Preliminary Project Definition

Guadalupe River Watershed Mercury TMDL

- *303(d) listing location and pollutant(s)*

  Location (Tetra Tech 2003c): The 170 square mile Guadalupe River Watershed is located in Santa Clara County. The Guadalupe River begins at the confluence of Alamitos and Guadalupe Creeks, and flows 19 miles through heavily urbanized portions of San Jose, ultimately discharging into South San Francisco Bay through Alviso Slough. The 80 square mile New Almaden Mining District is located in the Guadalupe headwaters.

  Extent of listing (Tetra Tech 2003a): In 1998, in accordance with Section 303(d) of the CWA, the California Regional Water Quality Control Board, San Francisco Bay Region (Water Board) listed the San Francisco Bay and several tributary waterbodies as impaired due to mercury, including these waterbodies in the Guadalupe River Watershed:

  - Guadalupe River
  - Guadalupe Creek
  - Alamitos Creek
  - Guadalupe Reservoir
  - Calero Reservoir

  Moreover, the Water Board has determined that mercury concerns in these Guadalupe River Watershed waterbodies can most efficiently be addressed by undertaking a single TMDL project that concurrently considers all mercury sources in the watershed, including all tributaries of the Guadalupe River upstream of tidal influence.

  The Guadalupe River Watershed Mercury TMDL will be the primary regulatory vehicle for achieving water quality goals in the watershed and will simultaneously reduce the load of mercury to the Bay in accordance with the San Francisco Bay Mercury TMDL requirements. There is an extensive transition zone from the River through the tidal Alviso Slough to San Francisco Bay.

  The most stringent standards of the Guadalupe River Watershed and San Francisco Bay Mercury TMDLs will apply in the transition zone (e.g. Bay wildlife targets and Guadalupe numeric water quality objectives). The two TMDLs will be coordinated to ensure that the fate and transport of mercury laden sediments from the River will be addressed, particularly in the hundreds of acres of soon-to-be-restored salt ponds adjacent to and near the mouth of Alviso Slough.

  Appropriate Standards: Federal Clean Water Act regulations and the San Francisco Bay Region Water Quality Control Plan (Basin Plan) (SFBRWQCB 1995) contain water quality standards that identify beneficial uses of the water bodies, numeric and narrative water quality objectives to protect those uses, and provisions to enhance and protect existing water quality. Several water quality objectives apply to mercury in the Guadalupe River Watershed above tidal influence:

- *Basin Plan Numeric Objective for Municipal Supply*

  The Basin Plan limits total mercury in water used for municipal supply (drinking water) to 2,000 nanograms per liter (ng/l, parts per trillion).

  The municipal supply objective has been exceeded in several wet season samples.

- *Basin Plan Numeric Objectives for Freshwater*

  The Basin Plan limits total mercury in fresh water to a 4-day average concentration of 25 ng/l, and to a 1-hour average concentration of 2,400 ng/l for the protection of aquatic life from chronic and acute adverse effects, respectively.

  Numerous grab samples from throughout the year from Alamitos and Guadalupe Creeks which drain the New Almaden Mining District, and from the Guadalupe River have exceeded the 4-day objective, although few samples from Almaden and Guadalupe Reservoirs on Alamitos and Guadalupe Creeks, respectively, have exceeded this objective. Several wet season grab samples have exceeded the 1-hour limit of 2,400 ng/l.

- *California Toxics Rule Numeric Objective*

  The California Toxics Rule (CTR) (USEPA 2000) limits total mercury to 50 ng/l for the protection of human health for consumption of water and organisms.

  Numerous grab samples from Alamitos and Guadalupe Creeks and the Guadalupe River have exceeded the CTR objective of 50 ng/l.

- *USEPA Fish Tissue Residue Numeric Criterion*

  The USEPA recently published a recommended criterion for the protection of human health of 0.3 milligrams per kilogram (mg/kg, parts per million) methylmercury in the edible portions of fish and shellfish (USEPA 2001).

  Numerous fish samples from the reservoirs, percolation ponds and creeks have exceeded the 0.3 mg/kg methylmercury criterion, with many samples exceeding 2 mg/kg.

- *Basin Plan Narrative Objective for Bioaccumulation*

  Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.

  See the “working hypothesis” section below.

Pollutant(s) to be addressed: mercury

- *Basis of listing* (Tetra Tech 2003a)

  The impairment listing was largely based on the Santa Clara County's fish consumption advisory for mercury contamination. Mercury concentration in fish muscle tissue that exceed the U.S. EPA human health mercury fish criterion of 0.3 mg/kg, have been measured at numerous creeks and reservoirs in the Guadalupe River Watershed. Elevated mercury concentrations in fish tissue may also pose a threat to wildlife (e.g., piscivorous birds, amphibians and mammals).

- *Key pollutant sources* (Tetra Tech 2003b, 2003c)

  Mercury is naturally present in the New Almaden Mining District principally in the form of the mineral cinnabar (mercury sulfide). Soils, runoff, and mine seeps are alkaline in contrast to other mining areas in California with acid-mine drainage. Much of the ore grade deposits containing cinnabar were removed by mining, particularly the original surface outcrops and a placer deposit in thick gravels in the lower portion of Deep Gulch Creek. However, dispersed cinnabar may be present in small outcrops. Silica carbonate bedrock, the Mining District bedrock type which most frequently contains cinnabar, is present in small areas of the Calero Reservoir watershed.

  The predominant source of mercury in the Watershed is the New Almaden Mining District, the largest-producing mercury mine in North America; other sources include atmospheric deposition from global and local sources, soil erosion from areas not known to contain mines, urban stormwater runoff, seepage from landfills, and Central Valley Project water inputs to Calero Reservoir. Mercury is lost by emissions to the atmosphere from water, soil and vegetation. Mercury is also removed from the watershed by sediment removal for flood control purposes.

  Mercury from the Mining District is present in an inorganic form and includes calcines (remaining waste material after the mercury-bearing ore has been roasted in furnaces or retorts), pockets of elemental mercury from spills, mine seeps, other mine wastes, and contaminated soil. Because mercury was processed in furnaces and retorts in the upper part of the watershed, soils may have higher mercury concentrations due to retort emissions deposited within the watershed.

  The large scale and long duration of mining has resulted in extensive distribution of mine wastes. Largely transported by stormwater, mine-waste deposits can be found in Almaden and Guadalupe reservoirs, and in the bottoms, banks, and flood plains of Alamitos and Guadalupe Creeks and tributaries, and the Guadalupe River. These downstream mine wastes are an important source of total and dissolved mercury.

- *Working hypothesis regarding cause of impairment* (Tetra Tech 2003c)

  The toxicity of mercury to humans and wildlife is closely tied to its uptake through the food chain. Inorganic mercury dissolves from particulates (both in sediments and in the water column) and naturally occurring bacteria convert it to organic forms, particularly mono-methyl mercury. Methylmercury bioconcentrates as it moves up the food chain from algae to zooplankton to prey fish and to predator fish. The largest single jump in concentration occurs from the water to algae. Methylmercury's

biomagnification is among the largest of all known chemical compounds. Concentrations in fish can be millions of times higher than in water.

The key hypothesis is that inorganic mercury from mine waste is converted to methylmercury in the Watershed. The mechanistic processes in the Watershed associated with mercury methylation and biological uptake need to be better understood.

- *Analysis strategy*

  Stakeholder involvement: This is a stakeholder-driven TMDL project. The Santa Clara Basin Watershed Management Initiative (WMI) assists the Water Board in developing this TMDL with public participation. The WMI convened the Guadalupe Mercury TMDL Work Group, which is co-chaired by staff from the Santa Clara Valley Water District (District) and the Water Board. The District has provided significant funding for consultant services. An independent, outside panel of technical experts is convened to review key consultant deliverables.

  Strategy to assess the impairment: Dry-season sampling was conducted in 2003 throughout the watershed (*Synoptic Survey Report* [Tetra Tech 2003b]). This was the first-ever watershed-wide sampling effort to assess the impairment. The wide spatial coverage of the Synoptic Survey provided an overview of mercury contamination in the watershed, and provided an indication of where key mercury transformations of solid phase mercury to bioavailable mercury are and are not occurring.

  Sampling is scheduled for early 2004 (*Data Collection*) to measure mercury loading during wet weather. The *Data Collection* effort includes sampling elements designed to answer methylation and bioaccumulation hypotheses from the *Draft Conceptual Model Report* (Tetra Tech 2003c) (see Analysis Strategy). There is insufficient funding to conduct all the recommended methylation and bioaccumulation sampling elements in 2004.

  Analysis strategy: The *Draft Conceptual Model Report* (Tetra Tech 2003c) presents an analysis of mercury transport, methylation and bioaccumulation in the wet and dry seasons. If funding is secured, the *Conceptual Model* will be revised in 2005 based on the findings from the *Data Collection* efforts in 2004.

  Project Plan: A Project Plan will be developed by March 2004 which will identify the steps needed to complete this TMDL project.

  Updates to the Project Definition: The Project Definition will be revised as new information is gathered in subsequent phases of this TMDL project.

- *References*

San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) 1995. *Water Quality Control Plan San Francisco Bay Basin (Region 2)*, June 21.

Tetra Tech. 2003a. Technical Memorandum 1.2 Preliminary Problem Statement. Guadalupe River Watershed Mercury TMDL Project. Prepared for Santa Clara Valley Water District. June 13.

Tetra Tech. 2003b. Technical Memorandum 2.2 Synoptic Survey Report. Guadalupe River Watershed Mercury TMDL Project. Prepared for Santa Clara Valley Water District. September 8.

Tetra Tech. 2003c. Technical Memorandum 4.1 Draft Conceptual Model. Guadalupe River Watershed Mercury TMDL Project. Prepared for Santa Clara Valley Water District. October 2.

U.S. Environmental Protection Agency (USEPA) 2000. *Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Final Rule*, 40 CFR Part 131, Vol. 65, No. 97, May 18.

U.S. Environmental Protection Agency (USEPA) 2001. *Water Quality Criterion for the Protection of Human Health: Methylmercury*, EPA-823-R-01-001, Office of Water, January.