Managing Inactive Mercury Mine Sites in the San Francisco Bay Region

This report was prepared using public funds by the Clean Estuary Partnership (CEP) to assemble technical information in support of development of a TMDL for mercury in San Francisco Bay. This document has not undergone formal peer review nor received CEP Technical Committee approval.

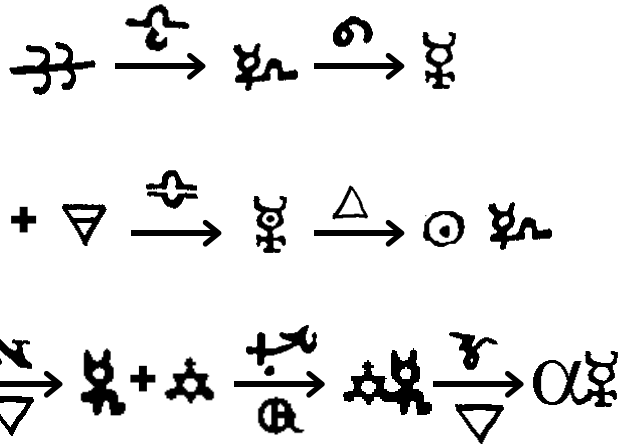
Managing Inactive Mercury Mine Sites in the San Francisco Bay Region

Status report on implementation of the Basin Plan Mines Program

Khalil Abu-Saba

Applied Marine Sciences, Inc.

July 22, 2003



Contents

1. Introduction

This report has been prepared in support of the development and adoption of a total maximum daily load (TMDL) for mercury in San Francisco Bay. California produced significant amounts of mercury from coast range mines during and after the gold rush. Many of these mine sites are located within the San Francisco Bay Region, including the New Almaden Mercury mine, which was at one time the largest producer of mercury in North America. Production at these sites ranged from a few hundred kilograms to more than 35 million kilograms of mercury produced at the New Almaden mines.

While mercury is no longer actively mined in the Bay Area, waste produced from these mining operations persists at the some of the sites, potentially affecting downstream water quality. The objectives of this report are to:

1) Summarize known mine sites, including their current status with respect to compliance with the existing Mines Program in the Basin Plan;
2) Describe an approach to assessing and managing impacts from known mine sites; and
3) Summarize options for remediating mine sites found to be significant sources.

2. The Basin Plan Mines Program

2.1 Framework

The San Francisco Bay Region's Water Quality Control Plan (the Basin Plan) contains a section in the Implementation Plan describing the Regional Board's program for managing active an inactive mining operations (pages 4-47 – 4-49). The goal of the Mines Program is to "restore and protect beneficial uses of receiving waters now impaired or threatened with impairment resulting from past or present mining activities."

Inactive sites are managed by identifying Best Management Practices necessary to protect water quality. The U.S. Natural Resource Conservation Service (NRCS) has developed a Resource Management System for Surface Mined Areas which references practices and treatment systems that address the following elements:

1) Erosion Control Practices that will dispose of surface water runoff at non-erosive velocities and reduce soil movement by wind and water to within acceptable limits;
2) Maintenance of adequate water quality and quantity for planned uses and to meet

federal, state and local requirements;
3) Pollution control to meet federal, state, and local regulations; and
4) A system of planned access and / or conveyance that is within local regulations and meets the needs for the intended use.

Best management practices (BMPs) at inactive mine sites include diverting stormwater runoff around contaminated areas, re-grading, capping, and re-vegetating exposed soil with elevated mercury concentrations, and other measures necessary to reduce erosive discharge of mercury. Implementation of these practices has resulted in substantial water quality improvements at inactive mercury mine sites such as the Gambonini Mine in Marin County and the New Almaden mine sites in Santa Clara County.

In 1980 the Regional Board negotiated a memorandum of understanding with the Council of Bay Area Resource Conservation Districts. The goal of this MOU was to provide for assessment and monitoring of potential and existing soil erosion-related water quality problems. It was agreed that local units of government should have the lead role in controlling land use activities that cause erosion.

The current framework of the Mines Program is that the Regional Board determines what information is needed to assess the potential for water quality impacts from inactive mine sites. Board staff work cooperatively with landowners, resource conservation districts, and local government agencies to gather the needed information and use it to guide the implementation of best management practices by the landowner or responsible party. In situations where cooperative approaches are not sufficient to protect water quality, the Regional Board has the authority to compel monitoring and BMP implementation through cleanup and abatement orders, waste discharge requirements, conditional waivers of waste discharge requirements, or national pollutant discharge elimination system permits.

2.2 Implementation

Implementation of the Basin Plan mines program for mercury starts with identifying sites where mercury was mined. Then sites should be inspected to assess the potential for water quality impacts and identify any needed BMP's. The Mines Program calls for landowners or responsible parties to develop and implement a Site Closure Plan to address site restoration and long term maintenance and monitoring, and a Site Management Plan to address stormwater runoff and erosion control BMPs.

Substantial progress has been in implementing the mines program. In 1995 the Basin Plan was amended to include a map and table showing the locations of all known mines and mineral production areas (Figure 4-5 and Table 4-16 of the Basin Plan). The locations and site histories of Bay Area mercury mines are shown in Table 1. In 1998 a report was prepared by Regional Board staff summarizing the results of site inspections for mine sites, including mercury mines (Seward, 1998). Based on that report, the condition and management of mercury mines in the Bay Area are summarized in Table 2.

2.3 Next Steps

The “site management tracking” section of Table 2 helps identify next steps in the implementation of the Basin Plan Mines Program. At a minimum, all sites should be completed through steps A – F (the shaded area in Table 2). The process of inspecting sites, identifying and contacting owners, notifying local agencies, and conducting load and risk assessments can very likely be completed through non-regulatory mechanisms. For some sites, it may be necessary for the Regional Board to use its regulatory authority to identify previous owners and operators, issue permits and orders, compel or initiate site cleanup, and conduct follow up monitoring (Steps G – J, unshaded area in Table 2). Possible next steps and priorities for known mine sites in the Bay Area are summarized in Table 3. Mine sites can be tentatively divided into four categories according to priority: low, medium, high, and highest priority. The priorities may change as new information is discovered.

2.3.1 Low priority sites

Sites are assigned a low priority if there are no obvious discharges, there is low connectivity to the Bay, and there is no immediate threat to fisheries resources in downstream reservoirs, embayments, or other sensitive habitat areas within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board.

The Silverado Mine in Napa County was inspected in 1997. Moderately elevated mercury concentrations were found in soils and sediments (2-5 ppm), and the mercury concentrations in the lower mine draingage (1.5 □g/L) exceed the statewide numeric objective (0.050 □g/L) by a factor of 30. Mercury loads from this mine are discharged into St. Helena Creek, which flows into the Lake Berryessa Watershed in the Central Valley Region. While the Central Valley Regional Water Quality Control Board will need to consider impacts of this mine on the beneficial uses of St. Helena Creek and downstream waterbodies, this mine is assigned a low priority for the San Francisco Bay mercury TMDL because if its low connectivity to the Bay.

The Chilleno Valley mine site in Marin County was inspected in 1991 and determined to be adequately managed. There was no evidence of tailings or excessive erosion, and so the only action taken was to work cooperatively with the property owners and the local Resource Conservation District to assure long term stability with respect to erosion. Essentially all of the necessary boxes have been checked for this site. For the future, Chileno Creek may be considered for inclusion as a watershed assessment site through monitoring conducted by Marin County Stormwater Pollution Prevention Program (STOPPP) to verify that no additional BMPs are needed to protect downstream water quality.

According to a 1997 survey, the Challenge Mine site in San Mateo County has no visible impacts to land or waters – in fact, the mine itself cannot be found. Sediments from a drainage adjacent to the mine area have 10 ppm mercury, which probably explains why

the water in that drainage exceeds the statewide numeric objective for mercury (0.050 □g/L) by a factor of 25 (1.2 □g/L). This area likely represents a common situation in coast range drainages, where cinnabar formations, both natural and disturbed, result in elevated mercury concentrations in soils and sediments. The most appropriate action for this location is to include the drainage (Arroyo Ojo De Agua Creek) in watershed assessments conducted by San Mateo County STOPPP in order to determine whether additional BMPs are necessary to protect downstream water quality. Because a children's play area is located in the vicinity, it may also be prudent to prepare a risk communication project, to help local users understand the difference between the risk of mercury exposure through the food chain vs. the relatively low risk posed by direct exposure to naturally occurring mineral formations.

The Silver Creek Mine in Santa Clara County is another area where there is no visual evidence of mine tailings or waste discharging to waters of the State, and low to moderate (2 ppm) concentrations of mercury in sediments near the mine area, according to a 1997 inspection. Silver Creek can be included in watershed assessments conducted by the Santa Clara County Urban Runoff Pollution Prevention Program (the SCVURPPP) to determine if BMPs are needed to protect downstream water quality.

In summary, for the low priority sites, the only actions likely to be necessary to fully implement the Basin Plan Mines Program are:

1) Identify property owners;
2) Communicate findings and recommendations to property owners, local RCD, and local stormwater management agency as appropriate;
3) Include the downstream drainage as part of a rotating watershed assessment within the next ten to twenty years.

2.3.2 Medium Priority Sites

Medium priority sites, like low priority sites, are those which have relatively low connectivity to the Bay, and lack visible evidence of mine waste discharging into state waters. Factors that elevate sites from low to medium include the presence of fishable reservoirs downstream that may be impacted by mercury, or lack of sufficient inspection and monitoring data to downgrade to a low priority site.

The Franciscan Mine and the Cycle Mine in Marin County are in the drainage basin of Soulajule Reservoir. Inspection of the Franciscan mine site in 1997 revealed no identifiable discharges to state waters. The Cycle mine site is presumed to be submerged by Soulajule Reservoir. Because Soulajule Reservoir is fished for crappie and large mouth bass, an assessment of mercury levels in fish and a study of local consumption patterns from this reservoir are the most appropriate actions. This should be coordinated through the Marin County Water District, which owns the reservoir.

The Hastings Mine in Solano County was inspected in 1997. Erosion from the mine area was characterized as minor. Similar to other smaller mine sites, sediments from the

drainage below the mine were found to have 10 ppm mercury, and spring water below the mine area was found to have 0.31 □g/L mercury, exceeding the statewide numeric objective for mercury by approximately six-fold. Drainage from the mine site flows into Lake Herman, which is listed as impaired due to mercury because of elevated mercury levels found in fish. Therefore, the most appropriate action is to work cooperatively with the City of Benecia, which owns Lake Herman, to conduct appropriate risk communication efforts, and to evaluate alternatives for managing the lake and its watershed which can help reduce mercury levels in fish. The current landowner of the Hastings mine site should be identified and contacted as well, and a follow-up visit should be conducted to determine whether additional BMPs are needed at this site.

The St. Johns Mine in Solano County produced considerable amounts of mercury – about 20,000 flasks. Although large hillside scarring and tailings piles greater than 10,000 cubic yards distinguish the site, a 1997 inspection reported that erosive discharges of mine tailings appear to be minimal. The drainage from the site flows through Rindler Creek into Chabot Lake, which is owned by the City of Vallejo. Chabot Lake is used for recreational fishing. Therefore, the most appropriate action is to assess mercury levels in fish from Chabot Lake, and coordinate risk assessment and communication with the City of Vallejo. Like Lake Herman, if mercury levels in fish from Chabot Lake are determined to be a problem, alternatives for managing the lake and its watershed should be developed. The property owner of the St. John's mine site should be identified and contacted, and the downstream drainage should be included in future watershed assessments conducted by the Vallejo Sanitation and Flood Control District to determine if additional BMPs at this site are needed.

The Corda Mine site in Marin County was inspected from an airplane reconnaissance in 1997, when a possible surface excavation was identified near the reported mine coordinates. Access to the site was impeded by private property restrictions, so an inspection on the ground has not been conducted. Therefore, the most appropriate next step is to identify and contact the property owner, conduct an inspection, and include the downstream drainage in watershed assessments conducted by Marin County STOPPP.

Im summary, the following steps are likely necessary for most medium priority sites:

1) Identify property owners;
2) Communicate findings and recommendations to property owners, local RCD, and local stormwater management agency as appropriate;
3) Conduct targeted risk assessment and risk communication, in coordination with appropriate local agency;
4) Conduct targeted monitoring; and
5) Consider special studies to evaluate mercury cycling and bioaccumulation.

2.3.3 High Priority Sites

Mine sites are assigned a high priority because of documented discharges into waters of

the State, high connectivity to the Bay, or obvious threats to downstream habitat.

The Mount Diablo Mercury mine is located in Contra Costa County, in the Marsh Creek drainage. Although the mine and its drainage are located within the Central Valley Regional Water Quality Control Board's jurisdiction, it is included in this report because Marsh Creek discharges into the San Joaquin River just upstream of the jurisdictional boundary of the San Francisco Bay Region, and because the Contra Costa Countywide Clean Water Program is regulated by both the San Francisco Bay and Central Valley Regional Water Quality Control Boards.

The magnitude of mining waste, discharges into Marsh Creek, and impacts to sediments and biota have been well documented (Slotton et al., 1996). Concerns over mercury discharges from Marsh Creek have delayed implementation of planned wetland habitat restoration projects downstream at Big Break, on the San Joaquin River. An important next step is to coordinate with the Central Valley Regional Water Quality Control Board to determine when staff will be assigned to initiate actions necessary to eliminate the discharge of mercury pollution into waters of the State.

The La Joya Mine in Napa County was observed in 1997 to have steeply cut tailings in contact with surface water. Because of the high potential to discharge mining waste into State waters, and because of the relatively high connectivity to the Bay through the Napa River, this is considered to be a high priority site. The next steps are to identify and contact the current property owner, and coordinate with the Napa County RCD to develop and implement a Site Management Plan. Depending on the level of cooperation attained, regulatory action by the Regional Board may or may not be needed to initiate monitoring and remediation.

The Bella Oaks and Borges mine sites in Napa County were inspected in 1997. There was no visible evidence of potential discharge to state waters at either location. However, because of the high connectivity to the Bay, follow-up monitoring and loads assessment should be conducted to determine whether either site represents a significant controllable source of mercury to the Bay. The Borges Mine drains into American Canyon Creek, and so monitoring and loads assessment could be coordinated with the City of American Canyon STOPPP. The Bella Oaks mine is located on private property in unincorporated Napa County, so monitoring and loads assessment may need to be conducted as a special project of the CEP, a proposition 13 proposal, a 319-grant project, or through some other funding mechanism.

2.3.4 The Gambonini Mine

Considerable progress has been made at the Gambonini mine. Although this site does not discharge into San Francisco Bay, it is included in this report as an example of how high priority mine sites can be managed.

This site was assigned an extremely high priority because of its threat to downstream commercial and recreational fisheries. Because of the high priority and the inability of the

current landowner to pay for remediation, the Regional Board used funds from the State Cleanup and Abatement Account pursuant to section 13304(b) of the Porter-Cologne Water Quality Control Act. In contrast to the liabilities incurred by the State at Penn Mine and Leviatian Mine in the Central Valley, the San Francisco Bay Regional Water Quality Control Board was shielded from liability by allowing the U.S. Environmental Protection Agency to take the lead as an emergency response action.

The property owner has been contacted and was issued a cleanup and abatement order in 1993. Remediation was coordinated with the Marin County RCD. Loads were assessed through monitoring prior to remediation (Whyte and Kirchner, 2000). Waste piles have been stabilized and re-graded, and follow-up monitoring is being conducted to assess the post remediation load and determine the extent of downstream impacts to water quality. The total cost of the cleanup and monitoring to date has been approximately $2,000,000.

2.3.5 The New Almaden Mining District

New Almaden and its associated mine sites present a unique case, because of the amounts of mercury produced, the size of the affected area, the complex ownership history, and the series of litigation, enforcement, monitoring, and remedial actions that have occurred and are ongoing.

Site History

New Almaden was at one time the largest producer of mercury in North America (Cargill et al., 1980), yielding over 35 million kilograms of mercury which was used first in gold mining and later in support of defense-related munitions production. It consists of several mercury mines, including New Almaden Mine, America Mine, Providencia Mine, Enriquita Mine, San Antonio Mine, San Mateo Mine, Senator Mine, and Guadalupe Mine. These mine sites are identified in Figure 4-5 and Table 4-16 of the Basin Plan. The discharge of mining waste from these areas has polluted Almaden Reservoir, Guadalupe Reservoir, and Calero Reservoir. Those reservoirs serve as water supply for groundwater recharge in the Santa Clara Basin. Numerous gulleys and small tributaries upstream of the reservoirs have been polluted. Downstream of the reservoirs, Arroyo Calero, Guadalupe Creek, and Alamitos Creek and the Guadalupe River have been polluted. The Guadalupe River conveys mercury-polluted sediments through Alviso Slough into lower South San Francisco Bay, which is part of the San Francisco Bay National Wildlife Refuge.

Mining in the area took place from 1845 until the most of the land was acquired by Santa Clara County in 1975, at which time all mining activity ceased. Persons or companies known to have mined mercury include:

Don Andreas Castillero	(deceased);
Alexander Forbes	(deceased);
George H. Sexton	(deceased);
Quicksilver Mining Company	(bankrupt);
New Almaden Inc.	(defunct);

New Idria Mining and Chemical Company (defunct); and
Cordero Mining (defunct).

In 1996, litigation over the issue of liability for the cleanup was settled, with financial responsibility divided between Santa Clara County, Myers Industries, Inc. (successor to New Idria Mining and Chemical Co.) and Newson, Inc. (successor to New Almaden, Inc.) (Rogers, 1996). It also is possible that a corporate successor to Cordero Mining exists, although if that information has been discovered it has not been published in a readily available document.

Current Status

Currently, lands and watercourses in and affected by inactive mercury mine sites of the New Almaden district are owned by:

County of Santa Clara (public agency);
Mid-Pennisula Regional Open Space District (public agency);
Guadalupe Rubbish Disposal Company Inc. (private landowner); and
Santa Clara Valley Water District (public agency);
City of San Jose (public agency);
Private homeowners (private landowners).

In 1987 the California Department of Toxic Substances Control (DTSC) ordered Santa Clara County to clean up areas within the County Park to protect human health from direct exposure to mercury. By 1998, remedial actions had been implemented in the park at Mine Hill, the Hacienda Furnace Yard, the Enriquita Mine Retort, the San Mateo Mine Retort, and the Senator Mine. The primary remedial actions undertaken were onsite containment via vegetated soil covers, substantial re-grading on mine hill, and a 1500 foot long rock and wire mesh barrier at the Hacienda Furnace Yard along the banks of Alamitos Creek (California Department of Toxic Substances Control, 2002). The total cost of remedial actions completed through this process has been approximately $4.2 million.

While DTSC has certified that threats to human health through direct contact have been mitigated, monitoring data suggests that additional work is needed to attain water quality standards. Fish collected from Almaden, Calero, and Guadalupe Reservoirs have mercury concentrations exceeding FDA action levels, prompting consumption advisories (Woodward Clyde Consultants, 1992). Stormwater monitoring data submitted by the County Parks indicates that the Basin Plan water quality objective for mercury (0.025 □g/L) is routinely exceeded during storm events. Mercury-polluted sediments have been distributed downstream, with concentrations increasing from 1 - 5 ppm at the base of the watershed to 10 – 50 ppm in the upper stream reaches. When these mercury-polluted sediments accumulate in sub-oxic areas (e.g., behind drop structures and diversion dams), methylmercury is formed at concentrations high enough to pose a substantial risk of bioaccumulation (Thomas et al., 2002).

There are at least seven programs or processes currently related to New Almaden, the Guadalupe River, and its tributaries and watersheds:

1) NPDES general industrial stormwater permits cover both the County Parks and the Guadalupe Landfill. These permits require basic stormwater monitoring.
2) The SCVWD is permitted to conduct operations and maintenance in streams and tributaries through a Waste Discharge Requirement (WDR).
3) There are three flood control projects planned or under way in the Guadalupe River, in its lower, middle, and upper reaches. These projects are subject to WDRs and water quality certifications ("401-certs"), and also require coordination with other resource agencies (e.g., California Department fo Fish and Game, United States Fish and Wildlife Service) through the Guadalupe River Flood Control Collaborative.
4) The United States Fish and Wildlife Service is discussing the possibility of a Natural Resources Damage Assessment (NRDA) with potentially responsible parties. (Santa Clara Basin Watershed Management Initiative, 2001)
5) The Santa Clara Valley Pollution Prevention Program (SCVURPPP) conducts watershed assessment and monitoring through compliance with its NPDES permit regulating the discharge of urban stormwater, as well as through participation in the Clean Estuary Partnership.
6) The Clean Estuary Partnership has provided funds to initiate the first year of a multi-year loads assessment on the lower Guadalupe River (Mckee and Leatherbarrow, 2002).
7) The South Bay Watershed Management Initiative (SBWMI) has formed a TMDL workgroup for the Guadalupe River. Through that workgroup, a contractor has been selected and a scope of work developed to produce a TMDL for mercury in the Guadalupe River. That TMDL addresses both mercury impairment in the Guadalupe River watershed as well as the Guadalupe River as a source of mercury to Lower South Bay.

Next Steps to Considerin the Guadalupe River Watershed

The scope of the multi-year loads assessment initiated by the Clean Estuary Partnership overlaps with self-monitoring requirements of WDRs issued to the SCVWD for flood control projects. Therefore, negotiating a funding partnership with the SCVWD or the U.S. Army Corps of engineers to support subsequent monitoring years is a useful next step that Regional Board staff could undertake.

The monitoring requirements of the NPDES general stormwater permits covering the County Park and the Landfill may need to be reviewed and revised. The current approach in the general permit is to sample first flush. This approach may not be appropriate to mining-impacted watersheds, when erosive remobilization may take place after first-flush events. Monitoring should address mercury loads and mercury methylation processes: where are there controllable loads, how do loads respond to BMP implementation, where is mercury converted to methylmercury, and are there any management actions possible that minimize either the transport of mercury into methylating areas or that reduce net

methylation rates?

The framework for answering these questions is best established through development of the Guadalupe River mercury TMDL. During the Fall of 2003, a conceptual model and data collection plan will be prepared and reviewed by the South Bay WMI's Guadalupe River Mercury TMDL workgroup.

In summary, the most important next steps at high priority sites are:

1) Locate and contact property owners;
2) Conduct responsible party search;
3) Issue permits, waivers, or cleanup and abatement orders, as appropriate;
4) Identify funding sources (Prop-13, Prop-50, Prop-40, 319-H grants) that could help close funding gaps when responsible parties cannot be identified.
5) Coordinate with other State and Federal regulatory and resource agencies, including DTSC, USFWS, and USEPA. DTSC Coordination will be essential in any situations requiring movement of soils having mercury concentrations above hazardous waste guidelines.

3. Summary of Approaches to Managing Mining-Impacted Watersheds

Watersheds impacted by mining can be subdivided into three general areas: upstream, instream, and downstream. Each area requires a different management approach, and will involve different groups of stakeholders. The following discussion summarizes some general approaches to be considered in each area.

3.1 Upstream management

Upstream, at the actual mine site(s), the approach is to identify soils, sediments, and waste piles bearing high concentrations (> 10 ppm) of mercury. These should be stabilized to reduce and eliminate the discharge of mercury-polluted sediments into State Waters. Visual cues to identify the need for this kind of action includes piles of waste rock or soil at a high angle of repose or in contact with State waters. Monitoring data needed before and after remediation includes mercury concentrations in soils and sediments, as well as in-stream monitoring of mercury and suspended load during storm events. Examples of this kind of management approach can be found at the New Almaden and Gambonini mine sites.

Some inactive mines may also be discharging acid mine drainage into State waters. In this case, the appropriate management actions are to divert surface water away from mine openings to reduce the water supply into the mines, and to capture and treat any discharges fed by subterranean flow. Visual cues that acid mine drainage is a problem include severely discolored water and total devastation of aquatic life for miles downstream of the discharge. Monitoring data needed before and after remediation includes pH, suspended load, and metals. While there are not any known discharges of acid mine drainage from mercury mine sites in the Bay Area, the New Idria mercury mine site in San

Benito County is an excellent example of how simple visual observations combined with monitoring data can point out obvious ongoing threats to water quality (Ganguli et al., 2000; San Benito County, 2003).

Typically, the responsibility for implementing management actions on mine sites falls to the current landowner and / or any previous land owners or mine operators. Responsibility for monitoring can fall either to the landowner and other responsible parties, or it may be undertaken as part of a regionally coordinated effort through stormwater programs, flood control agencies, or other special districts.

3.2 In-stream management

In-stream management needs to consider two factors: mercury loads and mercury methylation. In watersheds where substantial amounts of mercury have already been transported downstream, the majority of the mercury load may come from stream bed and bank erosion. Severely downcut areas provide important visual cues. Other approaches to assess the role of in-stream remobilization include measuring mercury concentrations in sediments of stream beds and banks, modeling erosion and degradation processes, and combining in-stream continuous monitoring of flow and suspended load with discreet sampling to quantify total water column mercury. Load management actions are typically directed at reducing channel velocity by re-grading channel banks to allow overflow during peak flow periods. In-stream operations and maintenance and construction of new projects should include a soil management plan to minimize the downstream transport of mercury polluted sediments. The recent restoration project conducted at Guadalupe Creek (in the upper Guadalupe River Watershed) by the SCVWD is an example of this kind of in-stream management.

The Guadalupe Creek restoration also shows how projects can consider mercury methylation. Prior to implementing the restoration, the project area was monitored to determine where elevated concentrations of methylmercury existed. The most significant pre-project finding was that mercury methylation was associated with low oxygen conditions. Based on the assessment, the restoration project was deemed by the project proponents to be a net benefit, because by restoring cold water fisheries habitat, the project would minimize stagnant pools and other areas prone to low oxygen conditions (Tetra Tech, 2000).

Responsibility for in-stream management and monitoring typically falls to flood control districts, riparian landowners, and/or project proponents with mitigation requirements attached to stream impacts.

3.3 Downstream management

Downstream, management alternatives for receiving waters will vary greatly with the nature of the waterbody in question. There are at least three downstream management scenarios relevant to the Bay Area that can be considered:

1) Lakes and reservoirs;
2) Planned wetland projects; and
3) Depositional zones at the estuary interface.

3.3.1 Lakes and Reservoirs

Lakes and reservoirs downstream of mine sites tend to act as sediment traps, substantially reducing the mercury load from mine sites to the Bay. Therefore, the management focus for mining-impacted lakes and reservoirs shifts away from loads discharge to the Bay, and towards the beneficial uses of the lakes and reservoirs themselves. Initial monitoring and risk assessment should be directed at the following questions:

1) Who fishes the lake or reservoir?
2) What fish are being caught for food?
3) What is the concentration of mercury in those fish?
4) Are consumption advisories needed?
5) If risk assessment shows that concentrations of mercury in fish are too high, what management alternatives are available to reduce those concentrations?

After conducting the necessary risk assessment and communication, and controlling all controllable upland mercury sources, lakes and reservoirs that still have consumption advisories could be considered for pilot implementation projects to reduce mercury levels in fish through oxygenation (e.g., Abu-Saba et al., 2003) or manipulation of other water quality factors, such as nutrients or flow. Municipal governments and water suppliers who own fishable reservoirs could consider applying for funding from CALFED or other funding sources to implement such pilot projects.

In the Bay Area, some mining-impacted reservoirs that could be considered for pilot projects include:

Almaden Reservoir (Santa Clara Valley Water District);
Guadalupe Reservoir (Santa Clara Valley Water District);
Calero Reservoir (Santa Clara Valley Water District);
Lake Herman (City of Benecia);
Chabot Lake (City of Vallejo); and
Soulajule Reservoir (Marin County Water District).

3.3.2 Wetland restoration projects

Wetlands are the second type of downstream waterbody potentially affected by the discharge of mining waste. Wetlands can potentially be areas of enhanced methylation because of their microbial communities, and enhanced bioaccumulation because of their complex food webs. Adaptive management questions about mercury in wetlands are

discussed in a separate report, and so are only briefly summarized in this report with respect to inactive mine sites.

The central mercury questions about the best approach to designing, constructing, and managing Bay Area wetlands are:

1) What mercury concentrations in sediments produce substantial increases in the risk of mercury exposure to humans and wildlife if those sediments are used in wetland projects?
2) What are some wetland design features (e.g., channel depth and configuration, covering vegetation, flushing rates) that affect mercury methylation rates?

Some important areas to address these questions include:

1) The Montezuma project in the northern reach of the Bay, where dredged Bay sediments (with mercury concentrations predominantly around 0.4 ppm) are being used to restore a tidal wetland;
2) The planned Big Break wetland restoration in the northern reach, which is downstream of the Mount Diablo Mercury Mine; and
3) The planned restoration of Pond A4 in lower South Bay, where a need exists for substantial amounts of foundation sediment because the pond is so subsided. The nearest source of readily available sediment is the regular dredging of the lower Gudalupe River for maintenance of flood capacity. However, dredged sediments from the Guadalupe River can be expected to have elevated mercury concentrations, so it is important to determine whether the use of these sediments as foundation material increases the risks of methylmercury exposure in the restored wetland habitat.

3.3.3 Depositional zones

One of the complicating factors in evaluating watershed loads is quantifying the transfer of pollutants through depositional zones. Sediments tend to deposit at the estuary interface, where flow velocities slow down and transport shifts from fluvial to tidal mixing (McKee and Newland, 2002). In some cases, these depositional zones are managed by flood control agencies or other special districts. A noteable example where the effect of management actions in the depositional zone on mercury loads needs to be evaluated is in lower South Bay. The depositional zone of the lower Gudalaupe River is managed by the Santa Clara Valley Water District. Monitoring studies in the region should focus on how much mercury is entering the depositional zone from fluvial transport, how much is removed through maintenance dredging, and what is the resulting net transfer of mercury into lower South Bay.

4. Cost-Benefit Analysis

4.1 Framework for predicting implementation costs

The costs of implementing the Basin Plan Mines Program can be projected by considering what implementation would take in terms of Regional Board staff time, other public agency staff time, and contract dollars to conduct monitoring, risk assessment and communication, and remediation. While there is insufficient information at present to rigorously predict future levels of effort, a framework for predicting costs is presented in Table 4. The table divides implementation into two phases: Phase 1 consists of the inspections, outreach, and risk assessment needed for all sites. Phase 2 represents more focused remediation and management efforts at a more limited subset of mine sites. Based on the assumptions about number of sites, priority, and levels of effort needed presented in Table 4, Phase 1 implementation of the Basin Plan Mines program is expected to cost approximately $1 million, whereas Phase 2 implementation would cost approximately $10 million. If fully funded, Phase 1 implementation could reasonably be completed within five years, whereas Phase 2 implementation could take 10 – 20 years before all sites are considered complete.

These estimates do not include costs associated with the Guadalupe River, which is a unique case because of the magnitude of mercury mobilized from the New Almaden mines. The DTSC-ordered remediation at New Almaden cost approximately $4.2 million. Development of a TMDL for the Guadalupe River to attain water quality standards is expected to cost between $ 1 million - $2 million. The implementation cost of that TMDL is unknown at present.

4.2 Funding mechanisms and public policy implications

There are four general revenue streams that could fund the mine site monitoring and remediation projects discussed in this report:

1) Federal funds. This includes programs such as the non-point source reduction program (US EPA's "319-h" grants that are administered by the SWRCB), and the U.S. Army Corps of Engineers Rehabilitation of Abandoned Mines (RAMS) program. Use of these funds spreads the costs of implementation among all U.S. taxpayers.

2) State Funds. This includes special voter-authorized bonds such as the Costa-Machado a Act (Proposition 13). Use of these programs spreads the cost of implementation among California taxpayers.

3) Local Government and Public Agency Funds. This includes property taxes, flood control fees, and sewerage rates. Although use of sewerage rates to remediate mine sites has been proposed as a "mass offset" in other contexts (Taylor, 1998; CVRWQCB, 2000), the legal basis for such an offset program is as yet unresolved. Use of local funds spreads the costs of implementation among local taxpayers and ratepayers.

4) Enforcement. In some instances (e.g., New Almaden, New Idria) the economic resources created from mercury exploration and production may be traceable to financially viable responsible parties. Enforcement assigns the cost of cleanup to the revenue stream derived from causing the pollution in the first place.

The particular approach used to fund remediation will vary by site. It is unlikely that any one of the above four revenue streams will take care of all mine sites in need of remediation. When determining who should pay for a project, the Regional Board can consider, among other factors:

1) Were the economic benefits of mining private, local, statewide, or national in scope? Mercury produced in California supported the Gold Rush, which underpinned the economic development of the State. Gold produced in California helped the Union win the Civil War. Mercury produced at New Idria helped fight World War I, World War II, the Korean War, and the Vietnam War, and thus was a benefit to the national defense. The profits from that mercury were used to build significant investment portfolios and sizable manufacturing corporations (see for example, report by San Benito County, 2003).

2) Will the economic and environmental benefits of remediation be local, statewide, or national? In some instances the main benefits of remediation will be localized to individual stream reaches or small lakes and reservoirs. In other instances, remediation has implications for reducing mercury loads to significant public resources, such as the San Francisco Bay National Wildlife Refuge (downstream of New Almaden), or the Mendota Wildlife Area (downstream of New Idria).

3) What funds are available? If Regional Boards are unable or unwilling to pursue enforcement against private responsible parties, costs to the public will increase. Absent enforceable programs, funding partnerships with Federal and State Programs can significantly reduce the fiscal burden on local governments. If the only revenue stream available is from local taxes and fees, the scope and priority of projects will be constrained by other local funding priorities, such as police, fire protection, infrastructure, and social services.

4.3 Benefits of implementation

When evaluating the benefits of implementation, both the benefits to the entire Bay (the TMDL basis) and benefits to the immediate watershed should be considered. Six of the mine sites listed in Table 3, (New Almaden, Mount Diablo, Borges, Bella Oaks, La Joya, and Corda) have relatively straightforward connections to the Bay. Without additional monitoring information, it is difficult to estimate the load reduction to the Bay that might be attained through remediation. Of the six, only the Guadalupe River, downstream of New Almaden has meaningful loads monitoring information.

Loads from the Guadalupe River into the depositional zone at the nexus to the Bay amount to approximately 100 kg/yr, with a likely range of 5-750 kg (Abu-Saba and Tang, 2000;

Clean Estuary Partnership, 2003). Additional questions that need to be answered to quantify the load reduction benefit possible from the Guadalupe River include:

1) What is the load removed from the depositional zone due to maintenance of flood control capacity?
2) How will the load into the depositional zone respond to upstream BMPs?

But with the available information, it is reasonable to estimate that the load reduction to the Bay that could possibly be attained through watershed management in the Guadalupe River will be smaller than 100 kg/yr. The other five Bay Area mercury mine sites, which were much smaller in production, can be expected to have proportionally smaller loads. Hence, it is unlikely that load reductions attained through mine site remediations will exceed 100 – 200 kg/yr Baywide.

Benefits to local watersheds are more readily identifiable. Stopping the discharge of mercury into potentially fishable lakes and reservoirs (e.g. Almaden Reservoir, Guadalupe Reservoir, Lake Hermann, Lake Chabot) can restore and protect local fisheries resources. Conducting necessary risk assessment and communication targeting such lakes has the immediate benefit of protecting public health and raising public awareness about the problems of and possible solutions to much mercury bioaccumulation in fish. Stream restoration projects (e.g., Guadalupe Creek) that have direct stream habitat benefits also reduce mercury loads, and maintain or decrease mercury methylation rates.

Thus, while the nexus remains uncertain between the Basin Plan Mines Program and the Bay Mercuty TMDL targets, there are very likely benefits possible to mining-impacted watersheds themselves. When setting priorities and determining next steps, factors to be considered should include not only “is a proposed project good for the Bay,” but also “will a proposed project improve the immediate watershed.” Such an approach can enhance local support and speed up implementation of remediation projects.

5. References

Abu-Saba, K.E., and L.W. Tang, 2000. *Watershed Management of Mercury in San Francisco Bay: a TMDL report to USEPA*. SFRWQCB staff report presented to the Regional Board in a public hearing, June 20, 2000. Available from the SFRWQCB, Oakland, CA. www.swrcb.ca.gov/rwqbc2.

Abu-Saba, K.E., Alpers, C.N., Butel, M.W., Marvin-Dipasquale, M., and Kuwabara, J., 2003. More Oxygen, Less Mercury: a feasibility assessment for reducing mercury concentrations in fish through dissolved oxygen management. Concept proposal submitted to the CVRWQCB for the 2003 Proposition-13 funding cycle. May 9, 2003.

Beutel, M.W. and Horne, A.J., 1999. A Review of the Effects of Hypolimnetic Oxygenation on Lake and Reservoir Water Quality. Lake and Reservoir Management [Lake Reserv. Manage.]., 15(4): 285-297.

California Department of Toxic Substances Control, 2002. Site Cleanup - Site Mitigation and Brownfields Reuse Program Database. 43100001 - Almaden Quicksilver County Park, California Department of Toxics Substances Control, Sacramento, CA.

Cargill, S.M., Root, D.H. and Bailey, E.H., 1980. Resource estimation from historical data: mercury, a test case. Statistics and Earth Sciences, 12: 489-522.

Central Valley Regional Water Quality Control Board, 2000. NPDES permit issued to the Sacramento County Regional Sanitation District.

Ganguli, P.M., Mason, R.P., Abu-Saba, K.E., Anderson, R.S. and Flegal, A.R., 2000. Mercury Speciation in Drainage from the New Idria Mercury Mine, California. 34: 4773-4779.

Gill, G.A. and Bruland, K.W., 1990 Sep. Mercury speciation in surface freshwater systems in california and other areas. Environmental Science & Technology, 24(9): 1392-1400.

Looker, R.E., and Johnson, B.J. 2003. *Mercury in San Francisco Bay: TMDL project report*. SFRWQCB Draft staff report presented to stakeholders in a public workshop on July 2, 2003. Available at www.swrcb.ca.gov/rwqcb2

Mckee, L. and Leatherbarrow, J., 2002. Measurement of Sediment and Contaminants From the Guadalupe River Watershed - Sampling and Analysis Plan, San Francisco Estuary Institute, Oakland, California.

McKee, L. and Newland, S., 2002. A Review of Urban Runoff Processes in the Bay Area - Existing Knowledge, conceptual model, and monitoring recomendations. Part 3: Sediment Processes, San Francisco Estuary Institute, Oakland, CA.

Rogers, P., 1996. Mercury Cleanup for Park OK'd. Toxics Pact: Company Agrees to Pay $2.5 Million, San Jose Mercury News, San Jose, CA, pp. 1B.

Santa Clara Basin Watershed Management Initiative, 2001. Core Group Meeting Minutes, Santa Clara Basin Watershed Management Initiative, San Jose, California.

Santa Clara Valley Water District, 2002. Draft Scope of Services for the Guadalupe River Total Maximum Daily Load Project, Santa Clara Valley Water District, San Jose, CA.

San Benito County, 2003. Request for Investigation, Enforcement, and Regional Planning Necessary to Clean Up and Abate the Discharge of Pollutants from the New Idria Mercury Mine in San Benito County, CA. Proposal adopted by the San Benito County Board of Supervisors, May 13, 2003, and transmitted to the Central Valley Regional Water Quality Control Board.

Seward, T., 1998. Mines Report, San Francisco Bay Regional Water Quality Control Board, Oakland, CA.

Slotton, D.G., Ayers, S.M. and Reuter, J.E., 1996. Marsh Creek Watershed 1995 Mercury Assessment Project, University of California, Davis, Davis, California.

Taylor, K.A., 1998. Defining the mercury problem in the northern reaches of San Francisco Bay and designing appropriate regulatory approaches. SFRWQCB draft staff report presented to the SFRWQCB in a public hearing December, 1998

Thomas, M.A. et al., 2002. Mercury contamination from historic mining in water and sediment, Guadalupe River and San Francisco Bay, California. Geochemistry, Exploration, Environment, Analysis, 2002.

Whyte, D.C. and Kirchner, J.W., 2000. Assessing water quality impacts and cleanup effectiveness in streams dominated by episodic mercury discharges. The Science of the Total Environment, 260: 1-9.

Woodward Clyde Consultants, I., 1992. Assessment of Mercury in Water and Sediments of Santa Clara Valley Streams and Reservoirs, URS Greiner Woodward Clyde, Oakland, California.

	Location information			Site History		
Mine	**Basin Plan Map Key**	**Coordinates**	**Location**	**Type**	**Operation dates**	**Production**
Silverado	3	38 deg. 39.13' N; 122 deg. 36.23' W	Napa County. Access is off highway 29 neat Mt. Saint Helena	Underground and open cuts	1872 - 1948	2000 flasks
Chileno Valley	11	37 deg. 10.77' N; 122 deg. 46.94' W	Northwest Marin County, east of Tomales Bay, 50 miles north of San Francisco (near Gambonini Mine)	Underground	1955-1970	Unknown
Challenge	29	37 deg. 27.23' N; 122 deg. 15.02' W	San Mateo County. Access is off Farm Hill Rd.	Surface and Underground	1955-1958	Unknown
Silver Creek	31	37 deg. 16.03' N; 121deg. 44.9' W	San Jose, off silver Creek Rd. Main mine located upstream from Silver Creek rd. about 1/2 mile. Santa Clara County.	Surface and Underground	Inactive 1940's	Unknown
Cycle	9	38 deg. 8.80' N; 122 deg. 45.02' W	Marin County. Access through N. entrance to Soulajule Reservoir	Underground	1970-1971	Unknown
Franciscan	10	38 deg. 8.94' N; 122 deg. 45.20' W	Marin County. Access through N. entrance to Soulajule Reservoir	Underground	1970-1971	Unknown
Hastings	5	37 deg. 27.23' N; 122 deg. 15.02' W	Solano County. Access is off west side of Sky Valley Rd.	Underground	1870's, intermittantly until 1930	Unknown
St. Johns	6	38 deg. 9.11' N; 122 deg. 11.37' W	Solano County. Mine is visible near eastern ridgeline at highway 80 and American Canyon Rd.	Extensive Underground	1870's, intermittantly until 1909	20,000 flasks
Corda	8	38 deg. 09.57' N; 122 deg. 37.74' W	Marin County. Located off of San Antonio Rd. on Corda Ranch	Surface	1968 - 1971	Unknown
La Joya	4	38 deg. 26.36' N; 122 deg. 28.26' W	Napa County. Access is off Wall Rd.	Underground	1865-1939	2000 flasks
Bella Oaks	NA		Napa County. Access is off Bella Oaks Rd about one mile south of Rutherford	Underground	1872-1910	1800 flasks
Borges	7	38 deg. 9.37' N; 122 deg. 12.98' W	Napa County. Access is off American Canyon Rd.	Underground / Minor Surface	Active August 1969	Unknown
Gambonini	12	38 deg 10.26' N; 122 deg. 46.70 ' W	Northwest Marin County, east of Tomales Bay, 50 miles north of San Francisco.	Surface and Underground	Intermittently 1945 - 1971	
New Almaden District	44-31	37 deg. 13' N ; 121 deg 50' W	Santa Clara County; Almaden Quicksilver County Park and surrounding lands	Surface and Underground	Intermittently 1854 - 1976	1,000,000 flasks

Table 1: Locations and site histories for inoperative mercury mines in the San Francisco Bay Region

	Site Condition						Site Management Tracking									
							(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
Mine	**Calcines, Tailings, and Waste Rock**	**Seds (ppm)**	**Water (ppb)**	**Drainage**	**Nexus to Bay**	**Date last inspected**	**Site inspected from the ground?**	**Property owner identified?**	**Property owner contacted?**	**Other local agencies notified?**	**Site Management Plan Implemented?**	**Loads / risk assessment conducted?**	**Previous PRPs identified?**	**Permits and orders issued?**	**Remediation initiated?**	**Follow-up monitoring initiated?**
Silverado	<1000 cy	3	1.5	St. Helena Creek	Region 5	9/19/97	X									
Chileno Valley	None visible	NA	NA	Chileno Creek	No	6/15/91	X	X	X	X	X					
Challenge	None visible	10	1.2	Arroyo Ojo De Agua and Tributaries	Redwood Creek	4/28/97	X	X								
Silver Creek	None visible	2.1	0.14	Silver Creek	Coyote Creek	1/23/97	X									
Cycle	None visible	NA	NA	Soulajule Reservoir	No	10/16/97	X	X								
Franciscan	Small	NA	NA	Soulajule Reservoir	No	10/16/97	X	X								
Hastings	Yes	10	0.31	Sulphur Springs Creek	Lake Herman	9/4/97	X									
St. Johns	>10,000 cy	NA	NA	Rindler Creek	Lake Chabot	9/4/97	X									
Corda	Unknown	NA	NA	San Antonio Creek	Petaluma R.	(by air) 12/11/97										
La Joya	Contact w/ water	NA	0.25	Dry Creek / Napa R.	Napa R.	9/12/97	X									
Bella Oaks	Visible	NA	NA	Seasonal trib to Napa R.	Napa R.	9/12/97	X									
Borges	None visible	2.7		American Canyon Creek	Napa R.	9/4/97	X									
Gambonini	Massives				No	Ongoing	X	X	X	X	X	X	X	X	x	X
New Almaden	Massive	10 - 100		Guadalupe River	Alviso Slough	Ongoing	X	X	X	X	In Part	X	X	In part	In part	

Table 2: Current condition and site management of inoperative mercury mines in the San Francisco Bay region.

Mine	Possible Next Steps	Priority	Basis for Priority
Silverado	Locate property owner; monitor / assess risk through BASMAA, CEP, or Central Valley RWQCB; coordinate SMP implementation with Napa County RCD, CVRWQCB	Low	Outside SFRWQCB jurisdiction; low connectivoty to Bay
Chileno Valley	Follow up with owner, Marin County RCD, to verify SMP implementation; monitor / assess risk through Marin County STOPPP, BASMAA, or CEP.	Low	Basin Plan mines program implemented
Challenge	Monitor / assess risk through San Mateo County STOPPP, BASMAA, or CEP; coordinate SMP implementation and risk comunication with San Mateo County Parks.	Low	No visible waste, moderate concentrations of mercury in sediments
Silver Creek	Locate property owner; monitor / assess risk through SCVURPPP, BASMAA, or CEP; coordinate SMP implementation with SBWMI, Guadalupe-Coyote RCD.	Low	No visible waste, relatively low concentrations of mercury in sediments
Cycle	Coordinate with Marin County Water District to determine if risk assessment / communication needed for fisheries resources in Soulajule Reservoir	Medium	Does not discharge Bayside; mine site likely submerged by reservoir, recreational fishing use.
Franciscan	Coordinate with Marin County Water District to determine if risk assessment / communication needed for fisheries resources in Soulajule Reservoir	Medium	Does not discharge Bayside; no visbile waste, low-moderate mercury concentrations in soils; recreational fishing use.
Hastings	Locate property owner; monitor / assess risk through BASMAA or CEP; evaluate mercury cycling in Lake Herman through CALFED or CEP; coordinate risk assessment /communication with city of Benecia; coordinate SMP implementation with Suisun RCD	Medium	Impacts municipal lake used for recreational fishing; low connectivity to Bay
St. Johns	Locate property owner; monitor / assess risk through Vallejo SFCD, BASMAA, or CEP; evaluate mercury cycling in Lake Chabot through CALFED or CEP, coordinate risk communication with City of Vallejo; coordinate SMP implementation with Suisun RCD.	Medium	Impacts municipal lake used for recreational fishing; low connectivity to Bay
Corda	Locate and contact property owner; conduct on the ground inspection; monitor / assess risk through Marin County STOPPP, BASMAA, or CEP; coordinate SMP implementation with Marin County RCD, Marin County STOPPP	Medium	No onsite inspection or monitoring information available, but no visible waste observed from air
Mt. Diablo	Coordinate with CVRWQCB, Contrac Costa Countywide CWP, Contra Costa RCD; Locate and Contact property owner; seek funding to complete remediation and restoration.	High	Well-documented unabated discharges that threaten downstream habitat resoration projects planned at Big Break and Marsh Creek
La Joya	Locate property owner; issue permits or waivers as needed to produce site management plan for mine tailings; monitor / assess risk through BASMAA or CEP; coordinate SMP implementation with Napa County RCD.	High	Observation of "steep cut tailings… tailings in contact with surface waters..." and reccomendation in Mines report
Bella Oaks	Locate property owner; monitor / assess risk through BASMAA or CEP; coordinate SMP implementation with Napa County RCD	High	Connectivity to Bay
Borges	Locate propery owner, monitor / assess risk through American Canyon STOPPP, BASMAA, or CEP; coordinate SMP implementation with Napa County RCD, American Canyon WTP, American Canyon STOPPP	High	Connectivity to Bay
Gambonini	Remediation initiated, monitoring and watershed assessment under way	Highest	Donwstream commercial and recreational fisheries in Tomales Bay
New Almaden District	See Text	Highest	Size of source, presence of unmanaged waste piles discharging into waters of the State

Table 3: Next steps and priorities for implementing the San Francisco Bay Basin Plan Mines Program

Phase 1 Cost / Site				
Site Priority	Number of Phase-1 Sites	Regional Board Staff Time (FTEs)	Other Agency Staff Time (FTEs)	Contracts ($)
Low	4	0.1	0.1	5,000
Medium	5	0.2	0.2	10,000
High	6	0.2	0.2	50,000
Total	15	2.6	2.6	370,000
Total Cost				890,000

Phase 2 Cost / Site				
Site Priority	Number of Phase-2 Sites	Regional Board Staff Time (FTEs)	Other Agency Staff Time (FTEs)	Contracts ($)
Low	0			
Medium	2	0.2	0.2	1,000,000
High	4	0.5	0.5	2,000,000
Total	6	2.4	2.4	10,000,000
Total Cost				10,480,000

Table 4: Framework for projecting costs of implementing the Basin Plan Mines Program. Phase 1 refers to completing steps A-F of Table 2 for all mine sites, Phase 2 refers to completing steps G-J of a more limited subset of mine sites.

Appendix A: Excerpts from San Francisco Bay Basin Plan, Chapter 4 (Implementation Plan), describing the Mines Program

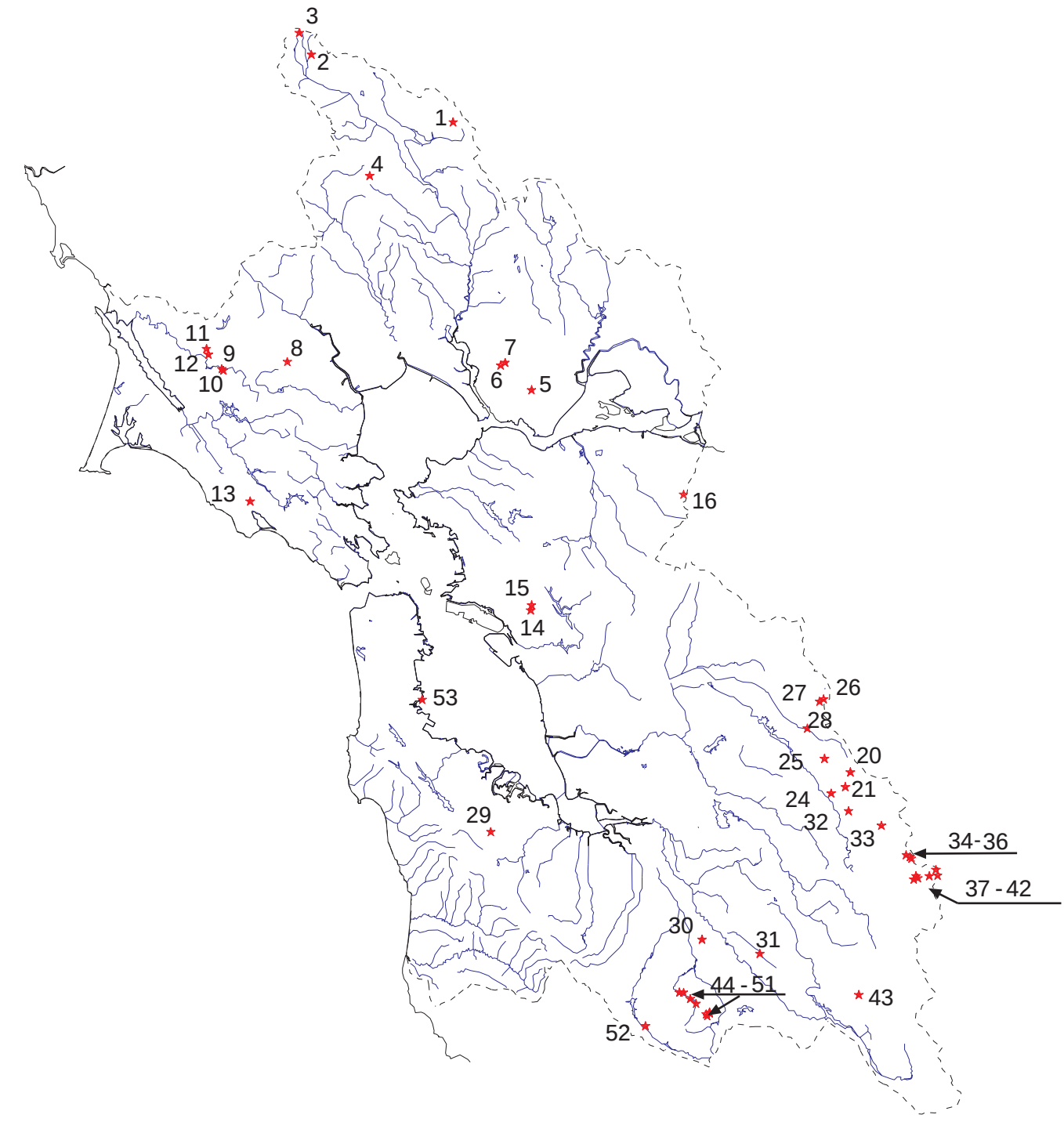


Figure 4-5
Inactive Mine Sites

SCALE 1:960,000

8. IMPACTS AT DREDGE SITE

The Regional Board may require additional documentation and inspections during dredging activities in order to ensure that dredgers minimize impacts at the dredging location. Water quality certifications or waste discharge requirements may contain additional conditions to address barge overflow and other impacts at the dredging site. Permit conditions may include:

- Special reporting procedures for the hydraulic pumping of dredged material into transport scows prior to disposal (marina slip applications);
- Time limit on the overflow from hopper-type hydraulic dredges in order to obtain an economical load; or
- Precautions to minimize overflow and spillage from the dredging vessel when enroute to the authorized disposal site. (Appreciable loss during transit shall be considered unauthorized disposal, or "short dumping," and such occurrences are subject to enforcement by the Regional Board or other applicable state or federal agencies.)

9. POLICY ON LAND AND OCEAN DISPOSAL

The Regional Board shall continue to encourage land and ocean disposal alternatives whenever practical. Regional Board staff have determined that there should be a high priority placed on disposing of dredged sandy material upland. At a minimum, incentives should be developed to limit disposal of any such material with a market value to upland uses. Staff may condition certifications so as to encourage upland reuse of high value sediments.

10. POLICY ON DREDGED MATERIAL DISPOSAL PERMIT COORDINATION

The Regional Board will implement these measures through its issuance of waste discharge requirements, water quality certification under Section 401 of the Clean Water Act, or other orders. In addition, the Regional Board may require pre- and post-dredge surveys to determine disposal volumes and compliance with permit conditions. In order to better manage data and reduce paper files, Regional Board staff may request, but not require, that applicants submit testing and other project data in a specific electronic format. The Regional Board has been an active participant in efforts to improve the overall dredging permit process and procedures. The goal of this effort is to provide the public with uniform testing and disposal guidelines, joint permit actions, a streamlined permit application process, and more uniform permit enforcement. Staff are working with other state and federal agencies to implement a combined state-federal dredging permit process. The process is generally based on the Washington State "Dredged Material Management Office," a part of the Puget Sound Dredged Disposal Analysis program (PSDDA), which regulates dredging and disposal in the Seattle and Tacoma regions.

MINES AND MINERAL PRODUCERS

INACTIVE SITES

Over 50 abandoned or inactive mines have been identified within the San Francisco Bay region (Table 4-16 and Figure 4-5). The mineral resources extracted include mercury, magnesite, manganese, coal, copper, silver, and gold. A large percentage of the mining activities took place from 1890-1930, although some areas were mined as recently as 1971. The sizes of these mines vary from relatively small surface mines of less than half an acre to the world's second largest mercury mine, the New Almaden District, located in southern Santa Clara County.

Water quality problems associated with mining activities can be divided into two categories:

- Erosion and sediment discharge from surface mines and ore tailings piles; and
- Acid or otherwise toxic aqueous discharge from underground mines, ore tailings, or other mining processes.

Problems of erosion and sediment discharged from mined areas may be intensified due to the fact that sediment from ore-rich areas typically contains high concentrations of metals. Biological processes that take place in lake and stream-bottom sediments may allow these pollutants to be released in a form that more readily bioaccummulates in the food chain.

Recent water quality and aquatic toxicity monitoring data suggest that the beneficial uses of a number of water supply reservoirs, creeks, and streams in the region have been impacted as a result of past mining activities. Threatened beneficial uses of lakes, streams, bays, and marshes due to mining activities so

far identified in the region include fish migration, fish spawning, shellfish harvesting, wildlife habitat, preservation of rare and endangered species, freshwater fisheries habitat, and water contact recreation. In response to these findings, surveys were conducted by Regional Board staff in order to locate all abandoned and operating mines in the region.

In many cases, the adverse results of previous surface mining activities can be reduced, and in some cases eliminated, through appropriate erosion and sediment control practices. The U.S. Natural Resource Conservation Service (NRCS, formerly Soil Conservation Service) has developed a Resource Management System for Surface Mined Areas. This management system references practices and treatment alternatives needed in order to address the following:

- Erosion control practices that will dispose of surface water runoff at non-erosive velocities and reduce soil movement by wind or water to within acceptable limits;
- Maintenance of adequate water quality and quantity for planned uses and to meet federal, state, and local requirements;
- Pollution control to meet federal, state, and local regulations; and
- A system of planned access and/or conveyance that is within local regulations and meets the needs for the intended use.

In 1980, a memorandum of understanding was negotiated with the Council of Bay Area Resource Conservation Districts in order to provide for assessment and monitoring of potential and existing soil erosion-related water quality problems and identification of control measures. It was agreed that local units of government should have the lead role in controlling land-use activities that cause erosion. Control measures include the implementation of best management practices (BMPs). The Resource Management System for Surface Mined Areas developed by NRCS specifically references BMPs determined to be the most effective and practicable means of preventing or reducing erosion- and sediment-related water quality degradation resulting from surface mining activities.

ACTIVE SITES

There are approximately 100 active mines and mineral producers within the San Francisco Bay region. The primary mineral commodities produced include clay, salt, sand and gravel, shale, and crushed stone. Water quality problems associated with mineral production activities generally consist of erosion and sediment discharge into nearby surface water bodies and wildlife habitat destruction.

Active mining and mineral production activities are in part regulated under the Surface Mining and Reclamation Act of 1975. This act requires all mine operators to submit a reclamation plan to the California Department of Conservation, Division of Mines and Geology, and the recognized lead local agency for the area in which the mining is taking place. Recognized lead local agencies for the San Francisco Bay region include county planning and public works departments. Additionally, some local planning departments regulate mining activities through the issuance of conditional land-use permits. The goal of each reclamation plan is to assure that mined lands are reclaimed to a usable condition that is readily adaptable for alternate land uses and creates no danger to public health and safety. To date, very little emphasis has been placed on the need to protect beneficial uses of surface and groundwaters in the established permitting process.

Under the California Code of Regulations, Title 23, Chapter 15, Article 7, the Regional Board has the authority to regulate mining activities that result in a waste discharge to land through the use of waste discharge requirements. Additionally, the federal NPDES stormwater regulations (40CFR Parts 122, 123, and 124) require active and inactive mining operations to obtain NPDES permit coverage for the discharge of stormwater contaminated by contact with any overburden, raw material, intermediate products, finished products, byproducts, or waste products.

GOAL

The Regional Board's goal is to restore and protect beneficial uses of receiving waters now impaired or threatened with impairment resulting from past or present mining activities.

This goal will be attained by the coordinated effort of the Regional Board, NRCS, the Council of Bay Area Resource Conservation Districts, the California Division of Mines and Geology, and lead local government agencies through the implementation of a mineral production and mining management program.

PROGRAM

1. The Regional Board intends to continue to work closely with Resource Conservation Districts and NRCS to identify all existing and abandoned mines and mineral production sites in the region. Responsible

parties will be identified, as well as potential funding alternatives for clean-up activities, if needed. Sites will be prioritized based on existing and potential impacts to water quality and size.

2. The Regional Board will require an NPDES permit for the discharge of contaminated stormwater from active and inactive mining operations, as defined in the NPDES stormwater regulations. The Regional Board will consider issuing individual permits or a general permit for such discharges, or will otherwise allow coverage under the State Board general permit for stormwater discharges associated with industrial activity as described in the "Urban Runoff Management, Industrial Activity Control Program" section. Requirements of the notice of intent to be covered under the general permit(s) and the schedule for submittal will be established in the permit(s).

3. The responsible party or operator of each site discharging or potentially discharging waste to land shall be required to submit a Report of Waste Discharge to the Regional Board, pursuant to the California Water Code Section 13267. Requests will be made on a site-by-site basis and based on priority. A Report of Waste Discharge shall consist of a "Site Closure Plan" and an "Operation and Management Plan" for active sites.

   - Each plan shall be designed to ensure short- and long-term protection of beneficial uses of receiving waters.
   - The "Closure Plan" shall address site restoration and long-term maintenance and monitoring.
   - The "Management Plan" shall address stormwater runoff and erosion control measures and practices.
   - Each plan will be evaluated in regard to potential impacts to beneficial uses of receiving waters. Waste Discharge Requirements will be issued or waived at the discretion of the Regional Board based on the threat to water quality and the effectiveness of identified and implemented control measures and the effectiveness of local agency oversight.

VESSEL WASTES

The discharge of wastes from pleasure, commercial, and military vessels has been a water quality concern of the Regional Board since 1968 when Resolution No. 665 was adopted, which suggested that the federal government regulate waste discharges from vessels. In 1970, the Regional Board adopted Resolutions 70-1 and 70-65 on vessel wastes. The first urged BCDC to condition marina permits for new or expanded marinas to include pumpout facilities, dockside sewers, and restroom facilities. Resolution 70-65 recommended that vessel wastes be controlled in such a manner through legislative action.

In 1982, the Regional Board conducted a study that found high levels of coliform in the vicinity of several marinas in Marin County's Richardson Bay. Subsequently, the Regional Board adopted a prohibition against discharge of any kind into Richardson Bay. A regional agency was formed to implement and enforce this prohibition.

There is an ongoing effort to construct, renovate, and improve pumpout facilities at marinas and ports around the region. The goal of these efforts is to increase the accessibility of these facilities to boaters and reduce pollution from vessel wastes.

WETLANDS PROTECTION AND MANAGEMENT

Wetlands and related habitats comprise some of the San Francisco Bay region's most valuable natural resources. Wetlands provide critical habitats for hundreds of species of fish, birds, and other wildlife; offer open space; and provide many recreational opportunities. Wetlands also enhance water quality through such natural functions as flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.

The Regional Board will refer to the following for guidance when permitting or otherwise acting on wetlands issues:

- Governor's Executive Order W-59-93 (signed August 23, 1993; also known as the California Wetlands Conservation Policy);
- Senate Concurrent Resolution No. 28; and
- California Water Code Section 13142.5 (applies to coastal marine wetlands).

The goals of the California Wetlands Conservation Policy include ensuring "no overall net loss," achieving a "long-term net gain in the quantity, quality, and permanence of wetlands acreage and values ...", and reducing "procedural complexity in the administra-