Allocations

Source category	Load during 1994-2004		Estimated reductions needed (percentage)	Load allocations	
	Metric tons/year	Percentage of Natural Background		Metric tons/year	Percentage of Natural Background
Land areas upstream of dams					
▪ Natural processes	7,000	4.8	0	7,000	4.8
▪ Human actions	11,000	7.5	51	5,000	3.6
Land areas downstream of dams					
▪ Natural processes	92,000	63	0	92,000	63
▪ Human actions:					
○ Channel incision and associated bank erosion	37,000	25	51	18,000	12
○ Roads	55,000	38	51	27,000	18
○ Surface erosion associated with vineyards and grazing	37,000	25	51	18,000	12
○ Gullies and shallow landslides associated with vineyards, and/or intensive historical grazing	30,000	20	51	15,000	10
TOTAL	269,000			182,000	123
Note: Above estimates for loads, percent reductions, and allocations are rounded to two significant figures					

Table 7.8.4-3b. Wasteload Allocations for Urban Runoff and Wastewater Discharges

Point Source Category	Current Load		Reductions needed (percentage)	Wasteload Allocations	
	Metric tons/year	Percentage of Natural Background		Metric tons/year	Percent of Natural Background
Construction Stormwater-NPDES Permit No. CAS000002	500	0.3	0	500	0.3
Municipal Stormwater NPDES Permit No. CAS000004	800	0.5	0	800	0.5
Industrial Stormwater NPDES Permit No. CAS000001	500	0.3	0	500	0.3
Caltrans Stormwater-NPDES Permit No. CAS000003	600	0.4	0	600	0.4
Wastewater Treatment Plant Discharges^a					
City of St. Helena NPDES Permit No. CA0038016	30	<0.1	0	30	<0.1
Town of Yountville/CA Veteran's Home NPDES Permit No. CA0038121	30	<0.1	0	30	<0.1
City of Calistoga NPDES Permit No. CA0037966	40	<0.1	0	40	<0.1
TOTAL	2500	2		2500	2
a. For wastewater treatment plant discharges, compliance with existing permit effluent limit of 30 mg/L of TSS is consistent with these wasteload allocations Note: Above estimates for loads, percent reductions, and allocations are rounded to two significant figures					

7.8.4.5 Implementation Plan

The actions described below, including the processes by which sediment and runoff control practices are proposed and implemented, are necessary to achieve TMDL targets and allocations and habitat enhancement goals. In addition, actions specified in this plan are expected to enhance steelhead run size and facilitate establishment of a self-sustaining Chinook salmon run.

Regulatory Tools

The only point sources of sediment identified in Tables 7.8.4-2 and 7.8.4-3b are those associated with urban stormwater runoff (e.g., municipal stormwater, runoff from State highways, and industrial and construction discharges) and wastewater treatment plants, which are regulated by NPDES permits. Table 7.8.4-4 shows implementation measures required of these sources.

The state’s Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program requires regulation of nonpoint source discharges using the Water Board’s administrative permitting authorities, including waste discharge requirements (WDRs), waiver of WDRs, Basin Plan Discharge Prohibitions, or some combination of these. Consistent with this policy, Tables 7.8.4-4a – 4d specify actions and performance standards by nonpoint source category, as needed to achieve TMDL sediment targets and allocations in Napa River watershed. The Water Board will consider adopting conditions for waiving WDRs that apply to the nonpoint sources (vineyards, grazing, roads, etc.) listed in Tables 7.8.4-4a – 4d, address all pollutants of concern, protect all beneficial uses, and balance the agricultural, environmental, recreational, and residential needs of the watershed.

Table 7.8.4-4 TMDL Implementation Measures for Sediment Discharges Associated with Urban Stormwater Runoff and Wastewater Discharges

Source Category	Actions	Implementing Parties
Urban stormwater runoff and wastewater discharges	Comply with applicable NPDES permits	Napa County, City of Napa, Town of Yountville, City of St. Helena, City of Calistoga, City of American Canyon, State of California, Department of Transportation, California Veterans’ Home, owners or operators of industrial facilities and construction projects > 1 acre

Problems associated with channel incision, related rapid bank erosion, and loss of essential habitat features, reflect and integrate multiple historical and ongoing disturbances, some of which are local and direct, and others that are indirect and distal. Effectively addressing these issues will require cooperative and coordinated actions by multiple landowners, working with public agencies, over significant distances along the river. The most effective means of controlling channel incision and reducing related fine sediment delivery to the river is a channel restoration program that re-establishes width-to-depth ratios and sinuosity values conducive to formation of alternate bars and a modest flood plain. The Water Board will work with stakeholders along the Napa River, through local stewardship groups, to implement such channel restoration/habitat enhancement projects. Tables 7.8.4-5a to 7.8.4-5d (Recommended Measures to Protect or Enhance Habitat), specify actions to address adverse impacts of channel incision on salmon habitat quantity and quality, and to accomplish habitat enhancement goals for flow, temperature, and fish passage for steelhead and salmon.

Individual landowners or coalitions may work with “third parties” to develop and implement sediment pollutant control programs. With regard to achievement of actions to protect or enhance baseflow, fish passage, habitat complexity, and stream temperature, the effectiveness of the recommended actions specified in Tables 7.8.4-5a through 7.8.4-5d, will be evaluated as part of the adaptive implementation program.

Minimization of Potential Impacts to Sensitive Natural Communities

In order to minimize potential impacts to sensitive natural communities that may not be fully protected through County regulations, Basin Plan amendment compliance actions will not be required or approved beyond the development footprint authorized by local land-use authorities in any of the following sensitive natural communities within the Napa River watershed:

- Redwood forest
- Ponderosa Pine alliance
- Tanbark Oak alliance
- Oregon white oak woodland
- Mixed serpentine chaparral
- Wet meadow grasses NFD super alliance.

Locations for these sensitive natural communities and/or land-cover types in the Napa River watershed can be determined by review of the Vegetation Map of Napa County, California (Thorne et al., 2004; <http://cain.ice.ucdavis.edu/regional/napavegmap/>), the Baseline Data Report (Chapter 4, Jones & Stokes, 2005) and/or the California Natural Diversity Database (<http://www.dfg.ca.gov/biogeodata/cnddb/>).

Table 7.8.4-4a Required and Trackable TMDL Implementation Measures for Sediment Discharges Associated with Vineyards¹

Land Use Category	Performance Standards	Actions	Implementing Parties	Completion Dates		
Vineyards	<p>Surface Erosion associated with vineyards: Control excessive rates of sediment delivery to channels resulting from vineyard surface erosion⁵; and</p> <p>Roads: Road-related sediment delivery to channels ≤ 500 cubic yards per mile per 20-year period; and</p> <p>Gullies and/or shallow landslides: Accelerate natural recovery and prevent human-caused increases in sediment delivery from unstable areas; and</p> <p>Effectively attenuate significant increases in storm runoff, so that the runoff from vineyards shall not cause or contribute to downstream increases in rates of bank or bed erosion.</p>	<p>Submit a Report of Waste Discharge² (RoWD) to the Water Board that provides, at a minimum, the following: a description of the vineyard; identification of site-specific erosion control measures needed to achieve performance standard(s) specified in this table; and a schedule for implementation of identified erosion control measures.</p> <p>Or</p> <p>Develop and begin implementing a farm plan certified under Fish Friendly Farming Environmental Certification Program or other farm plan certification program, approved as part of a waiver of WDRs. All dischargers applying for coverage under a waiver of WDRs also will be required to file a notice of intent (NOI) for coverage, and to comply with all conditions of the WDR waiver.⁴</p>	Vineyard owner and/or operator	October 2014		
		Comply with applicable waste discharge requirements (WDRs) or waiver of WDRs.			Vineyard owner and/or operator	As specified in applicable WDRs or waiver of WDRs
		Report progress on implementation of site specific erosion control measures. ³			Vineyard owner and/or operator	As specified in applicable WDRs or waiver of WDRs

¹To achieve TMDL allocations and consistent with the *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program* (State Board, 2004).
²Or compliance with applicable conditional waivers of WDRs that may be adopted by the Water Board.
³Reports may be submitted individually or jointly through a recognized third party.
⁴Additional conditions may be required under a General WDR and/or waiver program consistent with *the Policy for Implementation and Enforcement of the Non-Point Source Control Program* (State Board 2004), and/or as needed to avoid potentially significant environmental impacts.
⁵Napa County Conservation Regulations (County Code, Chapter 18.108) are effective in the control of excessive rates of sediment delivery resulting from vineyard surface erosion. Rates of sediment delivery are “excessive” when the predicted soil loss rate exceeds the tolerable soil loss rate (T), calculations as described in “The Universal Soil Loss Equation, Special Applications for Napa County, California” (USDA, 1994).

Table 7.8.4-4b Required TMDL Implementation Measures for Sediment Discharges Associated with Grazing¹

Land Use Category	Performance Standards	Actions	Implementing Parties	Completion Dates
<p style="text-align: center;">Grazing</p>	<p>Surface erosion associated with livestock grazing: Attain or exceed minimal residual dry matter values consistent with University of California Division of Agriculture and Natural Resources Guidelines⁴; and</p> <p>Roads: Road-related sediment delivery to channels ≤ 500 cubic yards per mile per 20-year period; and</p>	<p>Submit a Report of Waste Discharge² to the Water Board that provides, at a minimum, the following: description of the property; identification of site-specific erosion control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified erosion control measures.</p>	<p>Landowner and/or ranch operator</p>	<p>October 2014</p>
	<p>Gullies and/or shallow landslides: Gullies and/or shallow landslides: Accelerate natural recovery and prevent human-caused increases in sediment delivery from unstable areas.</p>	<p>Comply with applicable waste discharge requirements (WDRs) or waiver of WDRs.</p>	<p>Landowner and/or ranch operator</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
		<p>Report progress on implementation of site specific erosion control measures.³</p>	<p>Landowner and/or ranch operator</p>	<p>As specified in applicable WDRs or waiver of WDRs</p>
<p>¹To achieve TMDL allocations and consistent with the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (State Board, 2004). ²Or compliance with applicable conditional waivers of WDRs that may be adopted by the Water Board. ³These reports may be prepared individually or jointly or through a recognized third party. ⁴University of California 2002, California guidelines for residual dry matter (RDM) management on coastal and foothill annual rangelands. Rangeland Monitoring Series Publication 8092.</p>				

Table 7.8.4-4c Required TMDL Implementation Measures for Sediment Discharges Associated with Rural Lands^{1, 3}

Land Use Category	Performance Standards	Actions	Implementing Parties	Completion Dates
Rural Lands	<p>Roads: Road-related sediment delivery to channels ≤ 500 cubic yards per mile per 20-year period; and</p> <p>Gullies and/or shallow landslides: Accelerate natural recovery and prevent human-caused increases in sediment delivery from unstable areas.</p>	Submit a Report of Waste Discharge ² to the Water Board that provides, at a minimum, the following: description of the property; identification of site-specific erosion control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified erosion control measures.	Landowners	October 2014
		Comply with applicable Waste Discharge Requirements (WDRs) or waiver of WDRs.	Landowners	As specified in applicable WDRs or waiver of WDRs
		Report progress on implementation of-site specific erosion control measures. ⁴	Landowners	As specified in applicable WDRs or waiver of WDRs
<p>¹To achieve TMDL allocations and consistent with the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (State Board, 2004).</p> <p>²Or compliance with applicable conditional waivers of WDRs that may be adopted by the Water Board.</p> <p>³Rural lands, per Napa County definition include: non-farmed and non-grazing portions of parcels >10-ac that contain one or more residences and/or a winery; vacant residential parcels >10-acres; and/or portions of 10-acre or larger parcels with secondary vineyard, orchard, and/or grazing</p> <p>⁴These reports may be prepared individually or jointly or through a recognized third party.</p>				

Table 7.8.4-4d Required TMDL Implementation Measures for Sediment Discharges associated with Parks and Open Space, and/or Municipal Public Works¹

Landowner Type	Performance Standards	Actions	Implementing Parties	Completion Dates
PARKS AND OPEN SPACE AND PUBLIC WORKS	<p>Roads: Road-related sediment delivery to channels \leq 500 cubic yards per mile per 20-year period²; and</p> <p>Gullies and/or shallow landslides: Accelerate natural recovery and prevent human-caused increases in sediment delivery from unstable areas.</p>	<p>Submit a Report of Waste Discharge² to Water Board that provides, at a minimum, the following: description of the road network and/or segments; identification of erosion and sediment control measures to achieve performance standard(s) specified in this table; and a schedule for implementation of identified control measures. For paved roads, erosion and sediment control actions could primarily focus on road crossings to meet the performance standard.</p> <p>Adopt and implement best management practices for maintenance of unimproved (dirt/gravel) roads, and conduct a survey of stream-crossings associated with paved public roadways, and develop a prioritized implementation plan for repair and/or replacement of high priority crossings/culverts to reduce road-related erosion and protect stream-riparian habitat conditions.</p>	<p>Napa County Stormwater Management Program</p> <p>State of California, Department of Parks and Recreation</p> <p>State of California, Department of Transportation</p>	<p>October 2014</p>
		<p>Comply with applicable Waste Discharge Requirements (WDRs) or waiver of WDRs.</p>	<p>Landowners</p>	<p>As specified in applicable WDRs or waiver of WDRs, and/or the SWMP</p>
		<p>Report progress on development and implementation of best management practices to control road-related erosion.³</p>	<p>Landowners</p>	<p>As specified in applicable WDRs or waiver of WDRs, and/or SWMP</p>
<p>¹To achieve TMDL allocations and consistent with the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (State Board, 2004). ²Or compliance with applicable conditional waivers of WDRs that may be adopted by the Water Board. ³These reports may be prepared individually or jointly or through a recognized third party.</p>				

Table 7.8.4-5a Recommended Actions to Reduce Sediment Load and Enhance Habitat Complexity in Napa River and its Tributaries

Stressor	Management Objective(s)	Actions	Implementing Parties	Completion Dates and Notes
<p>Habitat degradation as a result of mainstem Napa River and lower reaches of its larger tributaries incising.</p>	<p>Reduce rates of sediment delivery (associated with incision and accelerated bank erosion) to channels, by 50 percent.</p> <p>Enhance channel habitat as needed to support self-sustaining run of Chinook salmon and enhance the overall health of the native fish community.</p>	<p>Develop and implement plans to enhance stream-riparian habitat conditions, and reduce fine sediment supply in mainstem Napa River and lower tributary reaches.</p>	<p>Landowners and/or designated agents, and reach-based stewardships</p>	<p>Comply with conditions of Clean Water Act Section 401 certifications (implementation of Rutherford Project completed by fall 2017, other projects by 2027)</p>
<p>Habitat degradation as a result of reduction in large woody debris in stream channels.</p>	<p>Enhance quality of rearing habitat for juvenile salmonids.</p>	<p>Develop and implement performance standards for protection of ecologically significant large woody debris in stream channels.</p>	<p>Napa County Stormwater Management Program and State Department of Parks and Recreation</p>	<p>Performance standards will be developed by Fall 2010, and implemented by Fall 2011</p>

Table 7.8.4-5b Recommended actions to protect or enhance baseflow

Stressor	Management Objective	Action(s)	Implementing Parties	Schedule/Notes
Low flows during dry season	Maintain suitable conditions for juvenile rearing, and smolt migration to Napa River estuary.	Local, State, and federal agencies to participate in a cooperative partnership to develop a plan for joint resolution of water supply reliability and fisheries conservation concerns.	Local municipalities working with Water Board, State Water Board (Division of Water Rights), National Oceanic and Atmospheric Administration Fisheries Service (NOAA), and California Department Fish and Game (DFG)	Adopt plan by Fall 2012
		Install and maintain dial-up water-level gage programs and implement public education program in 10 key tributaries for steelhead.	Local public agencies	Accomplish by Spring 2012
		Develop water-level guidelines to support juvenile salmonid rearing and migration.	Local public agencies	Adopt guidelines by Spring 2012
		Conduct water rights compliance survey to protect fish and water rights.	State Water Board(Division of Water Rights)	Schedule per consultation with National Oceanic and Atmospheric Administration Fisheries Service (NOAA), California Department Fish and Game (DFG), and Water Board

Table 7.8.4-5c Recommended Actions to Restore to Fish Passage

Stressor	Management Objective(s)	Action(s)	Implementing Parties	Schedule/Notes
Structures in channels that block or impede fish migration (note: flow-related barriers are addressed above)	No significant structural impediments to salmonid migration in mainstem or in 10 key tributaries for steelhead (including but not limited to the following): Dry, Milliken, Redwood, Sulphur, and York. Designation of remaining tributaries will be determined in consultation with Napa County RCD, CDFG, NOAA Fisheries, and USEPA.	Enhance conditions for adult and juvenile salmon and juvenile steelhead passage at Zinfandel Lane.	Local public agencies and landowners	Project completed by Fall 2012
		Restore passage for adult and juvenile steelhead to-and-from York Creek upstream of Upper Dam.	City of St. Helena	Schedule to be determined based on consultation with NOAA, and DFG
		Identify and develop a plan-to remedy all significant structural impediments to salmonid migration in ten key steelhead tributaries (including York).	Local public agencies and landowners	Complete comprehensive fish passage surveys in 10 key tributaries by Fall 2012. Schedule for barrier remediation to be determined based on consultation with NOAA and DFG

Table 7.8.4-5d Recommended Actions to Protect and/or Enhance Stream Temperature

Stressor	Management Objective(s)	Action(s)	Implementing Parties	Schedule/Notes
Stressful summer water temperatures in tributaries	Protect and/or enhance baseflow.	As described in Table 7.8.4-5b	As indicated in Table 7.8.4-5b	As described in Table 7.8.4-5b
	Enhance amount of ecologically significant large woody debris in channels.	As described in Table 7.8.4-5a	As indicated in Table 7.8.4-5a	As described in Table 7.8.4-5a
	Enhance potential shade along riparian corridors.	Implement management actions to accelerate recovery of native riparian tree species.	As indicated in Tables 7.8.4-4a to 4d.	As described in Tables 7.8.4-4a to 4d.

Agricultural Water Quality Control Program Costs

Implementation measures for grazing lands and vineyards constitute an agricultural water quality control program and therefore, consistent with California Water Code requirements (Section 13141), the cost of this program is estimated herein. This cost estimate includes the cost of implementing all actions to reduce sediment discharges and enhance habitat complexity as specified in the implementation plan, and is based on costs associated with technical assistance and evaluation, project design, and implementation of actions needed to achieve the TMDL. In estimating costs, the Water Board has assumed that owners of agricultural businesses (e.g., grape growers and ranchers), within the unincorporated area, own 75 percent of total land area on hillside parcels, and 95 percent of the land along Napa River and lower reaches of its tributaries. Based on these assumptions, we estimate total cost for program implementation for agricultural sources could be \$1.9-to-3.4 million per year throughout the 20-year implementation period. More than two-thirds of these potential costs are associated with reducing sediment discharges and enhancing habitat conditions (to address channel incision) in Napa River. Considering potential benefits to the public in terms of ecosystem functions, aesthetics, recreation, and water quality, it is anticipated that at least 75 percent of the cost of these actions will be paid for with public funds. Therefore, the total cost to agricultural businesses associated with efforts to reduce sediment supply and enhance habitat in Napa River is \$800,000 to \$1.7 million per year.

7.8.4.6 Evaluation and Monitoring

Three types of monitoring are specified to assess progress toward achievement of numeric targets and load allocations for sediment:

- 1) Implementation monitoring to document that required sediment control and habitat enhancement actions are implemented
- 2) Upslope effectiveness monitoring to evaluate effectiveness of sediment control actions in reducing rates of sediment delivery to channels
- 3) In-channel effectiveness monitoring (e.g., spawning gravel permeability and redd scour) to evaluate channel response to management actions and natural processes

Implementation monitoring will be conducted by landowners or designated agents. The purpose of this type of monitoring is to document that sediment control and/or habitat enhancement actions specified herein actually occur.

The Water Board will conduct upslope effectiveness monitoring to evaluate sediment delivery to channels from land use activities and natural processes. The first update will occur on or before the fall of 2017, when sediment delivery associated with land use activities should be reduced by 25 percent or more. A subsequent update may occur, assuming the numeric targets for sediment are not already achieved, on or before the fall of 2022, when sediment supply associated with land use activities should be reduced by 37 percent or more.

In-channel effectiveness monitoring should be conducted by local government agencies with scientific expertise and demonstrated capability in working effectively with private property owners (to gain permissions for access), as needed to develop a representative sample of stream habitat conditions, in relation to sediment supply and transport within the watershed. In addition, the Water Board will conduct in-channel effectiveness monitoring as part of the Surface Water Ambient Monitoring Program. In-channel effectiveness monitoring needs to include measurements of redd scour and spawning gravel permeability to evaluate attainment of water quality objectives for sediment, settleable material, and population and community ecology. To establish a high level of statistical confidence in estimated values,

spawning gravel permeability will need to be measured at 150 or more potential spawning sites located in ten-or-more tributaries, and 50 or more potential spawning sites in the mainstem of the Napa River. Redd scour will need to be measured in the mainstem Napa River at approximately 30 or more potential spawning sites, with 4 or more scour measurements per spawning site. Desired frequency for measurement of permeability and redd scour is once every two to three years. At a minimum, repeat surveys will be conducted once every five years.

In addition to the above described monitoring program to evaluate attainment of numeric targets for sediment, the Water Board will monitor turbidity and residual pool volume. Monitoring will be conducted in a subset of the channel reaches where spawning gravel permeability and/or redd scour are measured. Stream temperature and baseflow persistence will be monitored as part of the Surface Water Ambient Monitoring Program.

7.8.4.7 Adaptive Implementation

In concert with the monitoring program, described above, the Napa River Sediment Reduction and Habitat Enhancement Plan and TMDL will be regularly updated. Results of in-progress or anticipated studies that enhance understanding of the population status of steelhead trout and Chinook salmon in Napa River watershed, and/or factors controlling those populations, may also trigger changes to the plan and TMDL. At a minimum, data in response to the following questions will be considered to guide research and monitoring efforts and focus each subsequent update of the TMDL.

Key Questions to be considered in the course of Adaptive Implementation:

1. *What is the population status of steelhead and salmon in the watershed?* An improved understanding of the status of steelhead and salmon populations in the Napa River watershed is essential for guiding adaptive updates to the management actions recognized in this plan.

Two types of monitoring data may be needed to evaluate the population status of steelhead in the Napa River watershed: 1) "smolt" production and sizes, and 2) adult spawning run-size. Smolt refers to the life stage when juvenile salmon and trout migrate from freshwater to the ocean. Estimates of smolt production and sizes, and inter-annual variation in these parameters, can provide a strong basis for evaluating population status of ocean migrating species of trout and salmon, and influence of freshwater rearing habitat conditions on number of adults that successfully return to spawn. At least five years of monitoring (trapping) of ocean migrating smolts are needed to evaluate current steelhead population status. In addition to smolt trapping, three or more years of monitoring data are needed to estimate the number of adult steelhead returning to spawn. This information, when combined with estimates of smolt production and sizes, would provide a basis for assessing the influences of ocean and freshwater habitat on steelhead run-size, for validating smolt production estimates and predictions regarding ocean survival, and ultimately for evaluating the status of the steelhead population in the watershed.

A similar monitoring program is needed to evaluate the population status of the Chinook salmon in the Napa River watershed. Such a program might include the following elements: 1) adult spawning run-size and genetic structure; 2) smolt production; and 3) egg survival from spawning to emergence (emergence trapping). During the past two years, the Napa County Resource Conservation District has conducted surveys to estimate the number of adult salmon returning to spawn. These surveys should continue for at least three more years, both to estimate the number of spawners and inter-annual variations, and to collect fin clips, as needed to evaluate origins of the spawning adults (e.g., returning adults or strays from hatcheries or other streams). The hypothesis that Chinook salmon experience very high rates of mortality during all freshwater life stages in the Napa River watershed, could be confirmed or rejected through

direct monitoring of egg survival to emergence (emergence trapping), fry survival and growth, and smolt trapping.

2. *What are expected benefits of various actions to enhance habitat for steelhead and salmon?* For steelhead, the results of in-progress studies of juvenile growth and survival will enhance understanding of the significance of dry season base flow and temperature as potential limiters on steelhead run-size. Other information needed to refine the understanding of primary constraints on steelhead population size includes the following: a) comprehensive fish passage evaluations in all key tributaries that provide potential habitat for steelhead; b) dry season water-level monitoring in the same tributaries conducted over two-or-more consecutive years; and c) field surveys to evaluate winter rearing habitat quantity and quality. Given the above sources of information, it may be possible to accurately predict relative increases (high, medium, low) in smolt production associated with various management actions (e.g., baseflow enhancement, fish passage enhancement, reduction in fine sediment supply, etc.) in various locations throughout the watershed.

Key information sources needed to refine understanding of primary controls on Chinook salmon population size include egg survival-to-emergence and controls (e.g., redd scour, gravel permeability), fry survival and growth, and number and sizes of juvenile salmon migrating to the ocean. To this end, pre-and-post project monitoring associated with the proposed Rutherford channel enhancement project may provide an opportunity to determine the amount and types of habitat enhancement actions needed to support a self-sustaining run of Chinook salmon, and to enhance the overall health of the native fish community within the watershed. Key parameters that might be monitored to evaluate fisheries' response to channel enhancement could include: a) changes in quantity, quality, and frequency of key habitat types (e.g., riffles, pools, side channels, gravel bars); b) spawning gravel permeability and scour; c) base flow persistence and temperature; and d) relative abundance of native and introduced fish species.

7.9 WATER QUALITY ATTAINMENT STRATEGIES AND TMDLS FOR THE SUISUN BASIN (SEE [FIGURE 2-9](#))

7.9.1 Suisun Marsh Low Dissolved Oxygen/Organic Enrichment TMDL

The following sections establish the TMDL for dissolved oxygen (DO) in Suisun Marsh wetlands. The numeric targets, allocations, and implementation plan are designed to attain the numeric water quality objectives set forth in Section 3.3.5, reduce occurrences of anthropogenically-induced low DO in Suisun Marsh wetlands, specifically in sloughs and channels, and protect beneficial uses for aquatic life (i.e., EST, MIGR, RARE, and SPWN).

7.9.1.1 Problem Statement

Low DO events resulting from environmental conditions and management actions in some managed wetlands adversely impact the aquatic life beneficial uses in Suisun Marsh. These problems are particularly evident in the slow-flowing, low-mixing, back-end sloughs that dominate the western portion of the marsh. In fall, these sloughs experience low DO conditions caused by bacterial decomposition of vegetation in managed wetlands (e.g., duck clubs), leading to surface water that is anaerobic or has low levels of DO. When this water is drained from managed wetland properties, receiving waters in sloughs become degraded. Fish kills were observed in the western marsh with associated low DO conditions between 2000 and 2009. The extent of the environmental impacts of water released from managed wetlands depends on the residence time of the low DO water in the receiving water. Residence time is dependent on the amount of tidal circulation within the sloughs. Large tidal sloughs, such as Montezuma or Nurse sloughs, exchange water rapidly and thus are not as prone to low

DO problems. Small and especially dead-end sloughs experience less tidal exchange and longer residence times and, consequently, are particularly susceptible to low DO problems.

This TMDL focuses on resolving DO impairment of named and unnamed sloughs and channels in the western part of Suisun Marsh, including but not limited to Peytonia, Boynton, Sheldrake, Cordelia, and Goodyear sloughs.

7.9.1.2 Numeric Targets

The TMDL targets in Table 7.9.1-1 are the water quality objectives for dissolved oxygen designed to protect sensitive fish and invertebrates, thereby generally protecting aquatic organisms in Suisun Marsh sloughs and channels.

Table 7.9.1-1 Numeric Targets and TMDL for Suisun Marsh

Waterbody/Timeframe	Dissolved Oxygen Concentrations	
Suisun Marsh - All sloughs and channels / year-round	acute	≥ 3.8 mg/L ^a
	chronic	≥ 5.0 mg/L ^b
Montezuma, Nurse, and Denverton sloughs / January through April	chronic	≥ 6.4 mg/L ^b

- ^a Expressed as 1-day average
- ^b Expressed as 30-day running average

The acute DO objective (3.8 mg/L) ensures protection of juvenile and adult fish survival, and the chronic objective (5 mg/L) ensures protection of larval and juvenile growth effects under long-term exposure. The 6.4 mg/L chronic objective protects listed juvenile salmonids using the marsh as a migratory path. The acute objective is attained when the average daily DO concentrations are at or above 3.8 mg/L, and the chronic objectives are attained when average monthly (30-day) DO concentrations are at or above 5.0 mg/L or 6.4 mg/L in the applicable waterbodies. Continuous data collected at regular intervals (every 15 to 60 minutes) are needed to fully evaluate whether the objectives are met. A daily average is the arithmetic average of all DO measurements collected within a 24-hour period. The 30-day running average is the arithmetic average of daily averages for any 30 consecutive days. Each subsequent 30-day average is computed by sliding the averaging window by one day. Attainment of these objectives will ensure that conditions in the sloughs support the most sensitive aquatic life beneficial uses present.

7.9.1.3 Sources

Low dissolved oxygen is a common aquatic system response to elevated organic matter inputs. Tidal marshes and managed wetlands are naturally rich in organic matter due to the growth of wetland plants and their subsequent decay, which consumes oxygen. The natural tendency for organic enrichment in wetland environments is exacerbated in Suisun Marsh due to wetland management activities. Flooding and draining cycles and vegetation management practices at managed wetlands induce releases of organic carbon from wetland soils and vegetation beyond what would naturally occur. Other sources of organic oxygen demanding substances (carbon and nutrients) include the treated wastewater discharge from the Fairfield-Suisun Sewer District treatment plant (municipal wastewater), municipal stormwater runoff, and natural biotic processes in the marsh.

7.9.1.4 Total Maximum Daily Load and Allocations

The TMDL is equivalent to the TMDL targets in Table 7.9.1-1. The TMDL allocations are summarized in Table 7.9.1-2. These allocations apply year-round. Marsh landowners, the Suisun Resource Conservation District (SRCD), California Department of Fish and Wildlife (CDFW), California Department of Water Resources (DWR), and U.S. Bureau of Reclamation (USBR) are collectively responsible for meeting the managed wetlands allocations.

Table 7.9.1-2 Wasteload and Load Allocations

Source	Allocations
	Wasteload Allocations
Fairfield-Suisun Sewer District (FSSD) NPDES Permit No. CA0038024	Discharge shall not cause DO concentrations in receiving waters to decrease below 5.0 mg/L June 1-November 15 and 7.0 mg/L during all other times of the year (as 30-day running average)
Municipal stormwater runoff in tributaries draining to Suisun Marsh NPDES Permit No. CAS612008	DO concentrations in local tributaries draining urban areas and discharging to Suisun Marsh shall be ≥ 5 mg/L (as 30-day running average)
	Load Allocations
Managed wetlands	Discharges from managed wetlands shall not cause the DO concentrations in the sloughs to decrease below 3.8 mg/L (as daily average) and 5 mg/L (as 30-day running average)

7.9.1.5 Implementation Plan

The Suisun Marsh wetlands provide habitat for dozens of fish and aquatic invertebrate species, as well as a variety of resident and migratory waterfowl and shorebirds. The intended outcome of the implementation plan is to improve habitat conditions for aquatic organisms and wildlife and to minimize or avoid adverse effects of low DO concentrations. This implementation plan provides directions for implementing the TMDL and allocations and focuses on the following:

- Actions to control internal sources of low DO at managed wetlands;
- Actions to control external sources of low DO from municipal wastewater and municipal stormwater runoff; and
- Actions resulting from Estuary-wide plans and policies.

Internal sources at managed wetlands

Load allocations from managed wetlands will be implemented through Clean Water Act section 401 certifications and/or waste discharge requirements issued to responsible parties to attain DO concentrations in sloughs receiving discharges from managed wetlands. The Water Board will continue to require implementation of best management practices (BMPs) and DO monitoring in sloughs to attain the load allocations as part of the 401 certification of the U.S. Army Corps of Engineers' Regional General Permit (RGP). The RGP authorizes managed wetland operation and maintenance activities, including levee stability improvements and maintenance of water control facilities and structures in the marsh. These activities are conducted by private land owners and public entities (CDFW, DWR, and USBR) and coordinated by SRCD. All aforementioned entities are collectively responsible for implementing the provisions required by the 401 certification to achieve the load allocations. The RGP also authorizes the

cleaning of interior ditches, including the Goodyear Slough outfall managed by DWR. Maintaining good flow circulation in Goodyear Slough is essential to improving DO conditions in the western marsh. DWR is responsible for conducting the cleaning of the outfall as often as necessary to maintain water circulation and specifically should inspect and clean the outfall before the fall flood up begins at the managed wetlands.

Understanding of DO conditions across the entire marsh slough complex will improve with additional monitoring data over time and space. The information gained through the implementation of BMPs at the managed wetlands in the western portion of the marsh will be used to refine selection and deployment of BMPs in the future. As a result of adaptive management and monitoring, additional implementation of BMPs could be required in the western marsh or elsewhere depending on implementation progress or if water quality conditions decline in the eastern marsh.

External sources: municipal stormwater runoff and municipal wastewater

Municipal stormwater runoff and municipal wastewater discharges have been identified as potential sources of organic material into the marsh sloughs and a potential conveyer of other pollutants that may affect DO (e.g., nutrients). This TMDL does not require new implementation actions because the existing regulatory programs for municipal stormwater runoff and municipal wastewater are in place and will continue to address mercury and dissolved oxygen.

The wasteload allocations for municipal stormwater shall be implemented through the Municipal Regional Stormwater NPDES permit (MRP) as receiving water limitations. These allocations apply to the City of Fairfield and Suisun City.

The wasteload allocation for the FSSD wastewater treatment plant shall be implemented through its NPDES permit as receiving water limitations.

Estuary-wide plans and policies

Future large-scale tidal marsh restoration efforts, mitigation projects, and new flow and salinity objectives for the Delta and Sacramento and San Joaquin Rivers may result in a more productive aquatic food web in Suisun Marsh and in localized and system-wide changes to DO concentrations. The Water Board will work with the State Water Board and other State and federal agencies managing Suisun Marsh to protect fish and wildlife beneficial uses and to better manage and improve water quality in Suisun Marsh.

Evaluation and Monitoring

Implementing parties are responsible for developing monitoring plans and conducting monitoring sufficient to assess compliance with the wasteload allocations, load allocations, and DO numeric targets established for Suisun Marsh sloughs. SRCD, together with the managed wetland owners and other agencies (CDFW, DWR, USBR), are required to conduct DO monitoring in the sloughs receiving discharge from managed wetlands, including continuous DO monitoring at compliance points, in order to evaluate whether they are achieving the load allocation and site specific objectives. These entities shall report monitoring results annually to the Water Board, document their efforts to improve water quality, describe the BMPs implemented during the fall discharge period, and coordinate details among adjacent managed wetlands, with a focus on efforts in the western marsh.

The Water Board will collaborate with other agencies, especially DWR, which operates a network of monitoring sites for the purpose of mitigating adverse impacts on salinity from the State Water Project and Central Valley Project, to identify opportunities to collect additional DO data in Suisun Marsh

Water Quality Control Plan for the San Francisco Bay Region

sloughs. This information will be used to enhance our understanding of DO variability and the extent to which deviations from the DO objectives occur under natural and anthropogenic conditions.

The MRP shall continue to require monitoring of DO to identify stormwater pollutant sources and to evaluate attainment of water quality objectives in receiving waters.

The FSSD NPDES permit shall continue to require monitoring of DO in receiving waters and implementation of BMPs to maintain optimal treatment performance in relation to DO.

The National Estuarine Research Reserve (NERR) conducts water quality monitoring in the First and Second Mallard sloughs, which represent minimally impacted tidal sloughs. Continued data collection by NERR will assist the Water Board in evaluating the potential effects of climate on the marsh and trends in DO conditions.