

**Implementing the Mercury TMDL
for the Guadalupe River Watershed:
*Remediating Calcine-paved Roads and Upper Jacques Gulch***

Project at a Glance

EPA Grant Number (FAN): 99T03401

Program Code: W9

Start Date: 1/13/2014

End Date: 12/31/2017

Construction Period: 6/21/17 – 10/15/17

Budget: \$1,600,000

EPA: \$800,000

Match: \$800,000

Outputs and Outcomes

Tasks	Outputs	Outcomes
Project Element	Outputs	Outcomes
Calcine Roads	3.8 miles of mercury laden calcine pavement (3,353 CY removed from watershed and sequestered into SF Open Cut disposal site)	670 lbs of mercury is no longer at risk of eroding into the Guadalupe River Watershed
	6 culverts cleaned out and drainage inflow and/or outflow modified to reduce erosion	Calcine material in culverts removed and disposed of. Drainage improvements will prevent excessive erosion of trail
	3 culverts upsized to more appropriate dimensions	Prevention of future blockages which have led to significant erosion on trails. Reduction in trail and slope erosion and stabilization of

		sediments.
	2 rocked trail crossings and 6 rip-rap hardened inflows/outflows to existing culverts	Reduction in trail and slope erosion and stabilization of sediments.
Jacques Gulch	Feasibility Study for the remediation of Upper Jacques Gulch	The project site was determined to be infeasible to remediate. Development of new technologies or significant funding would be needed to achieve a successful remediation effort.

Introduction

Background

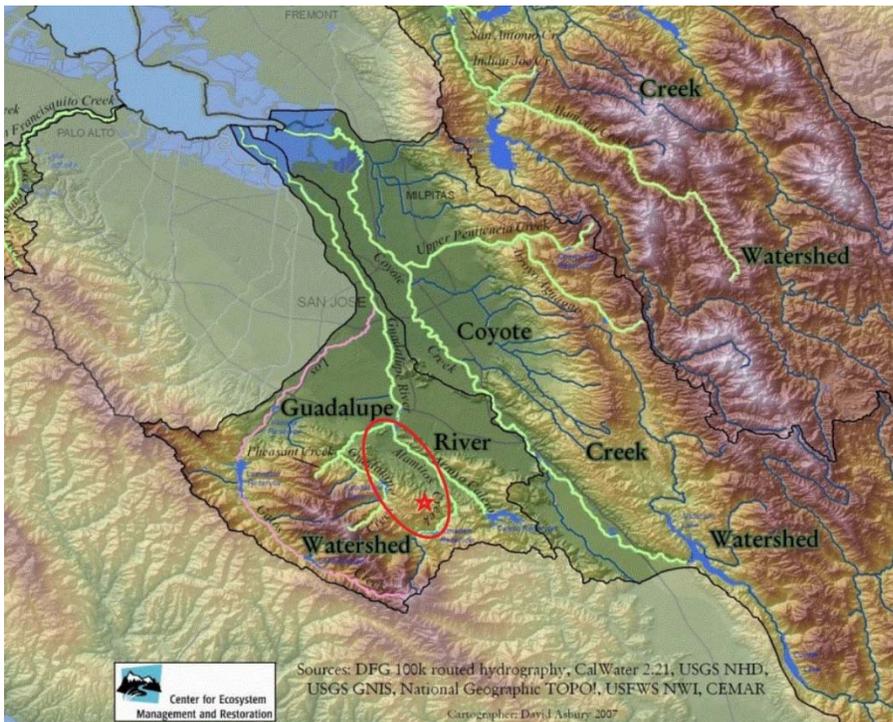


Figure 1: The Guadalupe River Watershed with the NAMD indicated by a circle. The project site is indicated with a star.

The New Almaden Mining District (NAMD), now largely located within Almaden Quicksilver County Park (Park), operated from 1845 into the 1970's. The NAMD is circled in figure 1 with the project site indicated with a star. The NAMD was the largest mercury mining district in North America and produced 5% of the world's total mercury. The Guadalupe River Watershed houses this old mining district and has

been significantly impaired by its operations, resulting in a Mercury TMDL finalized in 2008. Within the District, mercury laden cinnabar ore was excavated and heated to extract the mercury. The leftover heat-processed wastes are referred to as calcines. Due to an inefficient extraction process, these calcines

contain environmentally hazardous levels of mercury, ranging from 22 mg/kg to 233 mg/kg as measured within the Park¹.

The headwaters of the Guadalupe River Watershed begin in the eastern Santa Cruz Mountains and flow 19 miles south, through lakes and reservoirs, to the Guadalupe River and out the Alviso Slough, passing eight salt pond restoration sites before emptying into the South Bay. The Guadalupe TMDL addresses lakes and reservoirs (all in figure one except Lexington Reservoir), Guadalupe Creek, Alamitos Creek, and the Guadalupe River (Figure 2). These listed water bodies have some of the highest fish methylmercury levels in California, and are posted with “do not eat the fish” signs, one of only two areas in California with “do not eat” fish consumption advisories as contrasted to “limited consumption” advisories.

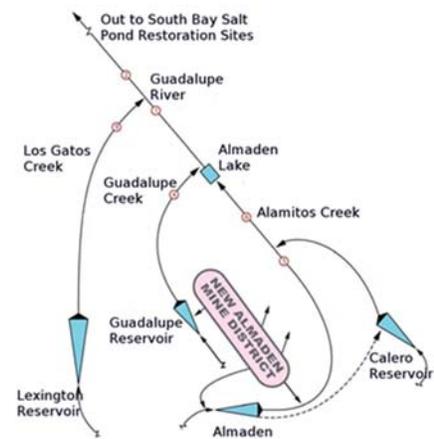


Figure 2: Direction of flow within the Guadalupe River Watershed with respect to the New Almaden Mining District, an old mercury mining district.

Project Summary

The San Francisco Estuary Partnership (SFEP) and the Santa Clara County Parks and Recreation Department (Parks) partnered in 2013 to apply to the US EPA’s San Francisco Bay Water Quality Improvement Fund to Implement the Mercury TMDL for the Guadalupe River Watershed: Remediating Calcine-paved Roads and Upper Jacques Gulch (project). The Project was supported by a wide group of stakeholders including the Regional Water Quality Control Board (Waterboard), the San Francisco Estuary Institute, the Parks department, the Santa Clara Valley Water District, and Mike Wasserman (current and past supervisor of the Project’s district).

This Project was composed of two components including the removal of calcines and calcine pavement from trails within the park, and the development of 25% design plans for the remediation of Jacques Gulch. Both of these project components were identified by the Waterboard as priority remediation sites in implementing the Guadalupe River Watershed Total Maximum Daily Load (Guadalupe TMDL).

The Project was completed in December, 2017 and was able to fully accomplish all goals and objectives related to the Calcine Paved Roads Component. An estimated 670 lbs of mercury was sequestered safely into the San Francisco Open Cut, a Department of Toxic Substances Control regulated disposal site within

¹ URS. 2011. Almaden Quicksilver County Park and Santa Teresa County Park Mine Material Evaluation: *Amended Final Report*.

the park. This estimate is conservative and could be as high as 1,320 lbs of mercury. More information on these calculations can be found in the TMDL Implementation section below.

The Jacques Gulch component was not completed as envisioned as the project site was such that the remediation of the upper Gulch was not feasible. This finding, approved by the US EPA, Waterboards, Parks, and SFEP, was supported by multiple site visits, studies and findings reports that indicated the project was not feasible for access, geotechnical, and cost/benefit reasons.

Tasks

Task 1: Project Management

SFEP submitted 15 quarterly progress reports that documented the financial and project updates. SFEP began managing this project in 2014 and continued through its completion in 2017. During this time, SFEP contracted with, remitted payment to, and coordinated with Parks, our local project partner. SFEP contracted with Parks on August 15th, 2014. SFEP received and reviewed all invoices submitted by Parks for payment and packaged them in payment requests to the EPA.

SFEP was able to achieve all typical project management goals and objectives and was additionally able to react nimbly to changing project needs as the Jacques Gulch component was determined to be infeasible. The Jacques Gulch budget was created with the expectation that formal assessments and reports would need to be drawn up in preparation for permitting. However, the consultant first undertook a feasibility study to assess the reach and the remediation options. It was determined that it is infeasible to remediate the reach with current technological and geotechnical limitations. As a result, the Jacques Gulch Task had approximately \$120,000 in unspent budget after the study. Around the same time, additional calcine pavement was found, increasing the total area to be excavated from 3 miles to 3.7 miles. This resulted in the county having to pay far more in construction costs than anticipated. To offset this cost, SFEP and the EPA agreed to reallocate the \$120,000 to the construction task to compensate for the unexpected cost overruns. When this shift was being formalized, SFEP staff assessed their management budget and found that due to efficiencies, SFEP would not spend their full budget. As a result, an additional \$4,000 was reallocated to offset construction costs.

Task 2: QAPP Development

SFEP worked with the county to determine the need for a QAPP for both the Calcine Paved Roads and the Jacques Gulch components. As the Calcine Paved Road project is primarily removing hardscaped roads and replacing them with ruggedized trails, impacts to vegetation that would require a revegetation plan and monitoring are largely limited to culvert crossings. The required Water Board monitoring is to take place for 3 years after construction is complete. The grant itself will close 2-3 months after the conclusion of the construction window. Specifically, the 401 Permit states:

- The Project site shall be monitored for a minimum 3-year period to ensure temporarily impacted vegetation areas become reestablished and the upstream and downstream areas at each stream crossing are stable;
- Annual letter reports (both electronic and hard copy) shall be submitted to the Water Board by January 31 of each year during the 3-year monitoring period. The reports shall include photographs from the photo-documentation points (See Condition 11) established at the Project site. Each report shall document the revegetation areas' progress towards becoming reestablished and each culvert's immediate upstream and downstream stability. If an annual report indicates that the revegetation areas may not become fully reestablished or a culvert's immediate upstream and downstream stability, in areas that Project work has been conducted, then the report shall identify remedial measures to be undertaken, including extension of the monitoring period until the criteria are met.

Additionally, it was determined that Jacques Gulch would not be feasible to remediate due to geotechnical limitations in technologies. SFEP will work with the EPA to reallocate the QAPP funds budgeted for these projects at the same time the remaining Jacques Gulch funds are reallocated.

Task 3 – 6 Calcine Paved Roads

Task 3 - Design Development

County Parks contracted with URS to create the 100% design plans. These plans were submitted at the 60%, 90%, and 100% stages. Parks submitted 60% design plans in October 2015. These very preliminary designs were reviewed by the Waterboard permitting staff and SFEP. The review was accompanied by a site visit in late 2015. Comments on various jurisdictional and biological features were submitted to Parks as the design process moved forward. The 90% design plans were submitted in July, 2016. These were also reviewed by SFEP and the Waterboard. SFEP had no comments, however, the Waterboard had several questions regarding the planned culvert replacements. The final designs were submitted to permitting agencies and SFEP in January, 2017.

Task 4 - Permitting and CEQA

All permits and designs were obtained as required to implement the Calcine Paved Roads construction component.

CEQA - The Santa Clara County Board of Supervisors adopted a Final Initial Study/Mitigated Negative Declaration and Mitigation Monitoring and Reporting Program on June 9, 2015.

404 Nationwide Permit - the permit was received from the US Army Corps of Engineers in March 2017.

401 Certification – the certification was received from the California Water Board in March 2017.

1600 Streambed Alteration – this permit was received from the California Department of Fish and Wildlife in April 2017.

Task 5 - Construction

The SCCPRD began construction activities on the calcine paved roads in June, 2017 and informed SFEP that the costs would far exceed the original estimates. This was due to a number of factors, chief among them being the increased scope of the construction project. In the original proposal, we estimated that a total of 3 linear miles of calcine pavement, at varied widths and depths, would be removed as part of this project. When design plans were finalized, additional calcine pavement was identified for removal and the linear estimate increased to 3.8 miles. Parks decided to address the additional calcine pavement in its construction activities. As such, the cost estimate of the project increased significantly. Parks graded and resurfaced the trails after pavement removal, including gaps between calcine pavement, and is installed rolling dips to reduce erosion. These gaps extended the total project length to 5 miles.

To help compensate for some of the cost overruns, SFEP and the EPA agreed to move unspent funds from the Management, QAPP, and Jacques Gulch tasks. As such, Parks still spent far more than originally intended on the project. Because of this decision, all of the newly discovered calcine pavement was removed and disposed of in the SF Open Cut.

TMDL Implementation

Mercury Concentrations

When the project was initially proposed, we did not include mercury concentration monitoring as it is somewhat expensive and previous work done in the region have resulted in a concentration range that can be expected in calcine material in the mining district. This data is presented in the following reports:

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- Dames & Moore Environmental Mercury Assessment, 1989 Prepared for the County of Santa Clara. Job No. 16707-002-043.
(No online source found)
 - URS Almaden Quicksilver County Park and Santa Teresa County Park Mine Material Evaluation, 2011 (Amended Final Report). Prepared for the County of Santa Clara.
(http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/guadaluperivermercurytml.shtml)

However, the project took longer than expected and in the intervening years, the Waterboard purchased a x-ray-fluorescence (XRF) machine that is capable of quickly and cheaply detecting mercury in soil samples. In 2017, staff of Waterboard obtained samples from calcines excavated from roads and placed in the San Francisco Open Cut, as well as from two roads that had not yet been excavated, Randol Trail and Unnamed Trail. Mercury concentrations were determined by XRF Niton XL3 Analyzer by EPA Method 6200 Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment. Mercury concentrations ranged from non-detect to 95 mg/kg (at a detection limit of 10.4 mg/kg). Data are presented in the appendices of this report. . Samples were disposed of in the San Francisco Open Cut after analysis.

This unanticipated monitoring provided us with a larger data set that was used to calculate a range of mercury concentrations. The range was determined by considering the data we have in different ways. The high end concentration of 76mg/kg was calculated by omitting non-detect readings for samples being analyzed on the XRF (under 10mg/kg) and including the single outlier in our dataset (233mg/kg – URS, 2011). The low end concentration of 60mg/kg was calculated by setting the non-detect readings to 0 and including them in the average, as well as omitting the single outlier in our dataset (233mg/kg – URS, 2011).

Density of Calcine Pavement

To calculate the density of the calcine pavement, SFEP referenced density benchmarks including:

- Natural Mineral Packed Aggregate – 1,520 – 1,680 kg/m³
- Asphalt – 2,360 kg/m³
- Average Rock Density – 2,600 kg/m³
- Normal Weight Concrete – 2,240 – 2,400 kg/m³
- Pyrite (commonly associated with mercury in cinnabar = 2,400 kg/m³
- Lead (reference) – 4,000 kg/m³

The low density range was set to that of packed aggregate (1,520 kg/m³) and the high density range was set to that of asphalt.

Mercury Eliminated Calculations

Once the concentration and density ranges were determined, the quantity of mercury within the 3,353 cubic yards of excavated calcine pavement was calculated using the following formula:

$(\text{Volume of Calcine Removed}) \times (\text{Density} - \text{low}) \times (\text{concentration} - \text{low}) = \text{Quantity of Hg Sequestered}$

Using this formula, an estimated 670 – 1,320 lbs of mercury was sequestered in the San Francisco Open Cut. This was much more than initially anticipated. The initial proposal estimated 55 – 580 lbs of mercury would be sequestered. The project exceeded those expectations, even using the more conservative density and concentration estimates.

TMDL Implications

The Guadalupe TMDL has allocations set for mercury mining waste below what an XRF can detect, making direct implementation of the allocation goals uncertain. However, the Guadalupe TMDL does set a limit for total mercury loads from the Guadalupe Watershed into the San Francisco, and that is 20.7 lbs of mercury per year. The Project was able to remove a quantity of highly erodible mercury that is equal to over 32 years of the maximum load defined in the TMDL.

For additional TMDL context, the San Francisco Estuary Institute Regional Monitoring Program conducted a study in 2017 that monitored the mercury loads during a large storm event. This study² proved that large events transport massive amounts of mercury due to the high energy in waterways during such events. The event, lasting for a seven day period, exported over 185 lbs of mercury. The single event was almost total to the maximum allowable mercury load for the Guadalupe for 9 years. The Project removed over 3.5 times the load that was transported during this flood event.

Task 6: Outreach and Education

The outreach and education component was intended to inform the local community and stakeholder groups of the remediation efforts and the significance of such efforts in protecting water quality and biota within the watershed. This component was planned for implementation during the construction year to

² McKee et al. San Francisco Estuary Institute. 2017 Guadalupe River Mercury Concentrations and Loads During the Large Rare January 2017 Storm.
http://www.sfei.org/sites/default/files/biblio_files/Guadalupe%20River%20January%20Hg%20release%20event%20report.pdf

make the outreach more relevant to those participating. Our outreach goal was to provide this information to over 100 individuals. This goal was to be achieved through installing signage within the park and through at least one public meeting.

The outreach task was postponed to the end of the project as planned. A public meeting was held at Casa Grande on January 30, 2018, in the afternoon at 3:00 pm. Tom McLauchlan, the project manager for Parks, prepared a powerpoint presentation that was shown in the audio-/visual room on the first floor of the Casa Grande. 8 1/2 x 11 signs were posted at each of the park entrances (4) on the information boards and at the Casa Grande two weeks in advance of the meeting. Local community groups were reached out to by the outreach department of Parks. Parks had a total of 8 members of the public. This was, in part, due to the timing of the meeting. SFEP, the EPA, nor the Waterboard was invited to the meeting as Parks seemingly forgot to invite these parties. A PDF of their presentation is located in the appendix. This presentation was not followed by a site visit as the project was newly completed in December and Parks was worried about unnecessary vehicle traffic on the trails during the winter season.

The majority of the comments from the public were questioning if this project was really needed and that mercury in the park is not toxic and that the TMDL (and folks were familiar with that) levels are set unreasonable low to a point that reaching that goal is unattainable and a waste of money. The community members in the area tend to be more concerned with the environmental damage caused by the removal of calcines rather than the toxic substance itself. This line of thinking is prevalent in the local community that has seen remediation projects come and go for the past two and a half decades.

SFEP conveyed its disappointment with this outreach component of this project as the funder, project partner, nor the permitting agencies were involved in the public meeting. After receiving the feedback from the local community, it shows how important this outreach actually is. Additionally, the powerpoint developed was never shared with SFEP before it was presented. The content of the slides indicates that the presentation was more a project recap rather than an informative presentation on present and past remediation efforts (including this one) and how those efforts are improving water quality within the watershed.

As the county was reviewing its signage within the NAMD to assess what could supplement the current array of information, the county determined that it has sufficient signage to meet project goals and objectives. The outreach department worked with Friends of the Los Alamitos Watershed to develop 6 instructional signs for park-goers a few years ago. These signs give an overview of the following topics:

- How mercury gets into watersheds

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- Methylmercury generation and bioaccumulation
 - Mercury reduction efforts in reservoirs
 - Inorganic mercury transport reduction efforts in the watershed
 - Various mercury compounds and their effects/uses
 - Environmental impacts of mercury and efforts being undertaken to reduce these effects

The Manager of Interpretation and Outdoor Recreation with Parks believed that the signage was sufficient to meet project needs and goals. The Interpretation and Outdoor Recreation department also wants to limit the amount of signage on the trail to allow visitors a more natural experience. SFEP agreed that the signage was certainly informative on the pollutant of concern and met outreach needs for this project in lieu of adding additional signage on the paved roads themselves. The funds allocated for the development and installation of signage remains unspent and has been returned to EPA.

These efforts will be supplemented by the creation of an outreach brochure to be displayed in the Casa Grande Historical Museum that is visited by approximately 8,000 – 10,000 per year, including school groups. Additionally, the interpretative staff at the Casa Grande were trained on the Calcine Paved Roads project as well as the mercury remediation occurring in the watershed. These interpretative staff work with the 8,000+ visitors to

Task 7: Jacques Gulch

Implementation

To begin the 25% designs, Roux & Associates, the design consultant, assembled a team of biological and geotechnical experts and conducted several site visits to Upper Jacques Gulch. Initial studies in the reach included:

- Soil sampling at 8 locations (RS-2 through RS-8), included in the Summary of Field Surveys for Conceptual 25% Design Plan for Jacques Gulch Remediation, Almaden Quicksilver County Park, San Jose, California dated February 22, 2017 (Field Memo)
- 86 XRF measurements at 28 intercepts along the project area, included in the Field Memo
- Upper Jacques Gulch Remediation Project – Preliminary Biotic Constraints and Restoration Opportunities, included as Attachment A in the Field Memo

In January, 2017, SFEP and the Waterboard visited Roux to look through their field notes, photos, and videos. This informed an internal Waterboard meeting regarding the site and the options currently being

pursued for its remediation. This meeting allowed Waterboard staff from the planning and permitting department to discuss the permissibility and feasibility of remediating the site. No decisions were made as the designs were preliminary at the time.

On March 01, 2017, Roux and its subcontractors, Santa Clara County Parks, SFEP, the Water Board, and the Environmental Protection Agency met to discuss the three design alternatives that Roux had put together. Two of these alternatives were too environmentally damaging to be permissible by any agency, while the third, an in stream detention basin, would not be permissible with the Water Board. The group decided to scrap all three alternatives and scheduled a site visit to assess how much of the downstream section of the reach could be remediated without triggering permitting issues.

On March 28, the Waterboard and SFEP visited the site with the County and Roux to determine if a reduced scope could be achieved. At the site visit, the team looked at access points, slope stability, and ecologically sensitive areas to determine the farthest upstream section that could be addressed.

Unfortunately, due to the way the Santa Clara Valley Water District built the site, there were no legacy access roads to the downstream portion of the project site. It was determined that the equipment needed to extract and move the calcines from the site could not be brought in without causing severe ecological damage to a well-established riparian corridor, or without destabilizing the slopes of the gulch.

It was determined by all parties that this project, unfortunately, is not currently feasible. This has been reported to the Environmental Protection Agency by phone and Waterboard Management has decided to accept this determination as well. Roux was asked to halt work on further development of the design alternatives in favor of providing a summary of the infeasibility of proceeding with any alternatives under current conditions. This report will be attached in lieu of the 25% designs.

The remaining funding in this task, approximately \$120,000, was reallocated to the construction task to pay for some of the cost overruns from the calcine roads construction.

Lessons Learned

The Team Approach for Remediation Projects

The Calcine Paved Roads Remediation project was able to be completed in four years due to the use of lessons learned in the Senator Mine Remediation Project (ended in 2015). This project piloted a proactive approach to designing remediation projects to ensure permitting was considered throughout the project.

This allowed various agencies including the Waterboard, CA Fish and Wildlife, and the US EPA to weigh

in before the designs were developed to assist the designers in avoiding permit issues once the final designs were developed. This approach was utilized in this project as well. Designs were reviewed and commented on at the 60% and 90% stages and allowed for quicker permit review. Additionally, SFEP worked very closely with the Waterboard to ensure the project would be permitted quickly. This work involved numerous internal meetings with the Waterboard and the appointment of permit staff to this project early in the design process. The Waterboard was also able to reach out to the Army Corps of Engineers, a critical sticking point in the Senador project, to ensure they were informed and that this project would be a priority for them, allowing the county to meet construction window requirements.

Management and Budget Flexibility

SFEP worked with Parks, the Waterboard and the US EPA to implement the Jacques Gulch task. The team approach was used on this project element as well. Waterboards and SFEP staff made two trips to the Gulch to hike the reach and to contextually review the information Parks and their consultants were presenting on the reach. The comprehensive feasibility report and the site visits were compelling for the group to agree that the project was indeed infeasible. This left this task with approximately \$120,000 of unspent funds.

As this task was completed, SFEP staff assessed the management funds and the QAPP task budget. It was determined that SFEP had an excess of management funds and that the QAPP task would not be completed as there was no need to develop a QAPP. The EPA and SFEP were able to be flexible with this project and directed these excess funds to the construction task, partially offsetting a large cost overrun. These funds totaled approximately \$136,000. The cost overruns were closer to \$500,000.

Jacques Gulch

This project had funding secured to develop the 100% design plans after the 25% designs were completed through a 319(h) grant from the Waterboard. SFEP project staff and TMDL staff at the Waterboard pushed this task as far as they could before finally agreeing that it was infeasible. This included at least two site visits by SFEP and the Waterboard, design review and comments, file review of Roux & Associates' field notes, and a final group meeting to discuss this element. There was a lot of support for this project as it is considered the last significant mercury mining waste source upstream of the Almaden Reservoir. Despite the desire to see this reach remediated and the funding secured for planning such remediation, all parties agreed that the site challenges were such that the remediation of the reach using current technologies and excavation practices was infeasible. The 319(h) funds were remitted back to the state. The lesson learned here is that despite the keen desire for this project to be completed, the rationale behind the determination of infeasibility was sound. The group approach allowed the diverse regulatory,

TMDL, and planning staff supporting this project to reach a consensus that may not have been as easily obtained if the process was confined to project partners and SFEP staff.

Planning Outreach

The outreach task was into Santa Clara County Parks and Recreation Department's contract and as such, was expected to be addressed. It was not until the late stages of the project when outreach was tackled. This was mostly due to the fact that Parks and SFEP project management staff wanted to present the project to the public in its final stages. In 2107, SFEP staff solicited the outreach information from Parks for reporting purposes. Upon finding that there was no plan in place to address this component, SFEP staff suggested an array of outreach options. Due to the incredibly resource intense construction phase of this project, Parks did not have a chance to address this component until the last quarter of 2017. As such, the outreach goals were not as successful as planned. In the future, SFEP will work with project partners to ensure that they are addressing, or have a plan to address, all project elements during the term of the project.

The project was able to meet some of its outreach goals and objectives through ongoing education at the park and associated museum as well as previously installed signage within the park.

Appendices

1. Santa Clara County Parks – Calcine Paved Roads Completion Report
2. Mercury Sampling Data
3. SFEP Site Visit Photos
4. 100% Designs
5. Outreach Presentation and Signage