



Water Quality Progress Report

Guadalupe River Watershed – Mercury

(Approved 2010)

WATER QUALITY STATUS

- TMDL targets achieved
- Conditions improving
- Improvement needed
- Data inconclusive

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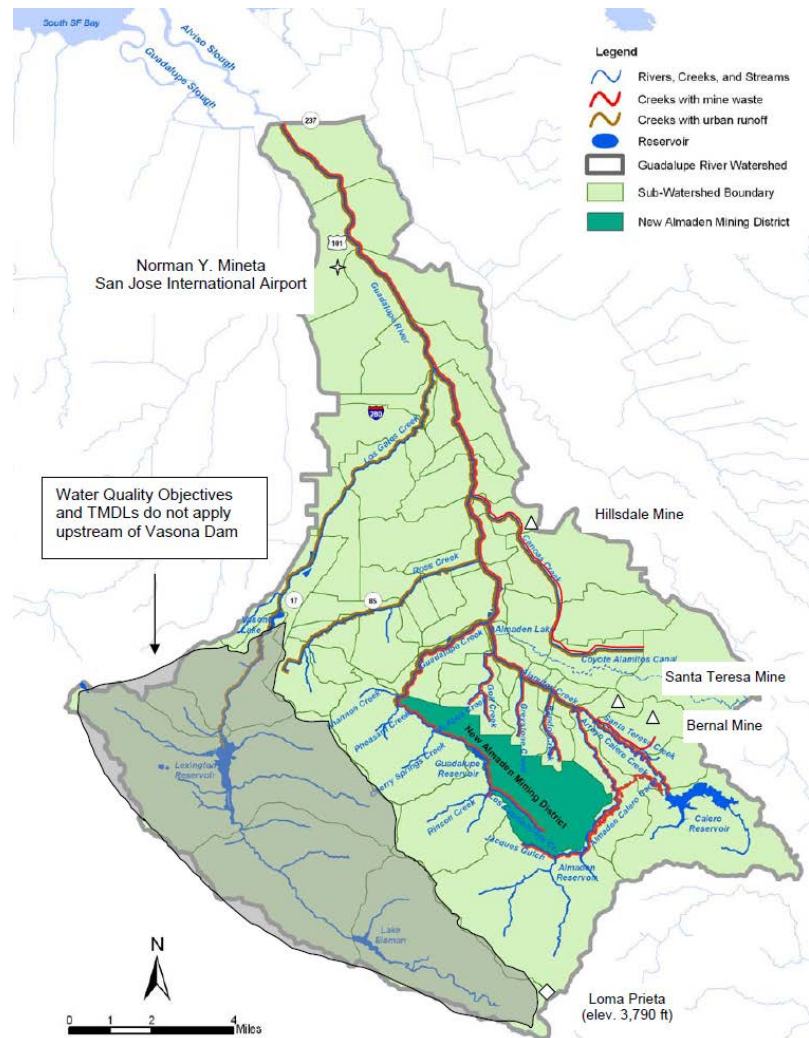
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Total Maximum Daily Load (TMDL) Summary

Waterbody – The Guadalupe River watershed is in the Eastern Santa Cruz Mountains, above the City of San Jose and draining to San Francisco Bay. This mountainous area in the central coast of California has numerous creeks that drain into several reservoirs before continuing downstream. The New Almaden Mining District is located near the headwaters of the central portion of the watershed. Guadalupe Creek flows adjacent to western side of the mining district. Alamos Creek is formed by several smaller creeks draining from the northeastern and eastern portions of the mining district. These two creeks drain into Lake Almaden and the Guadalupe River begins downstream of the lake. The river then flows 19 miles through heavily urbanized portions of San Jose, California. Three urban creeks (Ross, Canoas, and Los Gatos creeks) join the river before it discharges into South San Francisco Bay through Alviso Slough.

This TMDL addresses seven waterbodies in the 170 square mile Guadalupe River watershed: Guadalupe Reservoir, Calero Reservoir, Almaden Reservoir, and Lake Almaden as well as Guadalupe Creek, Alamos Creek, and the Guadalupe River upstream of tidal influence.



Guadalupe River Watershed

Water Quality Goals

Mercury water quality objectives were identified to protect aquatic organisms and wildlife. These objectives also protect humans who consume fish. The objectives are based on length in centimeters (cm) of trophic level¹ 3 fish.

For fish 5-15 cm in length: Not to exceed 0.05 mg methylmercury/kg (mg/kg) average wet weight in whole trophic level 3 fish.

For fish greater than 15-35 cm in length: Not to exceed 0.1 mg methylmercury/kg average wet weight in whole trophic level 3 fish.

These objectives apply to waters of the Guadalupe River watershed, except waterbodies upstream of Vasona Dam (illustrated in the map above).

Targeted Attainment Date – Fish tissue objectives and the San Francisco Bay mercury TMDL allocations to urban stormwater runoff and legacy mercury sources in the Guadalupe River watershed to be attained before 2029.

Water Quality Impairment – Mercury in the Guadalupe River watershed comes from historic mining activity, enriched soils, point sources, and deposition from air due to local and global emissions. Mercury is a naturally occurring element that has been mined because it is used for electrical applications, manufacture of chemicals, and certain lighting (among other devices), although its use is decreasing. Mining of mercury occurred in California for both direct use of the mercury as well as to extract gold during California's Gold Rush. It is also released from combustion (burning coal, natural gas, or petroleum). Mercury can be found in numerous chemical forms. One organic form, methylmercury, is the most hazardous form of mercury in the environment and can cause both chronic and acute toxicity to mammals (including humans), birds, and aquatic animals. In humans, methylmercury exposure can cause neurological symptoms as well as developmental concerns for children exposed in-utero. In addition, methylmercury exposure causes reduced reproductive success in wildlife. Within an organism, rates of intake of methylmercury tend to be greater than rates of elimination, such that it accumulates within tissues as an organism ages. Methylmercury also bioaccumulates, becoming increasingly concentrated in higher trophic levels of the food chain. The primary route of exposure for humans and wildlife to methylmercury is through consumption of contaminated fish and other aquatic organisms.

Fish collected from numerous creeks and reservoirs in the Guadalupe River watershed, downstream of the New Almaden Mining District, often contain extremely high concentrations of mercury. As of 2004, the fish tissue concentrations in the Guadalupe Reservoir were the highest in California. In 1987, California Office of Environmental Health Hazard Assessment issued a [fish consumption advisory](#) warning people not to eat fish from the Guadalupe River watershed. Mercury contamination is adversely affecting the contact recreation, wildlife habitat, and preservation of rare and endangered species beneficial uses. Therefore, several waterbodies have been added to the California List of Impaired Waters, including Guadalupe Reservoir, Calero Reservoir, Guadalupe Creek, Alamitos Creek, and the Guadalupe River upstream of tidal influence. Additional analyses confirm that Almaden Reservoir and Lake Almaden are also impaired by mercury.

Pollutant Sources – The Guadalupe River watershed lies within a region naturally enriched in mercury. Mercury found in the area was mined and used as part of the gold extraction process during California's Gold Rush in the 1800s. The New Almaden Mining District is the largest-producing mercury mine in North America (and fifth-largest in the world) and this mine is located in the watershed headwaters. Mining waste is the largest source of mercury to the watershed. This waste is associated with the New Almaden Mining District, the Guadalupe Mine, the Santa Teresa and Bernal mines, and depositional areas that accumulate mining waste downstream of the mines

¹ Trophic levels identify the position of an organism in the food chain, ranging from level one to level five where higher values are associated with carnivores and predators.

(including creeks, percolation ponds, and shallow impoundments) and contribute mercury-contaminated sediment during high flow events. Other sources of mercury include stormwater runoff (urban and nonurban), atmospheric deposition, and the Central Valley Project, which imports water to the Calero Reservoir and may be a small source of mercury to the watershed. In addition, reservoirs and lakes are a source of loading because mercury is converted to methylmercury in their surface sediment. Methylmercury is produced in surface sediments by bacteria. The chemicals cycle and they also flux between the water column and deposition to the sediment. The methylated mercury is bioavailable to organisms in the food chain, so the active sediment layer in lakes and reservoirs is also an important source of mercury.

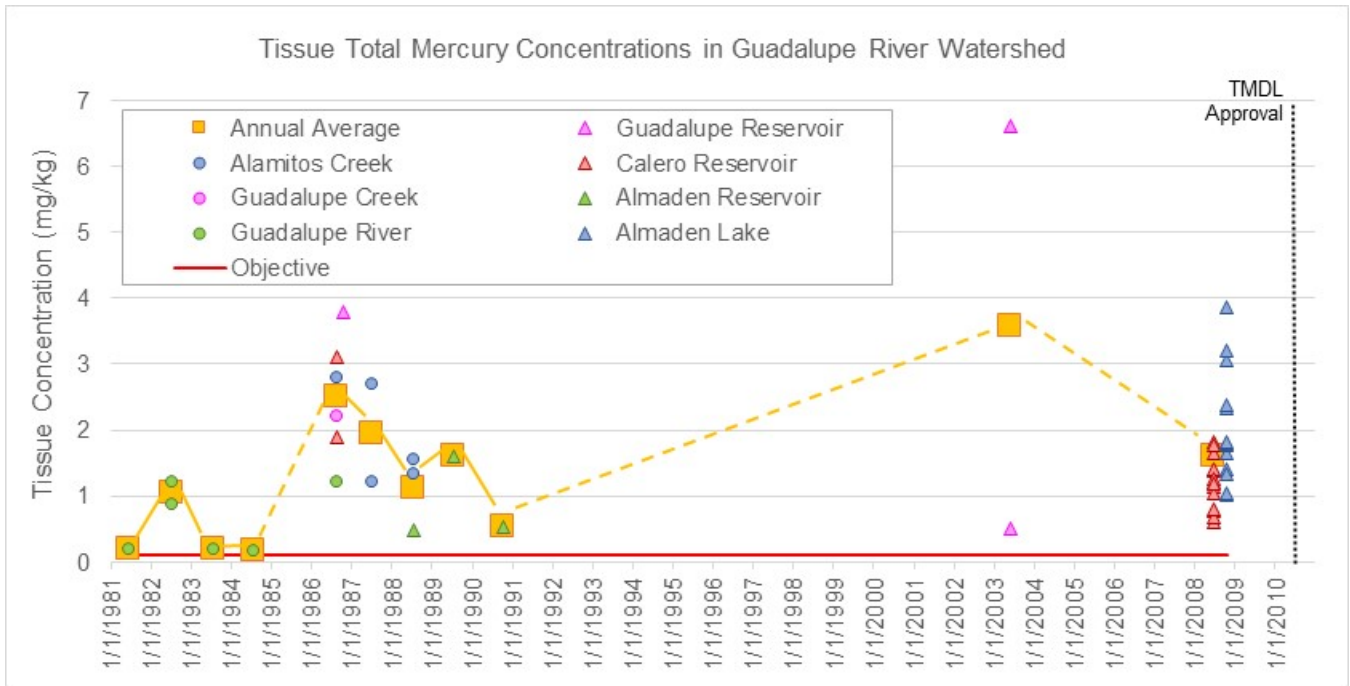
Loading Capacity and Allocations – The loading capacity is the maximum amount of a contaminant or stressor that can be assimilated by the waterbody without exceeding water quality objectives. The mercury loading capacity and source allocations in this TMDL are concentration-based limits. They are set to reduce both total mercury loads in the watershed as well as the transformation of mercury to methylmercury in lakes and reservoirs that are caused by anthropogenic activities. The loading capacity values are associated with mercury levels in suspended sediment for the creeks and rivers and mercury levels in water for the reservoirs and lakes. Specifically, the mercury loading capacity for Alamitos Creek, Guadalupe Creek, and Guadalupe River is 0.2 mg mercury per kg suspended sediment (dry weight, annual median), and for Guadalupe Reservoir, Almaden Reservoir, Calero Reservoir, and Lake Almaden the Loading Capacity is 1.5 nanograms total methylmercury per liter water (seasonal maximum, hypolimnion).

Load allocations were assigned to all nonpoint sources of mercury pollution, while wasteload allocations were assigned only to the permitted urban stormwater runoff discharges. The urban stormwater runoff discharges, nonurban stormwater runoff discharges, and atmospheric deposition allocations are proportionally equivalent to the mass-based mercury allocations assigned by the San Francisco Bay mercury TMDL ([link](#)). Implementation activities associated with these sources are consistent with the San Francisco Bay mercury TMDL. The load allocations for mercury mining waste and depositional areas are equivalent to the sediment concentration loading capacity, measured in erodible soil fines (which will attain the Guadalupe River watershed load allocation for legacy mining waste in the San Francisco Bay mercury TMDL), while the load allocation for methylmercury production in reservoirs and lakes is equivalent to the water concentration loading capacity. The TMDL linkage analysis provides a relationship between sources, production of methylmercury, and the fish tissue-based objectives, which consider bioaccumulation through the food chain. Achieving the concentration-based allocations for the various sources will ultimately result in attainment of the fish tissue-based objectives and restoration of beneficial uses.

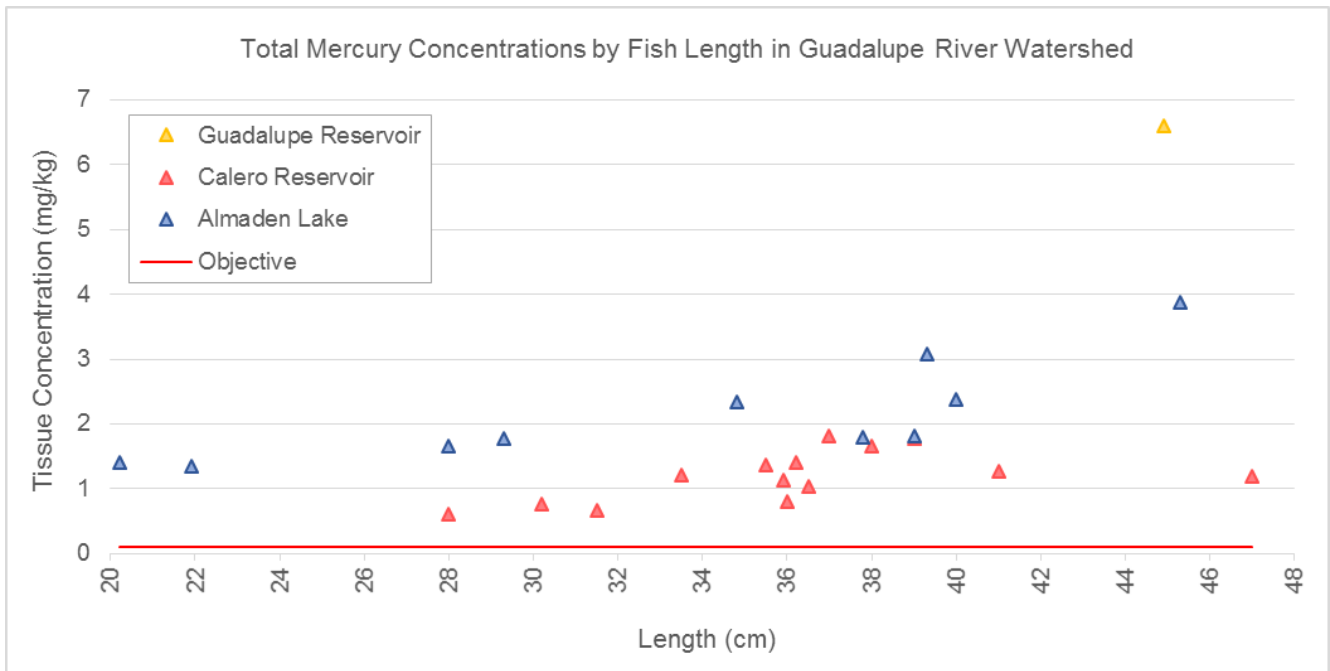
Is Water Quality Improving?

Prey fish tissue data are collected in the Guadalupe River watershed, although no data are available from California Environmental Data Exchange Network (CEDEN; www.ceden.org) from the 1980s to early 2000s. The available CEDEN data show that water quality has not yet improved (note: the TMDL was approved by the U.S. Environmental Protection Agency [EPA] in 2010; it is expected to take many years to observe improvements in fish tissue concentrations). Most of the samples analyzed were above the 0.1 mg/kg objective associated with fish 15-35 cm in length (note: all available data are shown below; most of these samples with reported fish lengths were 15-35 cm in length).

Overall, the measured concentrations from 2008-2009 are similar when compared to samples collected earlier. These data show samples at both creeks/rivers (circles in the graph below) and reservoirs/lakes (triangles in the graph below). The reservoir/lake data have higher concentrations than the creeks/rivers, but the sample size is too small to identify trends. In addition, the annual average concentration is shown on the plot (squares connected by lines where solid lines represent continuous years and dashed lines represent gaps between the years). These data confirm the lack of a temporal trend for the available data.



The available fish tissue data were further evaluated to compare mercury levels by fish length. All samples with both concentrations and fish length were plotted. The graphs include all lengths, not just those associated with the proposed evaluation lengths (less than 35 cm). The Guadalupe Reservoir data showed the highest concentrations, when compared to other fish; however, there is only one sample available from this waterbody and it is above the target maximum length of 35 cm. All of these Lake Almaden and Calero Reservoir samples were above the objective (nearly half of these are within the target evaluation length). Specifically, all of the data are above the objective and concentrations generally increase with size, especially in Calero Reservoir.



Through implementation of management measures associated with the mercury sources described above, these fish tissue concentrations are expected to decrease. The TMDL is being implemented in two phases and, ultimately, the fish tissue targets will be attained by 2029, so it will be many years before the tissue data show lower concentrations in response to the reduced loads from the watershed.

TMDL Progress – Implementation activities and milestones

Implementation Activity	Target Date	Status	Progress Details
<p>Phase 1: 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.</p>	<p>12/31/2018</p>	<p>In Progress</p>	<ul style="list-style-type: none"> • The Midpeninsula Regional Open Space District completed remediation of an eroding slope at Hicks Flat (link). • The Santa Clara County Department of Parks and Recreation has grant-funded mine cleanup projects underway (link). • Alamitos Creek: September 2008 meeting with property owners (presentation, questions, and manual). • Alamitos Creek: Cleanup efforts by the District on the District’s designated property (link). • The Water District continued voluntary methylmercury production and control studies, which it initiated in 2005 (see 2013 and 2011 progress reports).
<p>Phase 2: 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.</p>	<p>12/31/2028</p>	<p>In Progress</p>	<p>Various implementation activities are underway to achieve water quality objectives by this target date.</p>
<p>Attainment of urban stormwater wasteload allocations will be completed as part of the San Francisco Bay mercury TMDL (link)</p>	<p>None specified</p>	<p>In progress</p>	<ul style="list-style-type: none"> • San Francisco Bay mercury TMDL provides details on the implementation activities and progress towards achieving TMDL targets. See San Francisco Bay Water Board website for the TMDL.

Implementation Activity	Target Date	Status	Progress Details
<p>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.</p>	<p>13267 orders: December 2010</p> <p>13304 Orders: 06/30/2011</p>	<p>Complete</p>	<ul style="list-style-type: none"> • Water Code Section 13267 Technical Report Requirements on Erosion of Mercury Mine Wastes at the New Almaden Mercury Mining District and Guadalupe Mine, Santa Clara County, Letter to Stephen Abbors, General Manager, Midpeninsula Regional Open Space District dated June 18, 2009 (CIWQA #717685). • Site Cleanup Requirements (SCR) Order No. R2-2013-0024 for Guadalupe Mine, owned by the Guadalupe Rubbish Disposal Company (GRDC). The SCRs require GRDC to complete appropriate mercury mining waste cleanup and stabilization measures, focused on erosion control, by December 31, 2015 (link).
<p>Mercury Mines: 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.</p>	<p>06/01/2012</p>	<p>Complete</p>	<ul style="list-style-type: none"> • Midpeninsula Regional Open Space District, Mercury Mine Waste Erosion Inventory: Rancho De Guadalupe Area Sierra Azul Open Space Preserve, Revised, April 2011 (link) • Santa Clara County Department of Parks and Recreation, Almaden Quicksilver County Park and Santa Teresa County Park Mine Material Evaluation, Amended Final Report, May 2011 (link) • Guadalupe Rubbish Disposal Company, Technical Report on Erosion of Mercury Mining Wastes at Guadalupe Mercury Mine, Dec. 2010 (link), Addendum April 2011 (link), Addendum July 2011 (link)

Implementation Activity	Target Date	Status	Progress Details
<p>Mercury Mines: 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. Implement the approved plans in accordance with the approved schedule.</p>	<p>within 6 months of approval of the investigation report</p>	<p>In Progress</p>	<ul style="list-style-type: none"> • The Midpeninsula Regional Open Space District developed a plan and funding for the Hicks Flat Remediation Project. • The Santa Clara County Department of Parks and Recreation developed plans and secured grant funding for several project: <ul style="list-style-type: none"> ○ Senador Mine (as of April 2014, County Parks completed 90% design plans) ○ Calcine-paved roads (as of April 2014, County Parks completed 60% design plans) ○ Jacques Gulch (as of April 2014, County Parks secured funding for initial design plans) • Hacienda Furnace Yard creeks (as of April 2014, County Parks is developing design plans to restore creeks)
<p>Mercury Mines: 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.</p>	<p>12/31/2018</p>	<p>In Progress</p>	<ul style="list-style-type: none"> • The Midpeninsula Regional Open Space District completed remediation of an eroding slope of mercury mining waste at Hicks Flat (link) in September 2013. The project was funded by a Water Board and U.S. EPA Clean Water Act Section 319(h) grant, and was conducted in cooperation with the San Francisco Estuary Partnership. • The Santa Clara County Department of Parks and Recreation has grant-funded mine cleanup projects underway (link): <ul style="list-style-type: none"> ○ Senador Mine (300 pounds of mercury will be removed or stabilized by 2015 dry season) ○ Calcine-paved roads (remediation of 4 miles of roads; completed in 2015 dry season) ○ Jacques Gulch (initial design for portions not previously remediated; see link for previous remediation) ○ Hacienda Furnace Yard creeks (designs to restore creeks)

Implementation Activity	Target Date	Status	Progress Details
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.	None specified	In Progress	<ul style="list-style-type: none"> Water Board reissued a waste discharge requirement and water quality certification to the Santa Clara Valley Water District to implement its Stream Maintenance Program (link). The Program is specified in the Stream Maintenance Program Manual. Activities include vegetation management, sediment removal, and bank stabilization, among other activities.
Depositional Areas: For Alamos Creek, 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 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.	12/31/2028	In Progress	<ul style="list-style-type: none"> Water Board held a September 2008 meeting with property owners (presentation, questions, and guidance manual) Cleanup efforts by the District on the District's designated property (link)
Santa Clara Valley Water District conduct technical studies of methylmercury production and control.	None specified	Complete/ Ongoing	<ul style="list-style-type: none"> The District continued voluntary methylmercury production and control studies, which it initiated in 2005 (see 2013 and 2011 progress reports).
The Water 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 .	None specified	Complete/ Ongoing	<ul style="list-style-type: none"> Initially tried solar powered circulators, which were effective in suppressing methylmercury production in Lake Almaden, but not in Almaden or Guadalupe Reservoirs (link). Recently installed more powerful hypolimnetic oxygenation systems in Calero and Guadalupe Reservoirs. The District had planned to run the Calero and Guadalupe systems continuously in the 2014 dry season, but drought will likely delay these tests.

Implementation Activity	Target Date	Status	Progress Details
The Water District shall install methylmercury controls in Calero Reservoir , if necessary.	12/31/2017	Complete/ Ongoing	<ul style="list-style-type: none"> Recently installed more powerful hypolimnetic oxygenation systems in Calero and Guadalupe Reservoirs. The District had planned to run the Calero and Guadalupe systems continuously in the 2014 dry season, but drought will likely delay these tests.
The Water 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.	December of odd years	Complete/ Ongoing	<ul style="list-style-type: none"> Progress Report: Methyl Mercury Production and Control in Lakes and Reservoirs Contaminated by Historic Mining Activities in the Guadalupe River Watershed (2013 and 2011)
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 Water District to undertake actions to reduce fish mercury concentrations to attain the targets.	None specified	In Progress	Studies are underway by the Santa Clara Valley Water District; cleanup and abatement orders will not be issued until the studies are complete.
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.	12/31/2018	In Progress	To be completed close to the end of Phase 1.
TMDL Compliance Monitoring			
Responsible parties to submit a (individual or coordinated watershed) monitoring plan for review and approval by the Executive Officer.	06/01/2011	Complete	<ul style="list-style-type: none"> Final Coordinated Monitoring Plan (CMP) was submitted on November 15, 2010 by the County of Santa Clara, the Guadalupe Rubbish Disposal Company, Inc., the Midpeninsula Regional Open Space District, and the Santa Clara Valley Water District Approved by the Water Board on February 1, 2011
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)	None specified	In Progress	<ul style="list-style-type: none"> The Midpeninsula Regional Open Space District completed remediation of an eroding slope of mercury mining waste at Hicks Flat (link).

Implementation Activity	Target Date	Status	Progress Details
2. Monitoring of mercury load at the points of discharge to demonstrate progress in reducing loads (applicable to mercury mines, and reservoirs and lakes)	None specified	In Progress	<ul style="list-style-type: none"> Data collection and modeling are being conducted to estimate pollutant loads through the Regional Monitoring Program (RMP) (link).
3. Fish tissue mercury monitoring to assess progress in attaining targets (applicable to mercury mines, and reservoirs and lakes)	None specified	In Progress	<ul style="list-style-type: none"> Prey fish were monitored at five locations in 2011 and 2012, and there was no statistically significant difference in prey fish mercury concentrations between these years. A cursory analysis of prey fish monitoring data shows that fish mercury concentrations were lower in reservoirs in 2011, as compared to 2004, but higher in Lake Almaden and creek sites. Additional prey fish monitoring expected in 2016.
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)	None specified	In Progress	<ul style="list-style-type: none"> Scheduled for the 2014-2015 wet season. Data collection and modeling are being conducted to estimate pollutant loads through the RMP (link).
5. Special studies to inform adaptive implementation of these TMDLs (applicable to mercury mines, urban stormwater runoff, and reservoirs and lakes).	None specified	In Progress	<ul style="list-style-type: none"> Data collection and modeling are being conducted to estimate pollutant loads through the RMP (link). The Water District control studies, initiated in 2005, provide information on the reservoirs and lakes (see 2013 and 2011 progress reports).

What Next?

Additional reductions are needed to achieve water quality goals. However, implementation activities are underway. Completion of the planned implementation activities for this TMDL will be necessary to achieve the targets.

Information Source Documents

- **San Francisco Bay Water Board website for the Guadalupe River Watershed Mercury TMDL** ([link](#))
- **Staff Report for Guadalupe River Watershed Mercury Total Maximum Daily Load (TMDL) Project** ([link](#))
- **San Francisco Bay Water Board Basin Plan Amendment, Guadalupe River Watershed Mercury Total Maximum Daily Load (TMDL) Project** ([link](#))

- **San Francisco Bay Water Board TMDL Resolution Approval** – Amending the Water Quality Control Plan for the San Francisco Bay Region to Establish New Mercury Water Quality Objectives, Total Maximum Daily Loads, and an Implementation Plan for Mercury in the Guadalupe River Watershed, Resolution No. R2-2008-0089 ([link](#))
- **EPA Approval Letter for TMDL** ([link](#))
- **EPA Approval Letter for Water Quality Objectives** ([link](#))
- **Guadalupe River Watershed Mercury TMDL Conceptual Model Report**, Final dated May 22, 2005 ([link](#))
- **Santa Clara Valley Water District** ([link](#))
- **Santa Clara Valley Urban Runoff Pollution Prevention Program** ([link](#))
- **New Almaden Mine CERCLA Site** ([link](#))
- **California Environmental Data Exchange Network** ([link](#))
- **Regional Monitoring Program (RMP) Data Query Tool by San Francisco Estuary Institute** – Contaminant Data Display and Download ([link](#))
- **Reducing methylmercury accumulation in the food webs of San Francisco Bay and its local watersheds** ([link](#))
- **Mercury Contamination and The South Bay Salt Pond Restoration Project** ([link](#))